From: Marshall, Michael E
To: Reid, Rebekah N; Endries, Mark
Subject: Fwd: HENA SSA peer review ready
Date: Friday, May 11, 2018 1:31:00 PM
Attachments: Draft HENA SSA_05112018_Peer Review.pdf
Importance: High

Hey guys....see below....I had to add a few minor items to the PDF....will go out soon.

Thanks,

Mike
---------- Forwarded message ----------
From: **Marshall, Michael** <michael_marshall@fws.gov>
Date: Fri, May 11, 2018 at 1:30 PM
Subject: Re: HENA SSA peer review ready
To: "Hamilton, Byron" <byron_hamilton@fws.gov>

Here ya go Byron!

Thanks,

Mike

On Fri, May 11, 2018 at 1:12 PM, Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Hey Mike,
>
> Add to SSA:
>
> 1. Numbered lines on each page
> 2. Add Draft watermark
> 3. Add the following header:
>
> Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.
>
> 4. .pdf version of the document to send.
>
> I will send to Tim Merritt, the Regional Liaison, as soon as I get this back. I will ask Tim to cc you guys.
>
> On Fri, May 11, 2018 at 12:47 PM, Marshall, Michael <michael_marshall@fws.gov> wrote:
>
> > Good afternoon Byron!
> >
> > The draft SSA for dwarf-flowered heartleaf is ready for peer review. Attached you will find the document Rebekah put together suggesting folks for the peer review. We need

the reviews turned around by June 4th, so that we can incorporate before the Recommendation meeting. Also, will you please cc me and Rebekah when it gets sent out for the peer review please? Any way this can be sent out today?

Attachments are: the SSA itself, a cover page and table of contents, and appendices....and the list of reviewers to reach out to.

Let me know if you have any questions....thanks a bunch!

Mike

--
Mike Marshall
SSA Program Specialist
U.S. Fish and Wildlife Service Region 4
Cell: 512-461-6217
Alternate email: mmarshall@ag.tamu.edu

Work Schedule 1st Week
Monday-Thursday --> In Office 7:30-4:30 CST

Work Schedule 2nd Week
Monday-Thursday --> In Office 7:30-4:30 CST

This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act and may be disclosed to third parties.

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Mike Marshall
SSA Program Specialist
U.S. Fish and Wildlife Service Region 4
Cell: 512-461-6217
Alternate email: mmarshall@ag.tamu.edu

Work Schedule 1st Week
Monday-Thursday --> In Office 7:30-4:30 CST

Work Schedule 2nd Week
Monday-Thursday --> In Office 7:30-4:30 CST

This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act and may be disclosed to third parties.

--
Mike Marshall
SSA Program Specialist
U.S. Fish and Wildlife Service Region 4
Cell: 512-461-6217
Alternate email: mmarshall@ag.tamu.edu

Work Schedule 1st Week
Monday-Thursday --> In Office 7:30-4:30 CST

Work Schedule 2nd Week
Monday-Thursday --> In Office 7:30-4:30 CST

This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act and may be disclosed to third parties.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Chapter 1: INTRODUCTION

The dwarf-flowered heartleaf (*Hexastylis naniflora*) is a species of plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. The dwarf-flowered heartleaf has been listed as threatened under the Endangered Species Act of 1973, as amended (Act), since 1989 (FR 54 14964-14967). The Species Status Assessment (SSA) framework (USFWS 2016, entire) summarizes the information compiled and reviewed by the US Fish and Wildlife Service (Service), incorporating the best available scientific and commercial data, to conduct an in-depth review of the species' biology and threats, evaluate its biological status, and assess the resources and conditions needed to maintain long-term viability. The intent is for the SSA to be easily updated as new information becomes available and to support all functions of the Endangered Species Program from listing to consultations to recovery.

A Recovery Plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to make significant progress toward recovery of the species. The Service is initiating this SSA to aid in determining the appropriateness of reclassifying the species. In the event that the SSA does not support reclassification, the SSA will be used to inform the development of a Recovery Plan. Importantly, the SSA does not result in a decision by the Service on whether this species should be proposed for reclassification under the Act. Instead, this SSA provides a review of the available information strictly related to the biological status of the dwarf-flowered heartleaf. The reclassification decision will be made by the Service after reviewing this document and all relevant laws, regulations, and policies. The results of a proposed decision will be announced in the *Federal Register*, with appropriate opportunities for public input.

For the purpose of this assessment, we generally define viability as the ability of the species to sustain populations in its natural systems over time. Using the SSA framework (Figure 1.1), we consider what the species needs to maintain viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation (Wolf *et al.* 2015, entire).

- **Resiliency** describes the ability of populations to withstand stochastic events (arising from random factors). We can measure resiliency based on metrics of population health;

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

for example, birth versus death rates and population size. Highly resilient populations are better able to withstand disturbances such as random fluctuations in birth rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic activities.

- **Redundancy** describes the ability of a species to withstand catastrophic events. Measured by the number of populations, their resiliency, and their distribution (and connectivity), redundancy gauges the probability that the species has a margin of safety to withstand or can bounce back from catastrophic events (such as a rare destructive natural event or episode involving many populations).
- **Representation** describes the ability of a species to adapt to changing environmental conditions. Representation can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. The more representation, or diversity, a species has, the more it is capable of adapting to changes (natural or human caused) in its environment. In the absence of species-specific genetic and ecological diversity information, we evaluate representation based on the extent and variability of habitat characteristics across the geographical range.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

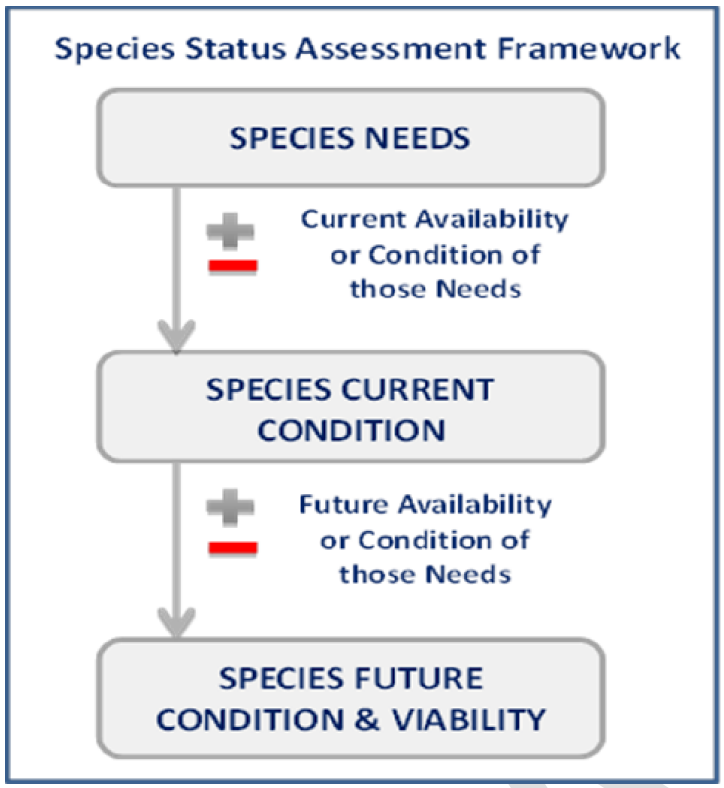


Figure 1.1. Species Status Assessment Framework

To evaluate the biological status of the dwarf-flowered heartleaf, both currently and into the future, we assessed a range of conditions to allow us to consider the species' resiliency, redundancy, and representation (together, the 3Rs). This SSA provides a thorough assessment of biology and natural history, and assesses demographic risks, stressors, and limiting factors in the context of determining the viability and risks of extinction for the species.

The format for this SSA includes: (1) Biology and Species Needs, (2) Current Conditions, (3) Influences on Viability, and (4) Future Conditions. This document is a compilation of the best available scientific and commercial information, and a description of past, present, and likely future risk factors to the dwarf-flowered heartleaf.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Chapter 2: SPECIES BIOLOGY

In this chapter, we provide basic biological information about the dwarf-flowered heartleaf, including its taxonomic history, species description, distribution, life history traits, and habitat characteristics. We then use this information to outline the resource needs within various life stages of dwarf-flowered heartleaf. Here we report those aspects of the life history of the dwarf-flowered heartleaf that are important to our analysis.

Taxonomy and species description

Dwarf-flowered heartleaf is a rare, low growing herbaceous plant in the birthwort family (Aristolochiaceae). The species was described by Blomquist (1957) in his revision of the North American members of the genus *Hexastylis*. The dwarf-flowered heartleaf has been recognized as part of the Virginica Group, and this group was further subdivided into three Subgroups: Virginica, Shuttleworthii, and Heterophylla (Blomquist 1957; Whittemore and Gaddy 1997). Three species have been recognized in the Heterophylla complex, *Hexastylis naniflora, H. heterophylla* and *H. minor*, and field biologist have generally recognized that considerable morphological overlap occurs (Murrell et al. 2007). One of the main concerns regarding this complex was the inability to distinguish between species without access to fresh flowers. Even with fresh flowers, Blomquist (1957) and Gaddy (1987) still recognized considerable overlap in flower morphology making species delineation difficult.

Murell et al. 2007, conducted a comparative genetic analysis using Inter Simple Sequence Repeats, and were unable to find banding patterns that could be used to separate *H. naniflora* from the other members within the complex. However, based on biogeographical, ecological, molecular, morphological, as well as micromorphological work, their results show that *H. naniflora* is a well-defined species.

Although there has been considerable disagreement on the generic distinctiveness of *Hexastylis* and *Asarum* (Barringer 1993 and Kelly 1997, 1998, 2001), a recent phylogeny estimate using chloroplast genes supports that *Hexastylis* is a monophyletic clade and therefore should be

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

recognized as a genus (Niedenberger 2010). Additionally, most North American publications recognize *Hexastylis* at the generic level (Flora of North America 1997, Weakley 2015).

The Service is not aware of any proposed changes in taxonomy that would affect the continued legal status of *H. naniflora* under the Act. However, within the range of *H. naniflora* there are populations which fall outside of the range of published values for key floral characteristics, overlapping with values described for *H. heterophylla* or *H. minor* (Figure 2.1; Weakley, 2010; Murrell et al. 2007; Gaddy 1987). These geographic areas of overlap in key characters have been the focus of recent genetic analyses (Murrell et al. 2007; Renninger, 2010; Murrell, 2015).

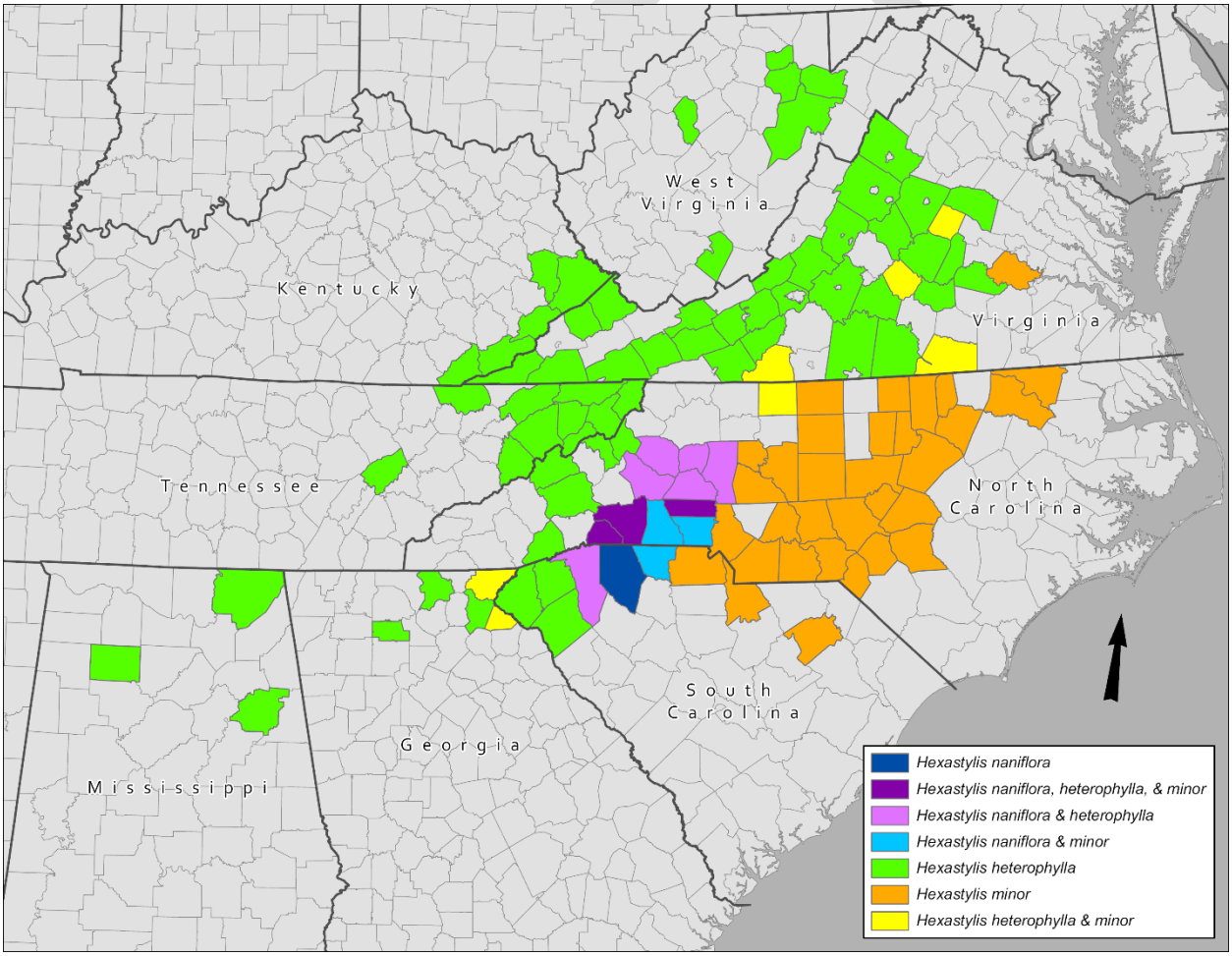


Figure 2.1. Distribution map showing county records for the three species in the *H. heterophylla* complex. Data was gathered from herbarium specimens, Element Occurrence Records (EORs) sheets and field studies. *Based on Murrell et al. 2007.*

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The most outstanding characteristic of this species is the small flowers, which are one of the smallest of any species in North America (Blomquist 1957). The plant's heart shaped leaves are dark green in color, evergreen, and leathery, and are supported by long thin petioles from a subsurface rhizome. The shape of the leaf blades, their pattern of variegation, and the ridged reticulation inside the calyx-tube, place this species inside the Virginica group. It differs from all the other members of this group, aside from the small flowers, in having no flare in the calyx-tube. Maximum height rarely exceeds 15 centimeters (cm). The jug shaped flowers are usually beige to dark brown in color and appear from mid-March to early June. The flowers are small and inconspicuous and are found near the base of the petioles. The fruit matures from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981). Characteristics that distinguish it from other *Hexastylis* species are found in floral structures and pollen characters (Gaddy 1987, Padgett 2004, Niedenberger 2010). *H. naniflora* has a smaller calyx tube orifice, which is typically 5mm or less (sometimes up to 7mm) and the ovary is half-inferior, rather than superior (Blomquist 1957, Gaddy 1987, Padgett 2004, HDR 2005). Pollen surface features have also been shown to be an effective character to identify *H. naniflora*, as it has a microporate surface and, unlike any other *Hexastylis* species, lacks gemmae entirely (Padgett 2004, Niedenberger 2010).

Distribution

Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (USFWS 2010, NCNHP 2016). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include four additional counties in North Carolina. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is in Cherokee, Greenville, and Spartanburg Counties. As of 2016, the distribution of this species consisted of 113 populations distributed across 13 counties in these two states (Figure 2.2).

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

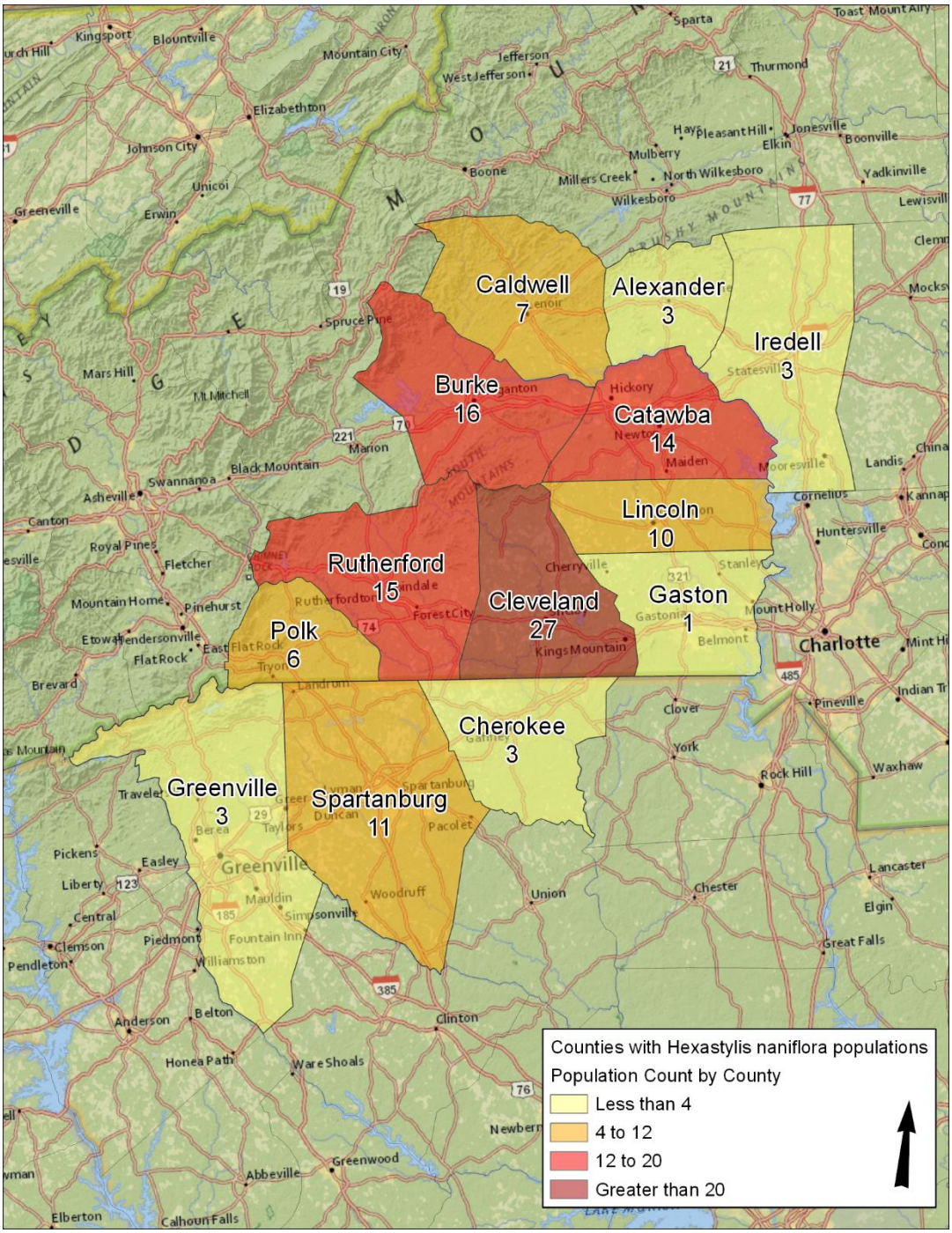


Figure 2.2. Current county distribution for dwarf-flowered heartleaf, with associated number of known populations within each county.

Many of those working with *Hexastylis naniflora* have used the terms “sub site”, “site”, “location”, “occurrence” (often, but not always, in reference to Natural Heritage Program Element Occurrence (EO) Records), “subpopulation” and “population” interchangeably. Others

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

have aggregated smaller sites into populations according to subjective criteria which have never been explicitly defined. This generates discrepancies among sources with respect to the abundance and distribution of the species, with the net result being that available data are usually not comparable from one source to the next. We describe how the numerous small, site-specific locations containing *H. naniflora* have been aggregated into proxies for 119 biological populations for purposes of this review, using mapping standards devised by NatureServe and its network of Natural Heritage Programs, in the Species Needs section of this report.

Life History

Demographics

The Service is aware of a single effort to collect demographic-level data (survivorship and recruitment of tagged individuals) for dwarf-flowered heartleaf. This effort was conducted during the 1990-1991 field seasons, within a portion of the Peters Creek population in Spartanburg County, SC (Newberry, 1993). This study demonstrated a 96.1% survival rate over these two consecutive seasons, with 50% of the mortality occurring in plants located at the highest position on the forested slope (away from the adjacent floodplain). Mortality was highest in small plants bearing fewer than four leaves. Plant size was variable, with the largest plant bearing 45 leaves and 33 flowers, and situated in the floodplain. In general, plants located in the floodplain were larger than plants located on adjacent slopes. The percentage of flowering plants averaged 70%, with the highest frequency of flowering occurring among plants situated in the floodplain (USFWS 2010).

Pollination and Dispersal

The pollination of *Hexastylis* has not been well studied but the genus was thought to be pollinated by insects including flies, wasps, and thrips (Otte 1977). Additionally, Lengyel et al. (2010) described how, within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal by ants). This supports Gaddy's work (1986), which found

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

three species within the Hexastylis Heterophylla subgroup (*H. heterophylla, H. naniflora, and H. minor*), which employ myrmecochory as a method for seed dispersal.

Ants appear to be a primary dispersal agent for the dwarf-flowered heartleaf (Gaddy 1986; Jones et al. 2014). All diaspores of *Hexastylis naniflora* presented to ants (*Aphaenogaster rudis*) were quickly removed (Gaddy, 1986). This is not to say that they are not occasionally, or even frequently, dispersed and/or pollinated by other means. Jones et al. (2014) suggests that the pollination mechanism is facultative, benefiting from more than one method of pollination/fertilization. Ants were the pollinators in a controlled experiment, and their data supports that when outside molesting forces/pollinators (biotic and abiotic) were limited by their caging procedure, the efficiency of pollination decreased by almost 50%, however, caged flowers did produce seeds, indicating pollination occurred via some alternative method.

Habitat

Dwarf-flowered heartleaf appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Wagner 2013). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of a given population. With the limited range and size in populations, questions arise regarding gene flow among populations. How much is occurring and how often does it occur? It is due, in part, to narrow habitat requirements that conservation measures have been implemented for the protection of the species. Any efforts made to protect this species must consider giving protection to the available habitat.

Dwarf-flowered heartleaf occurs on piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, Weakley 2015, USFWS 2015), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993).

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Wagner (2013) conducted a habitat suitability study to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants.

Soils

The species appears to be restricted to Pacolet sandy loam, Madison gravelly sandy loam, and Musella fine sandy loam soils (Gaddy 1981,1987). The species grows in acidic soils along bluffs and adjacent slopes, in boggy areas next to streams and creekheads, and along the slopes of nearby hillsides and ravines (Gaddy 1980, 1981). The plant is primarily found inhabiting north- to northwest-facing slopes, bluffs, and ravines in close proximity to creeks or streams. Within these areas exists the soil type required for *H. naniflora* to grow. It grows primarily on well-drained, sandy, acidic soils, and will not grow in heavy clay (Gaddy 1981).

The results of soil samples analyzed at the Clemson Soil Lab suggest that major differences in soil chemistry exist between the species in the *H. heterophylla* complex (Murrell et al. 2007). Statistical analysis of the soil samples showed that many of the basic elements were significantly different among the three species. Those significant differences occurred in Phosphorous (P), Potassium (K), Magnesium (Mg), Zinc (Zn), Manganese (Mn), (Na), Sodium, and Cation Exchange Capacity (CEC). Slightly significant differences were seen in Buffer pH (Bu pH), and Acidity.

Soil chemistry showed marked differences between the species in the complex (Murrell et al. 2007). The results indicated that soil chemistry is very different between *H. naniflora* and *H. minor* localities. The results also show that *H. heterophylla* and *H. naniflora* are found in soils where the chemistry is more similar, but still showed significant differences. It would appear that differentiation in soil types could be used as a proxy for species delineation. The soil analysis also indicates that soils must be considered when trying to select sites for relocation of imperiled populations of *H. naniflora*.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Thirteen population sites in North Carolina and South Carolina were examined using the Carolina Vegetation Survey (CVS) method to compare species richness between the three species of the *Hexastylis heterophylla* complex (Murrell et al. 2007). The analysis did not show statistically significant differences among the three species in the *H. heterophylla* complex. However, *H. naniflora* appears to have an association with three oak species that is lacking in the other two species in the complex. There are a number of oak species (*Q. coccinea*, *Q. prinus* (*Q. montana*), and *Q. velutina*), that tend to co-occur with only *H. naniflora*, but are not present with the other two species in the complex. This may be the result of some microbial need or specific soil nutrient required for those species to occur in the same habitat.

Fire

There are little data on the response to fire by *Hexastylis naniflora*, however, prescribed burns have been conducted within the population at Cowpens National Battlefield in Cherokee County, SC. Preliminary data at this site and recent annual monitoring data of this population support the theory that moderate controlled burns do not negatively affect this population (Walker et al. 2009). Additionally, a dormant season wildfire in Caldwell County did not show evidence of negative impacts to a population in Caldwell County (USFWS 2010). Fire suppression could be a hazard to *H. naniflora* by allowing fire intolerant, nonnative and invasive plants to thrive, as well as the accumulation of thick duff or leaf litter that may shade low growing species (Wagner 2013).

Genetics

Analyses on ecology, morphology, soil chemistry, pollen, and molecular genetics have been evaluated for *Hexastylis naniflora* to determine the boundaries within the *Hexastylis heterophylla* complex, which consists of *H. heterophylla*, *H. minor*, and *H. naniflora* (Murrell 2015, Wagner 2013, Niedenburger 2010, USFWS 2010, Murrell et al. 2007, Padgett 2004). These analyses support the continued recognition of these taxa as well-defined, discrete species. Scanning electron microscopy (SEM) consistently distinguished *H. naniflora* from other members of the *H. heterophylla* complex based on pollen microscopy. Principal Components

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Analysis of floral characters and soil chemistry also consistently distinguished *H. naniflora* from *H. minor* and *H. heterophylla*. However, efforts to obtain consistently distinct banding patterns using Inter Simple Sequence Repeats (ISSRs) were unsuccessful at distinguishing *H. naniflora* from other members of this group (Murrell et al., 2007). These results were based upon an extremely small sample size (n=10 *H. naniflora* individuals), and therefore warrant further investigation.

Field observations demonstrate that there are some populations of dwarf-flowered heartleaf with morphological characteristics that do not fit within the range of published values for key traits, overlapping with values for *H. heterophylla* or *H. minor* (Gaddy 1987, Murrell et al. 2007, USFWS 2010, Weakley 2015). These populations with overlap in key characteristics were the focus of a genetic analysis conducted at Appalachian State University (ASU) through funding provided by NCDOT (Murrell 2015). In some populations, floral characteristics are highly variable, which suggests the potential for hybridization or individuals with highly variable flower size and shape (Murrell 2015). Additionally, no vegetative characters were previously known to consistently distinguish *Hexastylis naniflora* from other close relatives. Given the difficulties with field identification of the species, particularly when not in flower, this study sought to develop a microsatellite library of molecular markers to resolve variation in populations of dwarf-flowered heartleaf and apply the markers to populations with highly variable characters, as identified by NCDOT biologists. The morphological and micromorphological information from those variable populations were compared to molecular results with morphological, micromophological, and distributional data to determine genetic structure, biological boundaries, and placement of putative hybrids or intermediate populations of *H. naniflora* (Murrell 2015).

The preliminary findings of this study suggest that populations in the southern range of dwarf-flowered heartleaf exhibit a more uniform genetic pattern, with some possible hybridization with *H. minor*. Populations in the northern part of the range appear to have hybridized with both *H. heterophylla* and *H. minor*, although there are still individuals with "pure" *H. naniflora* genotypes in the northern range (Murrell 2015). It is critical to note that although these data provide anecdotal evidence of hybridization with the *Hexastylis heterophylla* group, intraspecific variation may be caused by forces other than hybridization, such as convergent morphological

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

evolution (Dobzhansky 1937), or the species is in the process of speciation and this study shows a case of incomplete speciation (Murrell 2015), and/or other environmental factors are at play (Wagner 2013). On May 11, 2016, a meeting was held with USFWS, NCNHP, NCDOT, and ASU to discuss the status of *H. naniflora* and the current work being conducted among the agencies (Amoroso 2016). Based on discussions during this meeting, the results of this study reported by ASU to NCDOT in 2015 are preliminary. Dr. Matt Estep (ASU) provided additional preliminary results to NCNHP in May 2016, showing which populations were sampled, sample size, and percent of samples that show evidence of hybridization, and hybridizing with which species. ASU continues to work towards a more definitive explanation of the variation in the *H. heterophylla* complex (Murrell 2015, Amoroso 2016).

CHAPTER 3: SPECIES NEEDS

For the purpose of this report, we define viability as the ability of the species to sustain populations in the wild over time. Species with greater numbers (redundancy) of healthy populations (resiliency), encompassing a broad array of ecological and genetic diversity in a spatial arrangement that maintains adequate gene flow (representation), are more likely to be viable. Using the Species Status Assessment framework, we describe the species' viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation.

Delineating Populations

As stated in the USFWS five-year review, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to Natural Heritage Program Element Occurrence Records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This has generated considerable discrepancies among sources with respect to the number of known populations within a given area (or across the species' range), to the extent that numbers are not comparable from one source to the next. The tendency, in the past, to treat each location as a separate population also artificially inflated the actual number of populations known.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The Natural Heritage Program collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member Natural Heritage Programs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2002). Since USFWS does not maintain its own database of known locations of *Hexastylis naniflora*, it regards the NHP databases as the best repository for this information (USFWS 2010).

We delineate populations for the purposes of this SSA according to the NatureServe (2002) convention. Separation distances are a key component to delineating populations from EO records. For the dwarf-flowered heartleaf, we used the EO Data Standard which provides a Default Separation Distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several dwarf-flowered heartleaf populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Population Resiliency

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

heartleaf ecology that determine whether populations can grow to maximize habitat occupancy, thereby increasing resiliency of populations. These factors and habitat elements are discussed below (Figure 3.1).

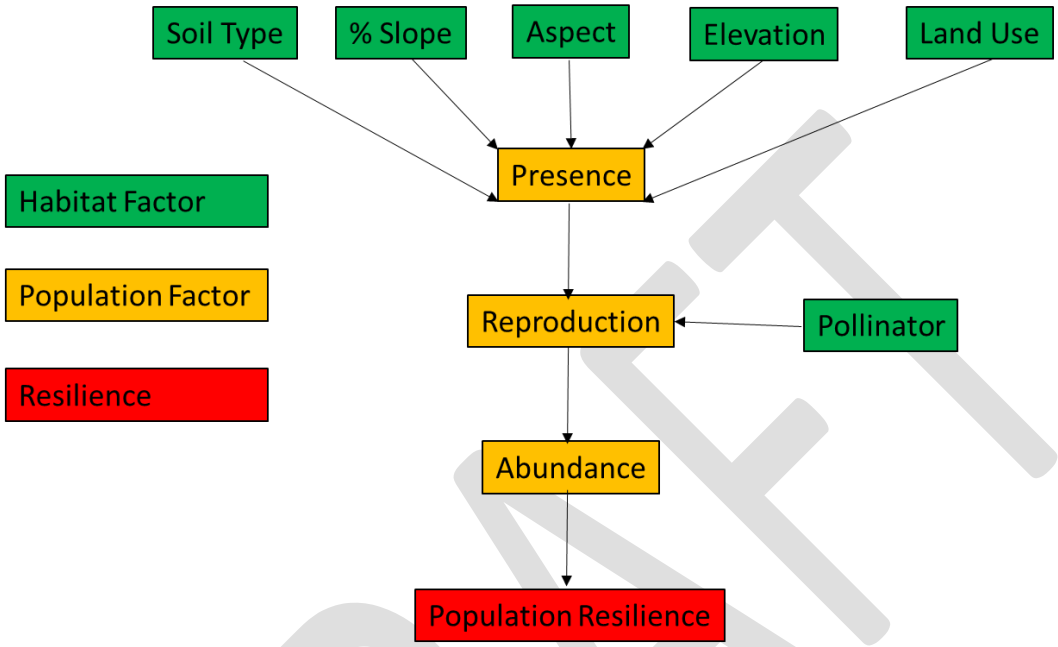


Figure 3.1. Conceptual diagram describing population and habitat factors influencing population resilience for dwarf-flowered heartleaf.

Habitat Factors: Slope, Aspect, Elevation, Soil, and Forest Type

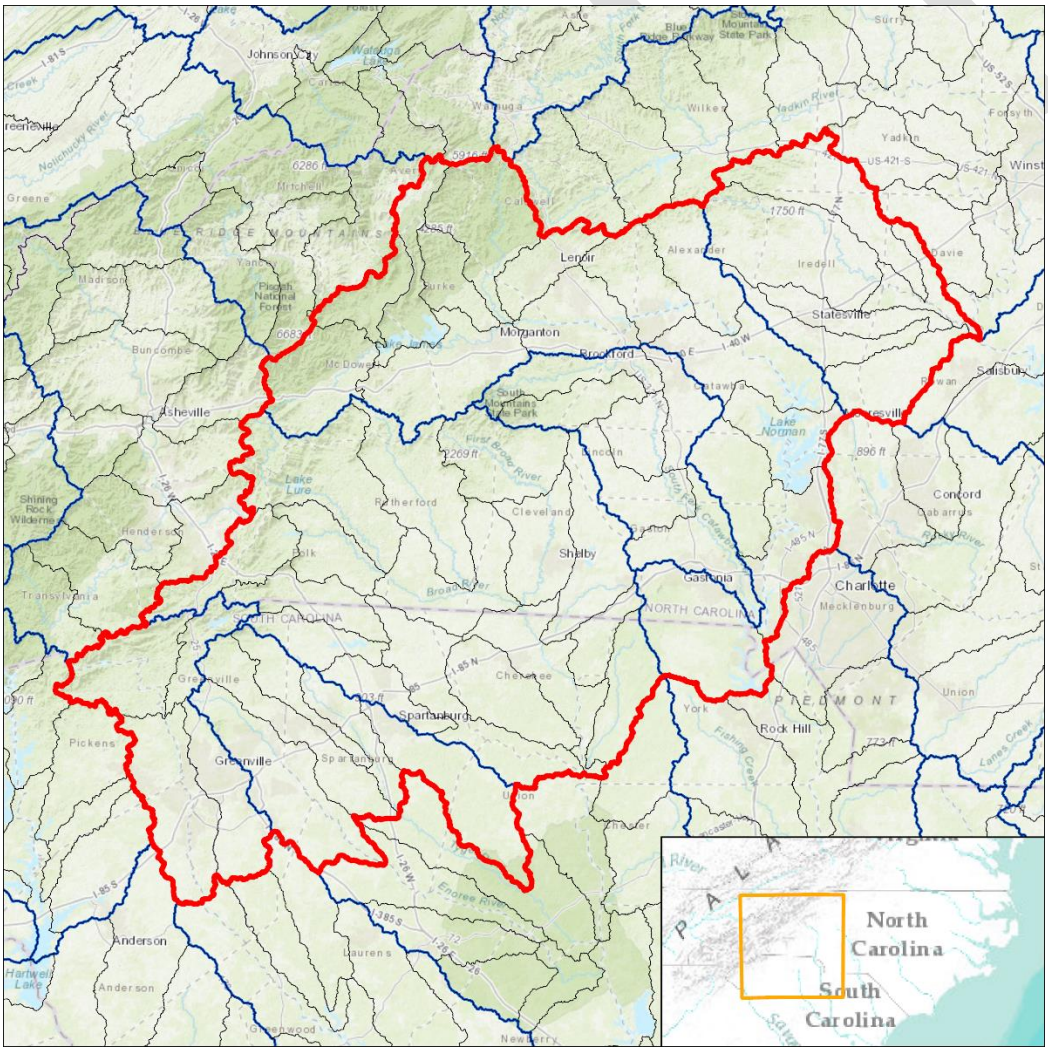
A previous habitat suitability study attempted to quantify the habitat requirements for dwarf-flowered heartleaf (Wagner 2013). With this model in mind, and the input of species experts as to important habitat factors for the species, we used updated habitat data, as well as inclusion of updated EOs, to create a new habitat model to identify potential habitat throughout the species range. All source datasets and variables created are described in Appendix 3.

Source Data and Model Variables

Fifty-three, 10-digit hydrologic units (HUC) comprise the analysis extent (Figure 3.2). In North Carolina, it includes all 10-digit HUC that fall within the boundaries of 8-digit HUC with known occurrence of *Hexastylis naniflora*. In South Carolina, we also included all 10-digit HUC that

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

382 fell within the boundaries of 8-digit HUC with known occurrence of *Hexastylis naniflora*, but
383 excluded the southern portions of the HUC-8 areas due to the boundaries being exceedingly large
384 and far away from any known occurrences.
385 *Hexastylis naniflora* element occurrence data was obtained from the North Carolina Natural
386 Heritage Program and the South Carolina Heritage Trust Program. Current populations of
387 *Hexastylis naniflora* were identified by reviewing the last observed data in the database and
388 excluding all populations that have not been observed since 2005 to remain consistent in our
389 approach of assessing resiliency described previously. To represent these current population
390 areas in Maxent, a raster cell center was retained for every 30 x 30 meter pixel that was situated
391 within the current element occurrence data polygons.
392
393



Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Figure 3.2. Analysis extent of the habitat model for *Hexastylis naniflora*. Red line indicates Maxent analysis extent, blue lines are 8-digit HUC boundaries, black lines are 10-digit HUC boundaries. The orange line in the inset map indicates where the analysis extent is situated in North and South Carolina

Model Development

We used Maxent software (version 3.4.1) for species habitat modeling (Philips et al., 2018). An initial single model Maxent run was done to determine which variables could be excluded due to limited percent contribution to the model. Any variable that contributed less than 1% to the single model run results was excluded in the final model. The following variables were excluded: landcover diversity, canopy height, SSURGO drainage class, SSURGO hydrologic group, aspect 9-class, aspect 5-class, slope, solar radiation, and maximum annual temperature. It is interesting to note that a previous habitat modelling effort (Wagner 2013) included aspect and slope, whereas the Maxent model excluded these variables. This does not mean these variables are not important components of dwarf-flowered heartleaf habitat, but rather these variables did not significantly improve the model. Also, landform data was included, and perhaps landform, which includes components of aspect and slope combined is a more meaningful variable than aspect or slope independently.

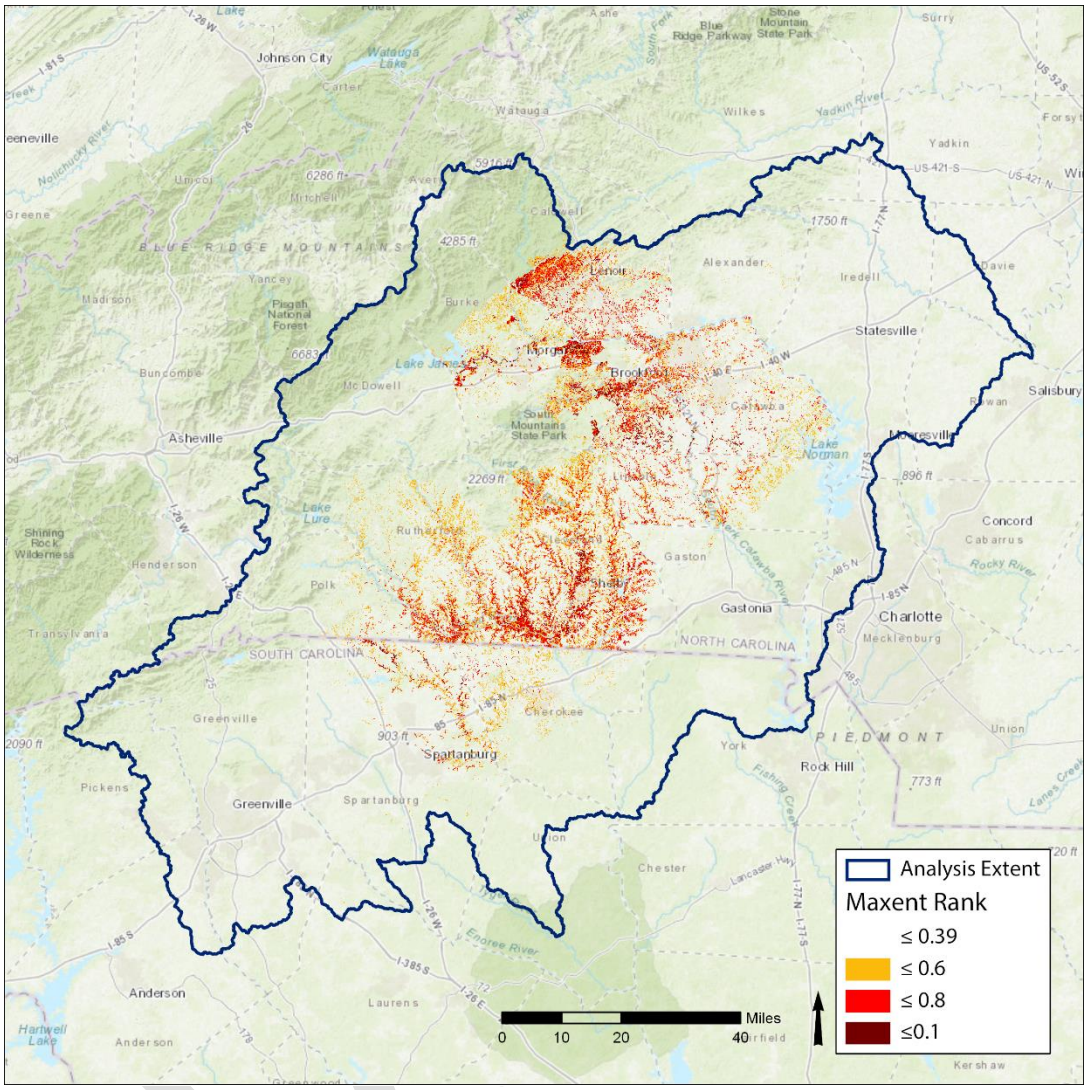
For the final model, a 10-run replicate Maxent model was created using cross-validation. For replicate models, the occurrence data is randomly split into a number of equal-sized groups called “folds”, and separate models are created leaving out each fold in turn. The individual model runs are then averaged together to derive the final model.

Results

Figure 3.3 shows the model output. The minimum cutoff value (to determine if an area is considered potential habitat for a species) of 0.39 was determined by using the average 10th percentile training presence. The 10th percentile training presence uses the suitability threshold associated with the presence record that occurs at the 10th percentile of presence records (Phillips 2018). This value excludes some of the outlier population areas in the Maxent

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

425 predictions to focus on the typical habitat conditions for this species. The total area ranked
426 greater than 0.39 in the Maxent model was just 6.00% of the total analysis area (Table 3.1).



427

428 **Figure 3.3.** Maxent model output map

429

430 **Table 3.1**-Area estimates of the Maxent model

Maxent Score	Acres	Square Miles	Percent of Total
0.39 and greater	302,834.13	473.18	6.02%
0.6 and greater	128,273.52	200.43	2.55%
0.8 and greater	22,115.97	34.56	0.44%

431

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The average area-under-curve (AUC) score for the replicate Maxent model is 0.86. The AUC is calculated from the receiver operating characteristic (ROC) plot. This value has a range of 0 – 1 and may be interpreted as a single test statistic that assesses model performance, indicating the ability of the model to correctly classify the occurrence data used. The model performed well in its predictions, with a mean AUC of 0.86 (AUC value of 0.5 is no better than random; AUC<0.5 is worse than random; AUC>0.5 is greater predictive power than random; Baldwin 2009).

The Maxent output supplies estimates of the relative contributions of the environmental variables to the Maxent model (Table 3.2). SSURGO map unit key) is the top contributing variable. One hundred and thirty-five individual soil types are present within the polygon boundaries of the *Hexastylis naniflora* element occurrences. Many of these individual soil types are part of soil complexes and are separated by things such as percent slope, erosion, how stony/rocky, and amount of clay. The most common individual soil type was Meadowfield-Rhodhiss complex, 25 to 60 percent slopes, very stony (14.1% of total). However, collectively the Meadowfield soils only comprised 14.3% of all soils). The individual Pacolet soil types were very common and collectively comprise 36% of all soil types present. Woolwine, Rion, and Fairview soils were also collectively common, comprising 10.4%, 9.7%, and 8.8% of all soils present respectively.

Table 3.2. Percent contribution of the environmental variables

Environmental Variable	Percent Contribution
SSURGO map unit key	23.5%
Minimum Annual Temperature	17.8%
Average Annual Precipitation	15.7%
Landcover	12.9%
Landcover Majority	12.0%
Landcover Hexastylis Grouping	5.4%
Geomorphons	4.9%
Elevation	4.6%
Canopy Cover	3.2%

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The minimum annual average temperature range in the analysis extent is 39 – 51 degrees Fahrenheit. The majority of the *Hexastylis naniflora* element occurrences (89%) are found at the 47 and 48 degrees. The average annual precipitation range in the analysis extent is 42 – 81 inches per year. The majority of the *Hexastylis naniflora* element occurrences (82%) are found in the 47 – 49 inches per year range.

Piedmont forested landcover habitats dominate the land area of the element occurrences. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier (53%), Southern Piedmont Mesic Forest (9%), Southern Piedmont Dry Oak-Pine Forest (5.2%), Southern Piedmont Small Floodplain and Riparian Forest (4.4%), and collectively comprise 71% of the element occurrences area. Evergreen Plantation or Managed Pine (9%), Harvested Forest (7.2%), Developed, Open Space (5%), Pasture/Hay (2.1%) collectively comprise 22% of the total element occurrence area. The remaining 6 percent of element occurrence area is comprised of a mix of 14 other natural and disturbed landcover classes, but each at small percentages. The landcover majority classification scheme reduces the total number of landcover classes present in the analysis extent from 23 to 11. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier is still the dominant landcover class (58%). However disturbed categories are increased in area (sum total of 35%). Evergreen plantation or managed pine (12%) and Pasture/Hay (12%) are the only other categories that have at least 10% or greater area. The increase in disturbed landcover area representation in the landcover majority layer suggests that many *Hexastylis naniflora* population areas are situated in areas impacted by disturbed landcover. This is likely due to urban encroachment and increasing fragmentation of habitats. The landcover *Hexastylis naniflora* grouping reveals the amount of disturbance present in *Hexastylis naniflora* population areas. Landcover classes grouped as disturbed comprises 27% of the total area. Mixed forest (deciduous and evergreen) comprises 58%, pasture/hay 12%, and hardwood forest 2%. Open water, evergreen and barren landcover groupings are all at less than 1% each.

Geomorphons revealed that the majority of *Hexastylis naniflora* element occurrence areas are situated in concave landforms. Geomorphon categories hollow (13%), valley (46%), and

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

depression (10%) collectively comprise 69% of all *Hexastylis naniflora* population areas. Flat landforms comprise 15.5% of the area and convex landforms the remaining 15.5%.

Within the analysis extent, the range of elevation present is 335 – 5,265 feet. For *Hexastylis naniflora*, the prime elevation range is from 666 – 908 feet (53% of total element occurrence area). A lesser elevation range is present from 935 – 1,184 (37% of total element occurrence area).

Canopy cover for the *Hexastylis naniflora* populations are dominated by Tree Cover 70-80% (20.2%) and Tree Cover 80-90% (63.9%). The rest of the canopy cover categories are 2% or less.

We performed a Kruskal-Wallis 1-way non-parametric Analysis of Variance (ANOVA) to investigate the relationship between Maxent scores and current resilience of populations (Table 3.3). There are significant differences in the average Maxent scores between the four resilience categories ($p = 0.04$) and the mean Maxent score increases as population resilience increases from low to very high. The model gives us some predictive ability regarding habitat suitability where higher Maxent scores, on average, result in higher population resilience.

Table 3.3 Results of the Kruskal-Wallis 1-way non-parametric ANOVA investigating relationships between Maxent scores and current resilience groups for dwarf-flowered heartleaf.

Groups	*Count*	*Mean Rank*
low	13	30.7
moderate	25	30.7
high	5	42.8
very high	28	45.7

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	4375.7	4	1093.92	2.65	0.0404

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Within Groups	28036.3	68	412.30
Total	32412.0	72	

Reproduction and Presence of Pollinators

The pollination of *Hexastylis* has not been well studied but the genus is thought to be pollinated by insects including flies, wasps, and thrips (Otte 1977). Additionally, Lengyel et al. (2010) described how, within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal via ants). This supports Gaddy's work (1986), which found three species within the Hexastylis Heterophylla subgroup (*H. heterophylla, H. naniflora, and H. minor*), which employ myrmecochory as a method for seed dispersal.

Because the flower for this species is oftentimes partially or completely covered with soil and leaf litter, possibly inhibiting pollinator activity (Gonzalez 1972), there is still uncertainty in the pollination mechanism for dwarf-flowered heartleaf. Otte (1977) suggests that a variety of possible pollinators reside in this leaf litter, however, the calyx opening is considered to be far too small for efficient pollinating (Gaddy 1981). There are, however, invertebrates within this proposed size limit that could theoretically act as pollinators. It is possible that the species employs self-pollination, with or without a vector, or that cross-pollination occurs by a number of invertebrates. Jones et al. (2014) investigated pollination of dwarf-flowered heartleaf under a manipulative experimental design, and found that while insects may play a significant role in pollination, even without them, flowers managed to produce a partial seed set. However, two points need to be considered here. First, although flowers managed to produce seeds in the absence of insect pollinators, the efficiency of pollination decreased by almost 50%. Also, even if successful pollination occurs in the absence of insect vectors, the dispersal of plants amongst populations would be limited, and could result in decreased resilience due to genetic concerns such as limited gene flow and issues associated with potential inbreeding depression.

Abundance

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The influence of stochastic variation in demographic (reproductive and mortality) rates is much higher for small populations than large ones. Stochastic variation in demographic rates causes small populations to fluctuate randomly in size. In general, the smaller the population, the greater the probability that fluctuations will lead to extinction. There are also genetic concerns with small populations, including reduced availability of compatible mates, genetic drift, and inbreeding depression. Small populations of dwarf-flowered heartleaf have low resilience, leaving them particularly vulnerable to stochastic events.

As of 2016, the combined databases of the NCNHP and SCDNR contain 239 Element Occurrence Records (EORs) for *H. naniflora* (NCNHP 2016, SCDNR 2016). These EORs depict roughly 113 locations which are sufficiently geographically distinct to be regarded as proxies for populations of the species (See *Delineating Populations*). Thus, the total number of populations has increased more than four-fold (from 24 to 113) since the species was listed in 1989.

At this time, the largest known populations have been monitored by NCNHP and NCDOT. The estimates for entire populations are based on a consistent monitoring methodology developed by NCDOT, USFWS, and NCNHP with monitoring plots representing roughly 10% of a population. Populations were delineated to get a more accurate boundary and size of the area occupied. All rosettes are counted annually in each monitoring plot to estimate an extrapolated population size, based on the number and density in the plots. As a result of these efforts, better estimates of population sizes for the largest known populations are available, compared to when the last five-year review was completed in 2010 (Robinson and Padgett 2016).

The 113 EORs have been estimated to contain anywhere from a single rosette to over 100,000 rosettes. Appendix 1 was created by NCNHP (2016) to replicate the same format and population data as Table B2 of the most recent USFWS five-year review of *H. naniflora* (USFWS 2010), for comparison of changes since 2010, and summarizes the largest occurrences of *H. naniflora*, with the size of the population based on the number of rosettes it was last estimated to contain. The number of populations estimated to contain over 1,000 rosettes is 26. This is approximately 23%

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

of the total known populations and many of these populations contain well over 1,000 individuals.

There are, however, 13 populations (12% of all known) that are simply known to be extant, with no available estimate of population size (NCNHP 2016, SCDNR 2016). If the most recent population estimates for each EOR are compiled across years of observation, the 113 populations could conservatively be estimated to contain a collective total of more than 300,000 rosettes (NCNHP 2016, SCDNR 2016).

Population Trends

Although abundance is critical in assessing the resilience of dwarf-flowered heartleaf, trends in population growth can also be informative. Long-term growth trends are typically defined as the degree of change in population size over 200 years, whereas short-term growth is typically measured as that degree of change over a 10 year period. We lack a robust data set to assess trends at either of these time scales. However, from 2012-2016, NCNHP conducted systematic annual surveys of thirteen of the largest populations across the range.

Based on the results of the five-year monitoring efforts completed in 2016, nine out of thirteen populations remain stable during the five years of data collection (Robinson and Padgett 2016). The largest known population, Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop in Rutherford County, NC, is estimated to have over 100,000 rosettes (Robinson and Padgett 2016). This large population consists of many scattered subpopulations on private property; two of the subpopulations are protected as a Registered Heritage Area, although Registry is a non-binding agreement with landowners that can be cancelled at any time (NCNHP 2018).

Two of the thirteen populations increased in numbers from 2012-2016: Cliffside Steam Station and Broad River: Floyds Creek, Long Branch. The Cliffside Steam Station is protected with a voluntary agreement with Duke Energy and was estimated to contain over 39,000 rosettes in 2016. The Broad River: Floyds Creek, Long Branch population is not at all protected, but was last estimated to consist of over 12,000 individuals in 2016 (Robinson and Padgett 2016).

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Based on the results of recent surveys and a review of all known populations of *Hexastylis naniflora*, the overall trend over approximately 30 years is estimated to be declining 10-30%. This is estimated by a combination of documented declines of some populations, while many others appear to be remaining relatively stable, and some have increased.

Chapter 4: CURRENT CONDITIONS

Below we assess current resilience, representation, and redundancy as they relate to population and habitat factors known to be important for species viability. Based off of recent reports (Robinson and Padgett 2016; Robinson 2016), the species consists of 119 populations distributed across 12 counties in North Carolina and South Carolina. Populations are composed of both multiple EOs and stand-alone EO records. Recent genetic research discussed in Chapter 2, suggests that dwarf-flowered heartleaf, as originally described, is found in the southern portion of its presumed range based on current EO locations, and the northern portion could be a currently undescribed species (Figure 4.1; Estep pers. Comm. 2018). The genetic analysis to support this is complete, but a review of the morphology is ongoing and a new species has not yet been described (Estep pers. Comm. 2018). For the purpose of this SSA, we assume all EO detections are *H. naniflora*, and represent the best currently available scientific data.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

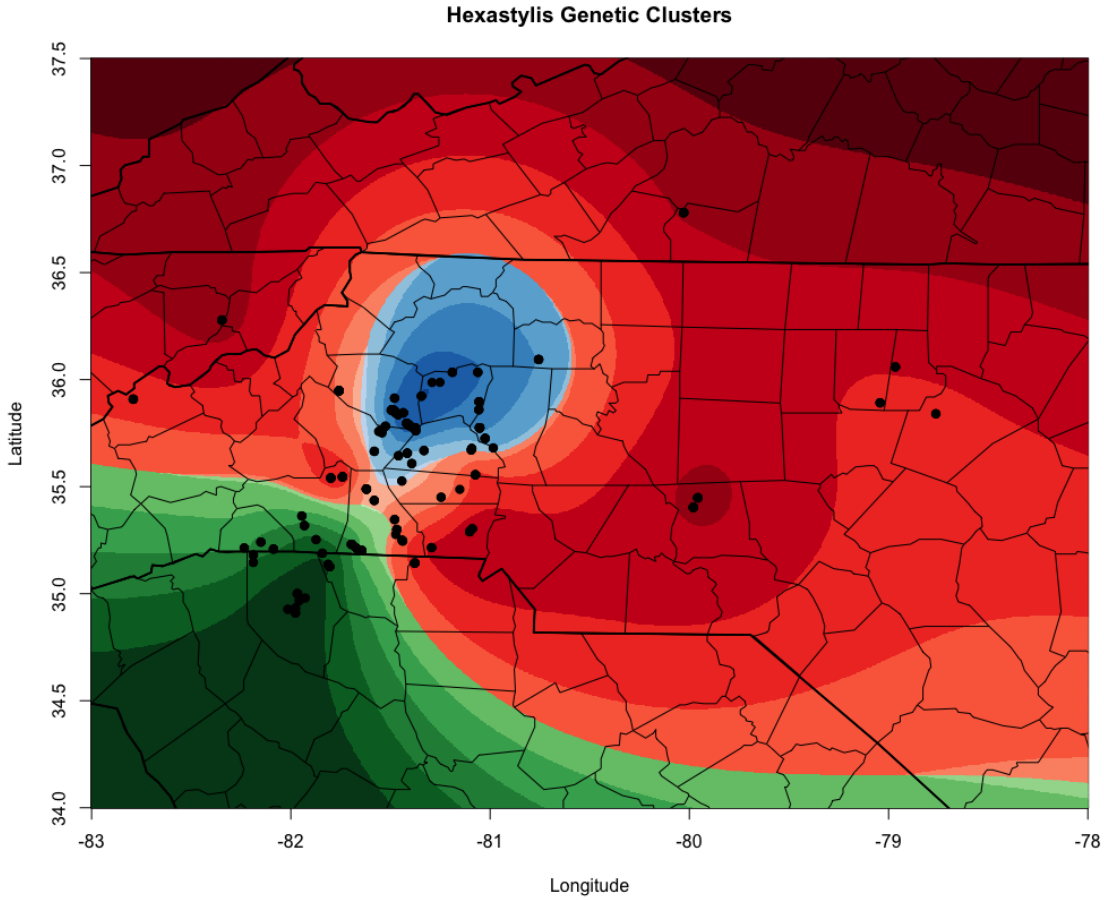


Figure 4.1. Recent genetic analyses detailing clustering of the genus Hexastylis. Black dots represent GIS locations of individual plants included in the genetic analysis. Green areas represent "true" *H. naniflora*; Blue represents a possible new species; Red represents other species in the genus (*H. minor*, *H. heterophylla*, etc.).

Current Population Resilience

Categorizing Resilience

For the purposes of this SSA, we use population size as the main driver of population resilience. The unit of measurement for population size in this species is a "clump" (rosette). As discussed previously, populations in North Carolina were delineated by NCNHP, whereas the Service defined populations in South Carolina. These delineations were based off of NatureServe criteria such as EO separation distance and intervening landscape matrix. EO data included a wide range

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

of years since the species was last observed at a given location (1964-2017), so although recent reports suggest the species consists of 113 populations, some of that data is fairly outdated. For the purposes of this SSA, we only used EOs that were observed since 2005. We did this for several reasons. First, we did not want to go back too far and assume a population was still present. Second, we wanted to be consistent in what we considered "current" for both categorizing resilience and use in the habitat model (discussed later). Also, experts concurred that records as old as 12 years are still likely to persist. Finally, there was a natural break in the data at the year 2005, coinciding with the year the last five-year review was initiated, where the number of EOs dropped off significantly in the years 2004 and earlier. It is important to note that many of the populations that we excluded from our analysis may still persist on the landscape. In fact, many EOs for this species have persisted for decades, despite not having intervening surveys to confirm their persistence.

Based on the criteria (excluding EOs prior to 2005), there are currently 78 populations distributed across the range of dwarf-flowered heartleaf, although this may be an underestimate as discussed above.

To determine overall resilience for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resilience categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are also incorporated secondarily. Appendix 2 shows the NCNHP EO rank specifications for dwarf-flowered heartleaf. The EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, given there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, depending on habitat conditions; poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016; Robinson and Padgett 2016) focus monitoring studies on populations with greater than 1,000 individuals, populations that are assumed to be very viable. Because we do not have habitat level information for every population we assessed, we synthesized all of the above population size information and created four resilience categories as follows:

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Occupancy and Abundance

There are 78 populations of dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). Table 4.2 shows the contribution of each resilience category as follows: 36% (very high); 7% (high); 34% (moderate); 23% (low). When looking at cumulative percentages of resilience, it is interesting to note that 77% of all of the populations are classified as moderate to very high resilience (Table 4.2).

Table 4.1. Current populations of dwarf-flowered heartleaf and associated resilience across the species range. Abundance and last observation date based on Natural Heritage Program data (2018).

Site Name	State	County	Last Observed	Total plants	Resilience
Glade Creek, Alex County	NC	Alexander	2017	>1000	very high
Catawba River: Hoyle Crk-Micol Crk	NC	Burke	2013	>1000	very high
Island Creek Heath Bluff	NC	Burke	2016	>1000	very high
Gunpowder Creek: South of Hudson	NC	Caldwell	2012	>1000	very high
Peaked Top Rare Plant Site/Foothills Landfill	NC	Caldwell	2014	>1000	very high
Jacob Fork West Corridor	NC	Catawba	2012	>1000	very high
Murrays Mill/Upper Balls Creek NA	NC	Catawba	2013	>1000	very high
NCDOT TIP: R-2824	NC	Catawba	2015	>1000	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	NC	Catawba	2013	>1000	very high
Cowpens NBF - Site 1	SC	Cherokee	2016	>1000	very high

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	State	County	Last Observed	Total plants	Resilience
Cliffside Steam Station	NC	Cleveland/Rutherford	2016	>1000	very high
Broad River/Sandy Run NA	NC	Cleveland	2012	>1000	very high
Broad River: Brushy Creek	NC	Cleveland	2016	>1000	very high
Buffalo Creek: Kings Mountain Res	NC	Cleveland	2016	>1000	very high
Buffalo Creek: Tributaries N and S of SR 2047	NC	Cleveland	2012	>1000	very high
Rhyne Conservation Preserve	NC	Lincoln	2016	>1000	very high
Mill Creek Forest and Seep	NC	Polk	2016	>1000	very high
New Hope Springhead Swamp	NC	Polk	2016	>1000	very high
Big Horse Creek Rare Plant Site	NC	Rutherford	2015	>1000	very high
Broad River: Floyds Creek	NC	Rutherford	2016	>1000	very high
Davenport Road/Mountain View Rare Plant Site	NC	Rutherford	2016	>1000	very high
Facebook Site	NC	Rutherford	2016	>1000	very high
Floyds Creek Tributray Rare Plant Site	NC	Rutherford	2012	>1000	very high
New Bethel Rare Plant Site	NC	Rutherford	2015	>1000	very high
Richardson Creek trib above Toms Lake	NC	Rutherford	2016	>1000	very high
DNR Peters Creek Heritage Preserve	SC	Spartanburg	2016	>1000	very high
Taylor Blalock Res	SC	Spartanburg	2016	>1000	very high
Leepers Creek Heartleaf Site	NC	Lincoln	2006	>1000	very high
Little Gunpowder Creek Rare Plant Site 1	NC	Caldwell	2015	500-1000	high
Little Gunpowder Creek Rare Plant Site 2	NC	Caldwell	2015	500-1000	high
Northern Catawba County	NC	Catawba	2017	500-1000	high
Rock Barn Solar Farm	NC	Catawba	2010-2011	500-1000	high
Buffalo Creek Rare Plant Site	NC	Cleveland	2012	500-1000	high
Third Creek Rare Plant Site	NC	Alexander	2010	100-500	moderate
Hickory Area	NC	Burke/Catawba/Caldwell	2016	100-500	moderate
Burke County - Drowning Creek UT	NC	Burke	2017	100-500	moderate
Simms Hill/Little River Uplands	NC	Burke	2015	100-500	moderate
Smith Cliff/Henry Fork River	NC	Burke	2015	100-500	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	NC	Catawba	2016	100-500	moderate
NCDOT TIP R-2824	NC	Catawba	2015	100-500	moderate
South Fork Catawba River, Henry Fork	NC	Catawba	2007	100-500	moderate
Broad River/Sandy Run NA	NC	Cleveland	2012	100-500	moderate
Brushy Creek Headwaters	NC	Cleveland	2014	100-500	moderate
First Broad River: Crooked Run Creek	NC	Cleveland	2010	100-500	moderate
No Business Creek, Boyd Tract	NC	Cleveland	2007	100-500	moderate

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	State	County	Last Observed	Total plants	Resilience
West Shelby Mesic Slope	NC	Cleveland	2016	100-500	moderate
UT of Kings Mountain Res	NC	Gaston	2012	100-500	moderate
Buffalo Shoals Creek	NC	Iredell	2014	100-500	moderate
Cat Square Heartleaf Forest	NC	Lincoln	2012	100-500	moderate
Collinsville (Hughes) Creek Slopes	NC	Polk	2016	100-500	moderate
Fox Knoll Farm	NC	Polk	2016	100-500	moderate
Forest City: Adj to Isothermal CC	NC	Rutherford	2010	100-500	moderate
Jonas Road Rare Plant Site	NC	Rutherford	2014	100-500	moderate
Knob Creek NA	NC	Cleveland	2005	100-500	moderate
Buffalo Creek	NC	Cleveland	2005	100-500	moderate
Kross Keys NA	NC	Polk	2005	100-500	moderate
Catawba River: North Fork Mountain Creek	NC	Catawba	2005	100-500	moderate
Catawba River: Lake James	NC	Burke	2006	100-500	moderate
Hogpen Branch Transplant Site	NC	Rutherford	2005	100-500	moderate
NCDOT TIP R-3603A	NC	Alexander	2017	<100	low
South Mountains Pleasant Grove Uplands	NC	Burke	2016	<100	low
Gunpowder Creek	NC	Caldwell	2012	<100	low
Killian Crossroads	NC	Catawba	2010	<100	low
Pott Creek	NC	Catawba	2012	<100	low
Beaverdam Crk at First Broad River	NC	Cleveland	2011	<100	low
Buffalo Creek: Potts Creek	NC	Cleveland	2012	<100	low
Buffalo Creek: Ravine	NC	Cleveland	2007	<100	low
Hickory Creek - UT (Shelby High School)	NC	Cleveland	2016	<100	low
Boulder Creek Subdivision - Jordan Road	SC	Greenville	2016	<100	low
Gateway Elementary School	SC	Greenville	2017	<100	low
Fanjoy Road Site	NC	Iredell	2015	<100	low
Levan Family Farm	NC	Iredell	2013	<100	low
Lincoln County, SR-1314	NC	Lincoln	2014	<100	low
Northeast Lincolnton: UT Walker Branch	NC	Lincoln	2009	<100	low
Sandy Spring Church Springhead Swamp	NC	Polk	2005	<100	low
First Broad River: Hickory Creek	NC	Cleveland	2006	<100	low
Smith Cliff/Henry Fork River	NC	Burke	2005	<100	low
First Broad River: Beaverdam Creek Tribs	NC	Cleveland	2006	<100	low

Table 4.2. Population resilience categories by county for dwarf-flowered heartleaf.

County	Very High	High	Moderate	Low	Totals
Alexander	1		1	1	3
Burke/Catawba/Caldwell			1		1
Burke	2		4	2	8
Caldwell	2	2		1	5
Catawba	4	2	4	2	12

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Cherokee	1				1
Cleveland/Rutherford	1				1
Cleveland	4	1	7	6	18
Gaston			1		1
Greenville				2	2
Iredell			1	2	3
Lincoln	2		1	2	5
Polk	2		3	1	6
Rutherford	7		3		10
Spartanburg	2				2
Totals	**28**	**5**	**26**	**19**	**78**
% of total	*36*	*7*	*34*	*23*	*100*
Cumulative %	*40*	*43*	*77*	*100*	--

Population Trends

Although we lack an adequate past time series of abundance data for all populations to estimate growth rates or population trends, NCNHP conducted surveys of thirteen of the largest populations across the range of the species from 2012-2016. Table 4.3 shows the results of all of these surveys. Two populations show an increasing trend, nine show a stable trend, and two show a decreasing trend.

Table 4.3. Summary of population trends over 5 years of monitoring data for 13 of the largest populations of dwarf-flowered heartleaf across its range (from: Robinson and Padgett 2016).

Trend	Survey	Site	2016 estimated number of plants (Rosettes)	2016 area occupied (Acres)
Increasing	NCNHP	Cliffside Steam Station (EO 276)	39,535	52
	NCNHP	Broad River: Floyds Creek, Long Branch (EO 177)	12,687	5.67
Stable	NCNHP	Island Creek Bluff/Love Lady Site (EO 029)	50,481	61.76
	NCNHP	Rhyne Preserve (EO 302)	19,873	22.43
	NCNHP	Mills Creek Forest and Seep (EO 023)	1,733	1.39
	NCNHP	New Hope Springhead Swamp (EO 125)	12,235	5.03

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

	NCNHP	Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop (EO099)	106,940	83.39
	NCNHP	Broad River: Cleghorn Creek, US 221 (EO 176)	6,750	7.24
	NCNHP	Cowpens National Battlefield (SC EO 016, 017, 018)	2,823	6.05
	NCNHP	Peters Creek Preserve (SC EO 011)	3,306	8.98
	NCNHP	Blalock Reservoir (SC EO 007, 031)	3,505	7.59
Decreasing	NCNHP	Second Broad River (Forest City Industrial Complex) (EO 154)	2,576	4.74
	NCNHP	South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)	123	0.09

Current Species Representation

Representation describes the ability of a species to adapt to changing environmental conditions. We lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species.

Current Species Redundancy

For the dwarf-flowered heartleaf to maintain viability, the species also needs to exhibit some degree of redundancy. Species-level redundancy reflects the ability of a species to withstand catastrophic events, and is best achieved by having multiple, widely distributed populations relative to the spatial occurrence of catastrophic events. Redundancy for dwarf-flowered heartleaf is the total number and resilience of population segments and their distribution across the species range.

An important question when investigating redundancy for dwarf-flowered heartleaf is, "what exactly is a catastrophe?" We consider a catastrophe to be any population level disturbance that

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

has the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, like hurricanes, and often with devastating effects, however they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010).

As stated previously, there are 78 populations of dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). The populations are spread across the range, although a majority occur in North Carolina. Although, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances, the species range is very small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

CHAPTER 5: INFLUENCES ON VIABILITY

Hexastylis naniflora populations occur in rapidly growing urban areas with expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. In addition to threats associated with residential, commercial, and industrial development, other documented threats include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of ponds, impacts from grazing cattle, ORV damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

752 siltation (NCNHP 2016, Robinson and Padgett 2016). Climate change may exacerbate these risk
753 factors through changes in temperature and precipitation.
754
755 Threats were assessed for populations monitored by NCNHP during 2012-2016 (Robinson and
756 Padgett 2016), and EOs were reviewed for other documented threats to populations. Indirect or
757 direct threats that were observed, inferred, or suspected to have an impact on populations were
758 recorded and assigned a ranking based on their severity, scope, and immediacy from field
759 observations. The rank for each threat factor determines the overall value for each threat
760 observed at each population. No significant changes in threats within populations were noted
761 from 2012-2016. Threats observed during these years included development, incompatible
762 forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and
763 road construction.
764
765 Below, we summarize primary threats to the viability of dwarf-flowered heartleaf. Primary
766 influences will be carried forward in our future projections in the next section.
767
768 ***Human Population Change***
769 Increasing human populations drive development. With increases in population, there will be
770 increasing conversion of open space to more impervious cover, with a subsequent increase in
771 roads and other associated infrastructure. Increases in roads and impervious cover have the
772 potential to lead to habitat loss and/or fragmentation, a primary risk factor for dwarf-flowered
773 heartleaf. Tables 5.1-5.2 and Figures 5.1-5.2 show the estimated human population increases for
774 North Carolina and South Carolina counties within the range of the species. The most populous
775 counties include Greenville and Spartanburg in South Carolina, and Catawba, Gaston and Iredell
776 counties in North Carolina.
777
778 **Table 5.1**-Human population projections for North Carolina counties within the range of dwarf-
779 flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

County	2018	2023	2028	2033	2037
Alexander	38,609	39,244	39,686	39,992	40,169
Burke	90,865	93,124	95,382	97,644	99,452

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Caldwell	83,919	86,723	88,689	91,126	92,870
Catawba	157,424	159,799	162,175	164,549	166,447
Cleveland	98,862	99,685	100,004	100,128	100,170
Gaston	221,112	227,667	237,344	245,276	252,388
Iredell	179,740	195,623	211,501	227,383	240,088
Lincoln	84,494	91,034	96,865	103,069	107,858
Polk	21,273	21,823	22,288	22,681	22,955
Rutherford	67,880	68,154	68,283	68,341	68,368

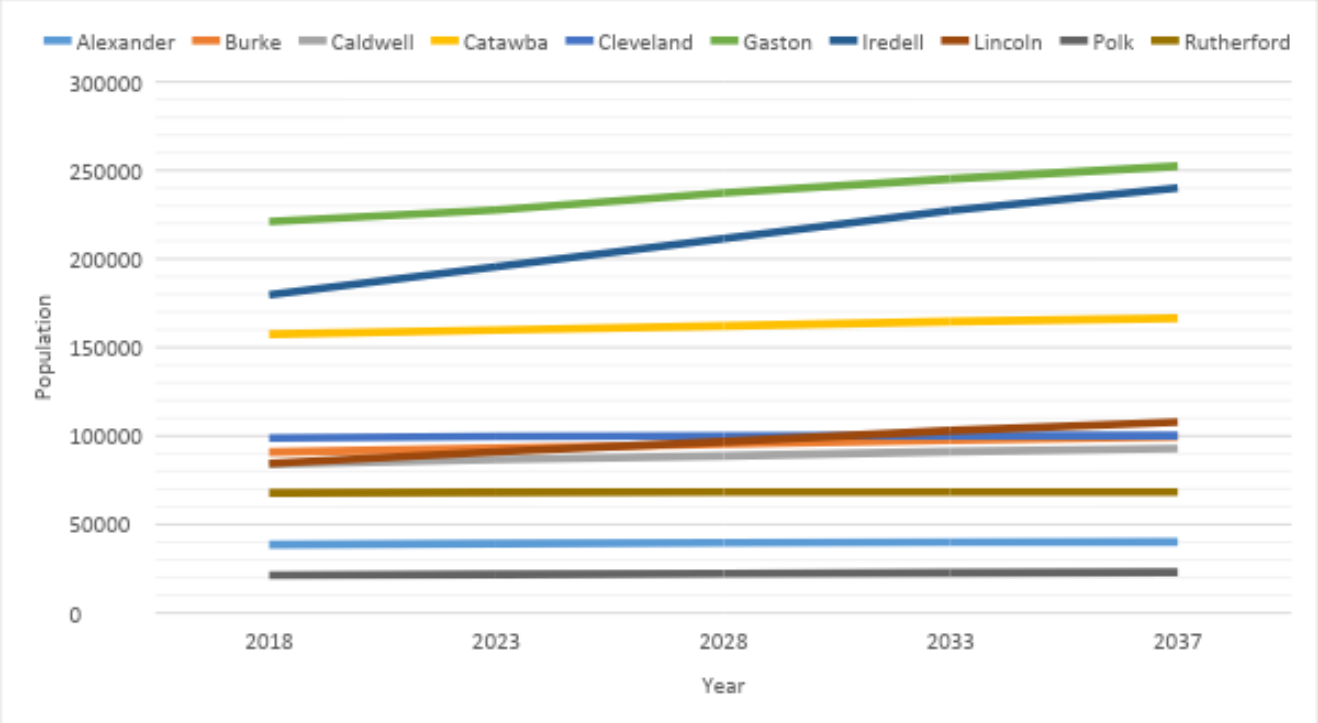


Figure 5.1- Human population projections for North Carolina counties within the range of dwarf-flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

Table 5.2- Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

County	2020	2025	2030	2035
Cherokee	61,760	64,760	67,350	70,170

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Greenville	492,890	517,740	542,290	567,010
Spartanburg	310,220	323,550	336,810	350,110

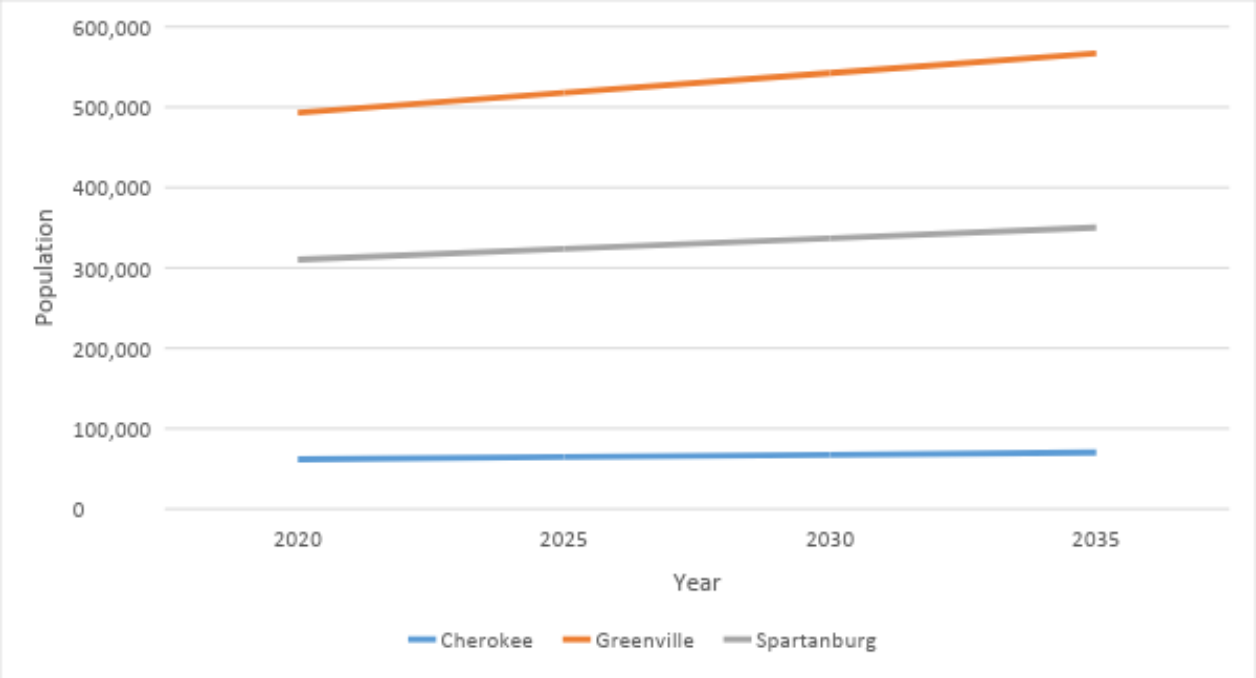


Figure 5.2. Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

Development

A large number of the known populations occur near expanding urban areas and are threatened by the residential, commercial, and industrial development associated with this growth. Populations occurring in more rural areas are threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds.

A 2010 review of existing NHP EOR data revealed that all or portions of 26 populations (24% of the total) had been directly or indirectly impacted through development projects or other causes such as trash disposal, expansion of residential lawns, cattle, or invasive exotics (NCNHP 2010;

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

SCDNR 2010). Another 16 populations have been specifically reported to be threatened by one or more of these same sources. Therefore, threats have either occurred or are reasonably foreseeable within 42 of the 113 populations (corresponding to 37% of all known populations). Of these 42 populations, all or portions of 22 (50%) had been adversely impacted by activities requiring ESA Section 7 consultation with the USFWS. The fact that nearly 20% of all known populations had been subject to formal Section 7 consultation illustrates the threats faced by the species.

In the same 2010 review, the most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving *H. naniflora* is road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations between the USFWS and the NCDOT. Collectively, these projects have adversely impacted or are currently expected to impact some 22,135 rosettes. In most cases the Section 7 process has resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection to those plants remaining (post-construction) within NCDOT right-of-way (ROW).

Other forms of economic development have also resulted in the destruction or modification of habitats occupied by *H. naniflora*; in many cases, these activities have also required Section 7 consultations with the USFWS. Examples of these activities include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities (in compliance with Federal Aviation Administration standards) at a regional airport. Collectively, these activities have involved the loss or relocation of several thousand rosettes.

Blalock Reservoir in Spartanburg County, South Carolina was once estimated to contain the largest population of *H. naniflora*, with over 11,000 rosettes reported here in 1997 (JJ&G, 1998). This population was the subject of a section 7 consultation as a result of a proposal to raise the elevation of Blalock Reservoir, which provides water supply storage to Spartanburg County and the City of Spartanburg (USFWS, 2001). Approximately one-third of this population was directly threatened by inundation, and the Federal agency committed to the relocation of some

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

3,054 rosettes to remaining areas of occupied habitat around the reservoir. At the conclusion of formal section 7 consultation, the USFWS anticipated that as many as 6,619 rosettes (assuming that all transplants survived) would be afforded protection through restrictive covenants placed on properties owned by the Spartanburg Water System (SWS) surrounding Blalock Reservoir. However, this population was last reported to contain a mere 1,400 rosettes (Newberry, 2006), and has twice since been impacted by encroachments from adjacent landowners (Newberry, 2009; Schneider, 2006, and JJ&G, 2006). Some of these apparent declines could be partially an artifact of incomplete survey effort, in that the exhaustive surveys which led to the 1997 estimate (of 11,000 rosettes) have never been repeated. However, it seems unlikely that plants occurring on privately owned shoreline not subject to restrictive covenants would be any more stable than those occurring on properties specifically protected and managed for the species (by SWS).

Invasive Species and Woody Encroachment

Several of the known populations of dwarf-flowered heartleaf occur on steep ravine slopes which also support stands of mixed hardwoods with an understory of mountain laurel (*Kalmia latifolia*) or *Rhododendron spp*. These stands are often very dense and reduce the amount of light reaching the dwarf-flowered heartleaf plants growing below. Under these conditions the plants often show reduced vigor and reduced flower and fruit production. Careful, selective logging or natural tree fall and limited understory removal would open up these populations to more light. Additional light, if not accompanied by increased siltation from the intensive soil disturbances associated with forest clear-cutting, probably would benefit these populations (Gaddy 1981).

Invasive exotic plant species are rampantly spreading throughout riparian corridors and ravines across the range of this species (USFWS 2011). Invasive exotics such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum* spp.), Japanese honeysuckle (*Lonicera japonica*) and Japanese Nepal grass (*Microstegium vimineum*) are known to threaten several populations; however, the scope and magnitude of this threat has not been comprehensively assessed. This threat requires active management in order to be successfully abated. At present, the majority of protected

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

870 populations are secured against habitat conversion, but lack designated managers with the
871 technical expertise and available resources (funding and personnel) to address this threat.
872
873
874
875 ***Climate Change***
876
877 There is a growing concern that climate change may lead to increased frequency of severe storms
878 and droughts (McLaughlin *et al.* 2002, p. 6074; Golladay *et al.* 2004, p. 504; Cook *et al.* 2004, p.
879 1015). Because typical habitats for this species include moist soils adjacent to creeks,
880 streamheads, or along lakes and rivers, and plants have been observed to grow larger and have
881 more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993),
882 specific effects of climate change to the dwarf-flowered heartleaf are likely related to changes in
883 soil moisture associated with potential increases in drought.
884
885 Warming in the Southeast is expected to be greatest in the summer (NCCV 2016) which is
886 predicted to increase drought frequency, while annual mean precipitation is expected to increase
887 slightly, leading to increased flooding events (IPCC 2013, p.7; NCCV 2016). Changes in
888 climate may affect ecosystem processes and communities by altering the abiotic conditions
889 experienced by biotic assemblages resulting in potential effects on community composition and
890 individual species interactions (DeWan et al. 2010, p.7).
891
892 Despite the recognition of potential climate effects on ecosystem processes, there is uncertainty
893 about what the exact climate future for the Southeastern US will be and how the ecosystems and
894 species in this region will respond. Although climate change was not a factor leading to the
895 original listing of the species, it should be recognized that the greatest threat from climate change
896 may come from synergistic effects. That is, factors associated with a changing climate may act as
897 risk multipliers by increasing the risk and severity of more imminent threats. As a result, impacts
898 from rapid urbanization in the region might be exacerbated under even a mild to moderate
899 climate future.
900

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Regardless of a pessimistic, optimistic, or status quo climate future, the following systematic changes are expected to be realized to varying degrees in the Southeastern US (IPCC 2013):

- More frequent drought
- More extreme heat (resulting in increases in air and water temperatures, Figure 5-3)
- Increased heavy precipitation events (e.g., flooding)
- More intense storms (e.g., frequency of major hurricanes increases)
- Rising sea level and accompanying storm surge

In recent years, the Southeast has experienced moderate to severe droughts that many observers have implicated in population declines and poor transplant survivorship (NCNHP, 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). The extent to which these climate changes will significantly affect populations of dwarf-flowered heartleaf is currently unknown.

Appendices 4a and 4b gives summary reports on historical and future predicted climate parameters from the USGS National Climate Change Viewer for both North Carolina and South Carolina. As discussed above, the trend for these States is consistent with the general trend in the Southeast: more frequent drought, more extreme heat, and increased precipitation events. If these predictions hold true, dwarf-flowered heartleaf habitat would likely be impacted through increased evaporative rates and decreased soil moisture (Appendices 4a and 4b), increased potential for catastrophic wildfire events, as well as potential disruption of stream bank morphology through increased flooding events. Our habitat model indicates a preferred temperature and precipitation range, indicating that the species would be sensitive to a changing climate.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Chapter 6: FUTURE CONDITION

Future Considerations

Our analysis of the past, current, and future influences on what the dwarf-flowered heartleaf needs for long term viability revealed that there are several influences that pose risks to future viability of the species. These risks are primarily related to habitat changes from development and long term climate change. We use projections of urban development to assess potential habitat loss and fragmentation. We also considered how climate change may exacerbate the impacts of development in a qualitative fashion using a narrative approach.

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below. Based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape, we chose to project populations out to the year 2040 under each scenario, but no further.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

DRAFT

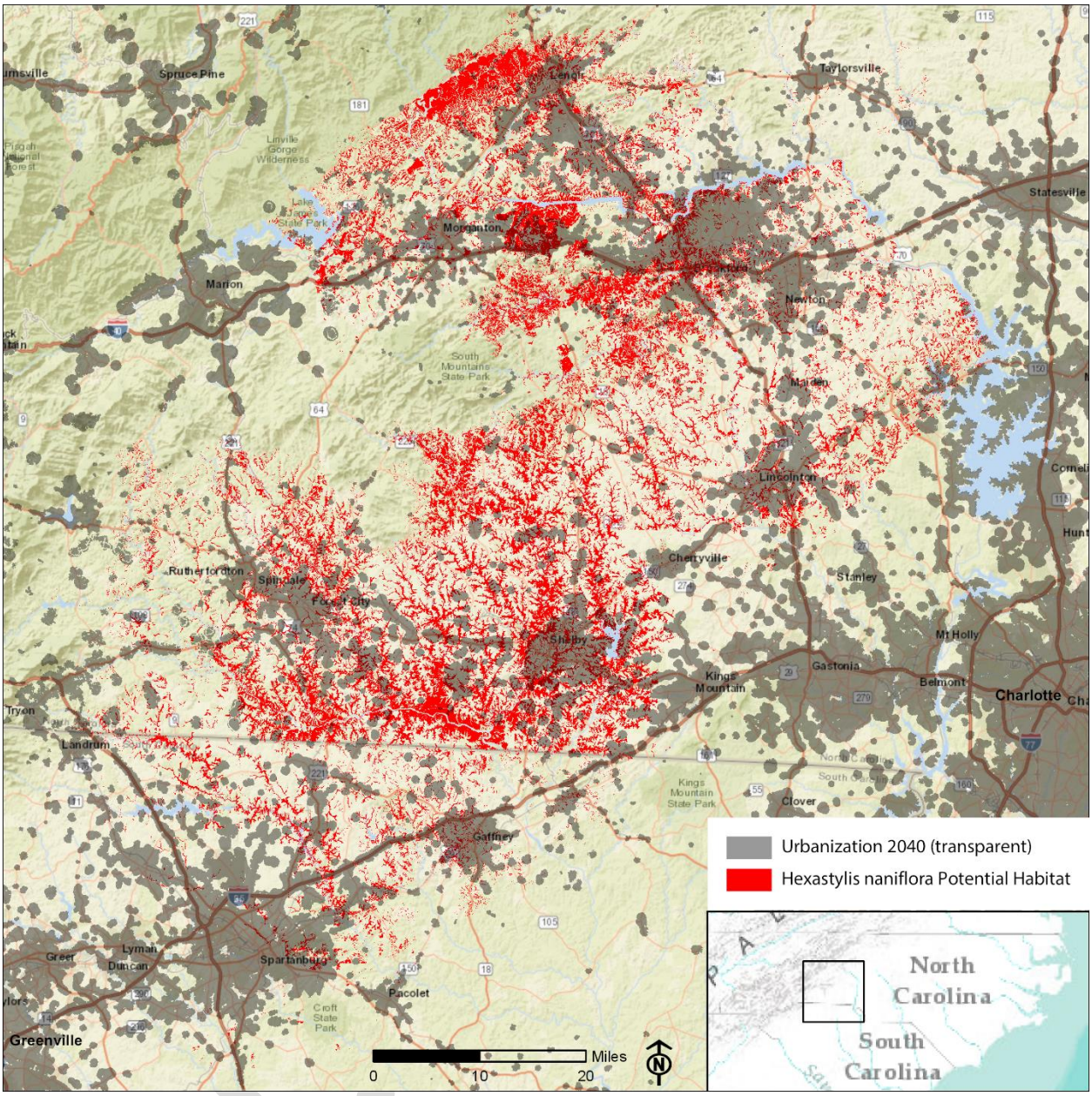
Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040 (Figure 6.1). SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995).

Figure 6.1. Results of the SLEUTH model with *Hexastylis naniflora* potential habitat predicted by the MAXENT model overlaid.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.



The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations (from Current Conditions—68 populations)

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There is no data available on the exact relationships between urbanization and the impacts to dwarf-flowered heartleaf. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative impacts; development increase of at least 50% was likely to have significant impacts to populations. We also assume that populations currently on protected lands are likely to see smaller impacts from urbanization compared to those that are not protected, but protection status (perpetuity vs non-perpetuity) matters. For example, Registered Heritage Areas are non-binding agreements with a land owner, and if the land changes ownership, or the owner decides not to continue with the agreement, then the Registry is no longer valid. Appendix 4 shows the protection status of each delineated population which helped to inform our assessment of resilience under each scenario.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. We believe this is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider for Current Conditions include detections that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to persist. Dwarf-flowered heartleaf is a long-lived perennial, and several EOs have been revisited after more than 10 years and the species was present. For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

habitat present within older EOs based on the Maxent model predictions that were not included as current populations.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future, was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resilience of that population.

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics including resilience category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resilience categories were assessed using last known abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score was calculated by taking the mean Maxent score of all potential habitat within the 1,000 foot buffer. The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 foot buffer that falls within the highest habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 foot buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

1047 flowered heartleaf is likely to persist. Table 6.1 (North Carolina) and 6.2 (South Carolina) show
1048 all of the EOs we considered and the corresponding metrics associated with resilience categories,
1049 urban development, and habitat scores.
1050
1051 **Table 6.1.** North Carolina raw data for metrics assessed to investigate potential sites where
1052 dwarf-flowered heartleaf was historically found and is likely to persist. Resilience categories are
1053 based on last known abundance estimates as follows: 1 = low; 2 = moderate; 3 = high; 4 = very
1054 high. MAXENT Average Mean refers to the mean Maxent score of all potential habitat. %
1055 Maxent classified as 0.8-1.0 represents the percentage of all potential habitat that falls within the
1056 highest habitat class. % Urban Development refers to the percentage of the 1,000 foot buffer
1057 around the EO that is projected to be urbanized in the year 2040.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

1058

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	2	34	1	3
2				
3	2	22	0	10
4	2	22	0	7
5	2	21	0	0
6				
8	1	27	0	6
9	3	44	4	0
10	4	33	2	0
11				
12	4	54	10	0
13	1	31	1	30
14	2	61	16	7
15				
16	4	18	0	47
17	1	50	13	0
18	1	36	8	2
19				
20	2	22	1	88
21	2	34	4	54
23	4	15	0	8
25	1	47	15	30
27				

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
28	2	43	12	29
29	4	43	8	30
30	4	27	2	74
31	4	30	3	86
32	2	34	2	47
33	2	33	3	0
34	1	49	13	63
35	1	42	10	23
36	1	19	0	12
37	4	41	6	17
38	2	14	0	46
39	1	19	0	11
40	2	37	2	32
44	4	20	0	59
45	1	27	5	13
46	3	42	6	6
47	1	28	1	96
48	1	14	0	12
49	4	61	14	5
50				
51	4	52	11	18
52	2	46	4	0
53	1	35	4	24
54	1	35	1	10
55	4	30	0	0
56	2	40	2	6
57	2	21	0	80
58	1	42	5	0
59	2	11	0	49
60	1	25	0	2
61	3	41	0	0
62	2	34	0	0
63	1	27	0	6
64	2	39	9	11
69	2	46	11	19
70	2	38	1	0
71	2	30	2	0
72	2	52	14	0
73	4	60	17	1

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
74	3	65	14	4
75	4	47	6	9
76	4	42	4	10
77	3	31	1	27
79	2	39	1	0
80	1	43	4	15
83	2	17	0	11
84	2	13	0	1
85	2	42	4	5
87				
89	2	13	2	0
90	2	28	2	0
91	1	49	5	0
92	2	15	0	30
106	4	39	4	38
107	1	14	0	40
113	4	46	4	7
114				
115	2	37	3	26
118	3	42	0	9
121	2	41	5	0
122	1	12	0	39
124	1	12	0	9
125	4	15	0	41
130	2	17	0	24
149	4	64	17	3
151	2	16	0	27
154	4	30	1	22
157	2	20	0	0
158	3	36	7	5
159	4	62	24	60
160	3	62	24	32
161	4	64	28	30
162	1	32	2	58
163	2	15	0	56
164	3	18	0	52
165	1	13	0	56
166	1	14	0	40
167	4	30	0	20

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
168	4	19	0	34
169	1	30	0	12
170	2	17	0	40
172	1	39	3	7
173	2	30	1	48
174	1	42	4	16
175				
180	2	21	1	0
181	4	29	2	0
182	4	45	4	0
183	2	15	0	5
184	4	19	0	19
187	2	20	1	35
188	2	24	0	53
189	1	25	0	14
190				
191	2	34	2	0
192	2	35	3	0
193	2	36	7	6
194	4	51	14	18
195	1	21	0	96
196	1	23	4	67
197	4	35	8	38
198	2	32	6	25
199	2	29	5	43
200	1	26	2	87
201	1	39	4	63
202	4	35	4	85
203	1	43	4	49
204				
205	2	43	1	49
206	1	37	3	66
207	2	33	2	85
208	1	32	1	67
209	2	33	2	94
210				
212	1	37	3	85
213	1	36	4	72
219	1	32	1	4

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
222	2	23	3	7
223				
224	1	22	3	17
225	2	24	2	12
227	4	55	2	5
229	2	28	0	21
230	1	54	15	13
231	1	41	7	0
233	4	53	12	14
235	2	50	8	6
236	2	62	14	5
237	2	67	16	5
238	4	51	15	0
239	2	63	14	5
240	1	57	18	0
241	2	62	16	3
242	1	53	9	0
246	1	62	13	4
249	4	47	5	0
250	4	45	4	0
251	4	43	4	0
254	2	54	18	6
255				
256	2	54	15	13
258	3	19	0	51
259	4	25	0	0
262	4	29	2	50
263				
264				
265				
266				
267	2	29	1	0
268	1	33	2	0
269	2	49	17	0
270	1	46	18	1
271	1	26	7	0
272	1	33	0	71
273	2	28	2	0
274	2	50	8	0

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
275	2	12	0	0
276	4	42	5	21
277				
278				
279	1	32	4	89
280	2	64	30	30
281	1	64	31	36
282	1	64	31	51
283	1	65	34	59
284	1	64	35	45
286				
287	2	15	0	35
291	2	21	1	84
292	2	14	0	83
293	1	8	0	16
294	2	36	4	61
296	2	3	0	5
297				
298	2	16	0	1
299	1	12	0	0
300	1	9	0	18
303	2	31	0	0
304	2	31	0	0
305	1	30	2	0
306	1	4	0	53
308	2	15	0	3
309	1	5	0	0
310	4	58	26	35
311	2	15	0	0
312	4	17	0	57
313				
314				
315	1	36	4	61
317	1	15	0	53
318	2	34	4	52
319	4	43	4	10
320	4	41	6	98
321				

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
Min	1	3	0	0
Max	4	67	35	98

Table 6.2. South Carolina raw data for metrics assessed to investigate potential sites where dwarf-flowered heartleaf was historically found and is likely to persist. Resilience categories are based on last known abundance estimates as follows: 1 = low; 2 = moderate; 3 = high; 4 = very high. MAXENT Average Mean refers to the mean Maxent score of all potential habitat. % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat that falls within the highest habitat class. % Urban Development refers to the percentage of the 1,000 foot buffer around the EO that is projected to be urbanized in the year 2040.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	2	21	0	0
2	2	1	0	4
3				
4	1	13	0	10
5	2	0	0	64
6	1	0	0	36
7	4	27	0	35
8	2	0	0	14
9				
10				
11	4	14	0	52
12				
13	1	7	0	100
14	4	14	0	43
15	1	0	0	4
16	4	22	0	38
17	4	22	0	33
18	3	19	0	52
19	1	12	0	65
20	2	5	0	100
21	3	5	0	90
22	1	0	0	0
23				

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
24	1	4	0	3
25	1	14	0	48
26	4	12	0	65
27	4	18	1	40
28	4	19	1	49
29				
30	2	7	0	88
31	4	0	0	0
32	2	7	0	93
33	2	2	0	20
34	1	31	3	1
35	1	23	1	53
36	2	6	0	0
37	1	24	2	0
38	4	5	0	37
39	1	6	0	1
40	2	6	0	20
41	1	11	0	87
42	2	3	0	6
43	1	23	0	43
44				
45				
46	1	10	0	96
47				
48				
49	3	8	0	70
50	2	5	0	54
51	1	0	0	35
52	3	0	0	0
53	2	10	0	66
54	2	9	0	91
55	1	4	0	99
56	2	14	0	96
57	3	15	0	38
59	2	4	0	17
60	4	17	1	12

Min	1	0	0	0
Max	4	31	3	100

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development

Next, we implemented a set of ranking rules using the data from Tables 6.1 and 6.2 to further assess which EOs had a higher likelihood of persistence on the landscape. We used SMART methodology to quantify and implement our ranking rules. Because the metrics of interest vary in data type (i.e. categorical vs continuous) and range of values (i.e. not all continuous variables have the same maximum and minimum), our first step was to normalize all of the data on a scale of 0-100. Normalization techniques allow for aggregation of criteria with numerical and comparable data. We decided to analyze North and South Carolina data separately because the Maxent model predicts habitat differently across state lines due to differences in soil classification. We weighted each variable according to our opinion of the level of contribution each variable had to the probability of persistence of that particular EO. This resulted in abundance having the highest weight (100%), with habitat (as calculated by average Maxent score) and urbanization given relatively similar weighting (80%). The results of the normalization procedure and weighting can be found in Tables 6.3 and 6.4.

Table 6.3. Normalized scores for SMART analysis of North Carolina EOs and weighting scores. Resilience category represents the normalized scoring based on the last known abundance (0=low; 33=moderate; 67=high; 100=very high); MAXENT Mean is the normalized score of the average Maxent rank of all potential habitat; MAXENT percent 0.8-1 represents the normalized score of the percentage of potential habitat that falls within the highest rank category; 80% or greater SLEUTH Percent of Total is the total amount of current urbanization plus predicted urbanization at year 2040 (>80% probability) from the SLEUTH model.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	33	49	3	97
2				
3	33	30	0	90
4	33	29	0	93
5	33	28	1	100
6				

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
8	0	37	0	94
9	67	65	11	100
10	100	46	6	100
11				
12	100	80	28	100
13	0	43	2	69
14	33	90	44	93
15				
16	100	23	0	52
17	0	73	37	100
18	0	52	22	98
19				
20	33	30	3	11
21	33	48	12	45
23	100	19	0	92
25	0	68	42	69
27				
28	33	62	33	71
29	100	63	22	69
30	100	38	5	24
31	100	43	8	12
32	33	48	5	52
33	33	47	8	100
34	0	73	37	35
35	0	60	29	77
36	0	25	0	88
37	100	60	17	82
38	33	17	0	53
39	0	24	0	89
40	33	54	7	67
44	100	26	1	40
45	0	37	14	86
46	67	60	18	94
47	0	39	2	2
48	0	17	0	88
49	100	91	39	95
50				
51	100	77	31	82
52	33	68	11	100

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
53	0	50	11	76
54	0	49	1	90
55	100	43	0	100
56	33	58	7	94
57	33	28	0	19
58	0	60	15	100
59	33	12	0	50
60	0	34	1	98
61	67	59	1	100
62	33	49	0	100
63	0	38	0	94
64	33	56	24	88
69	33	67	31	80
70	33	55	3	100
71	33	42	5	100
72	33	77	41	100
73	100	89	48	99
74	67	97	41	95
75	100	69	16	91
76	100	61	11	89
77	67	43	2	72
79	33	56	4	100
80	0	62	11	85
83	33	22	0	89
84	33	15	0	99
85	33	61	10	95
87				
89	33	15	5	100
90	33	38	5	100
91	0	71	13	100
92	33	18	0	70
106	100	56	10	61
107	0	16	0	59
113	100	68	11	93
114				
115	33	53	8	74
118	67	61	1	91
121	33	59	13	100
122	0	14	0	60

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
124	0	13	0	91
125	100	19	0	58
130	33	22	0	76
149	100	95	49	97
151	33	20	0	72
154	100	41	2	78
157	33	26	0	100
158	67	51	20	95
159	100	92	69	39
160	67	92	69	68
161	100	95	79	69
162	0	45	7	41
163	33	18	0	43
164	67	24	0	47
165	0	16	0	43
166	0	16	0	59
167	100	41	0	79
168	100	25	0	65
169	0	42	0	88
170	33	22	0	60
172	0	56	8	93
173	33	42	3	52
174	0	62	12	84
175				
180	33	28	2	100
181	100	41	6	100
182	100	66	12	100
183	33	18	1	95
184	100	24	0	81
187	33	27	2	64
188	33	33	0	46
189	0	33	1	86
190				
191	33	48	7	100
192	33	49	10	100
193	33	51	19	94
194	100	75	40	81
195	0	28	0	3
196	0	30	10	32

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
197	100	50	24	61
198	33	45	18	74
199	33	41	14	56
200	0	35	6	11
201	0	56	11	36
202	100	49	11	13
203	0	62	11	50
204				
205	33	62	4	50
206	0	52	8	33
207	33	47	4	14
208	0	45	4	32
209	33	46	5	4
210				
212	0	53	9	14
213	0	52	11	27
219	0	45	2	96
222	33	31	9	92
223				
224	0	29	8	83
225	33	32	6	88
227	100	81	7	95
229	33	39	0	79
230	0	80	44	87
231	0	59	20	100
233	100	79	34	86
235	33	74	22	94
236	33	93	41	95
237	33	100	46	95
238	100	74	41	100
239	33	94	40	94
240	0	85	51	100
241	33	93	47	97
242	0	78	27	100
246	0	93	38	95
249	100	68	13	100
250	100	65	12	100
251	100	62	11	100
254	33	80	51	93

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
255				
256	33	80	44	87
258	67	25	0	48
259	100	34	0	100
262	100	41	6	49
263				
264				
265				
266				
267	33	41	3	100
268	0	46	7	100
269	33	72	49	100
270	0	67	52	99
271	0	35	19	100
272	0	47	0	28
273	33	39	7	100
274	33	73	23	100
275	33	14	0	100
276	100	61	14	79
277				
278				
279	0	46	11	9
280	33	95	85	70
281	0	95	88	64
282	0	96	88	48
283	0	97	95	40
284	0	95	100	54
286				
287	33	18	0	64
291	33	28	4	14
292	33	16	0	16
293	0	7	0	84
294	33	52	11	38
296	33	0	0	95
297				
298	33	20	0	99
299	0	13	0	100
300	0	9	0	82
303	33	44	1	100

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
304	33	43	0	100
305	0	42	5	100
306	0	1	0	46
308	33	18	0	97
309	0	3	0	100
310	100	86	75	64
311	33	19	0	100
312	100	22	0	42
313				
314				
315	0	51	10	38
317	0	19	0	46
318	33	48	12	47
319	100	63	12	89
320	100	60	17	0
321				

Weights			
100	60	20	80

Table 6.4. Normalized scores for SMART analysis of South Carolina EOs and weighting scores. Resilience category represents the normalized scoring based on the last known abundance (0=low; 33=moderate; 67=high; 100=very high); MAXENT Mean is the normalized score of the average Maxent rank of all potential habitat; MAXENT percent 0.8-1 represents the normalized score of the percentage of potential habitat that falls within the highest rank category; 80% or greater SLEUTH Percent of Total is the total amount of current urbanization plus predicted urbanization at year 2040 (>80% probability) from the SLEUTH model.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	33	67	14	100
2	33	2	0	96
3				
4	0	42	3	90
5	33	0	0	36

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
6	0	0	0	64
7	100	87	2	65
8	33	0	0	86
9				
10				
11	100	43	0	48
12				
13	0	23	0	0
14	100	43	0	57
15	0	0	0	96
16	100	72	1	62
17	100	70	1	67
18	67	62	0	48
19	0	37	0	35
20	33	16	0	0
21	67	15	0	10
22	0	1	0	100
23				
24	0	13	0	97
25	0	44	0	52
26	100	40	0	35
27	100	56	18	60
28	100	60	28	51
29				
30	33	22	0	12
31	100	0	0	100
32	33	23	0	7
33	33	5	0	80
34	0	100	100	99
35	0	75	34	47
36	33	18	0	100
37	0	78	66	100
38	100	16	0	63
39	0	19	0	99
40	33	18	0	80
41	0	36	0	13
42	33	10	0	94
43	0	72	0	57
44				

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
45				
46	0	32	0	4
47				
48				
49	67	27	0	30
50	33	16	0	46
51	0	1	0	65
52	67	0	0	100
53	33	33	0	34
54	33	29	0	9
55	0	13	0	1
56	33	43	0	4
57	67	47	8	62
59	33	13	0	83
60	100	53	21	88

Weights			
100	60	20	80

To determine a final rank for likelihood of persistence, we calculated a weighted sum for each EO. We then converted the weighted sum to a final rank value that ranged from 0-100. Finally, we determined the top 10% or 90th percentile, and top 25% or 75th percentile ranking for EOs in each state. Table 6.5 summarizes the final ranks and top 10% and 25% percentile ranks for North and South Carolina. We will include the top 10% in the status quo scenario, and the top 25% in the conservation scenario.

Table 6.5. Final Rank Scores for EOs in North and South Carolina. Dark green represents the top 10% of scores, and light green includes the top 25% of scores.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

South Carolina

EO_Code	Final Score
60	79
7	79
17	75

North Carolina

EO_Code	Final Score
149	94
73	93
49	92

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

16	74
27	71
28	70
31	69
14	66
11	63
38	62
34	61
1	60
26	59
52	56
57	56
18	55
37	54
36	48
42	44
2	43
40	42
59	41
49	41
8	39
33	39
4	37
39	35
35	34
43	34
24	33
21	32
22	31
53	31
50	31
15	30
25	26
56	24
5	24
54	22
30	22
32	20
51	20
6	20
19	19

12	90
238	90
161	88
227	87
249	86
233	86
182	85
250	85
251	84
194	84
51	84
310	84
75	84
113	84
319	81
76	81
74	81
10	80
181	79
55	79
37	79
276	78
259	77
159	77
29	76
160	73
167	72
9	72
154	72
23	71
106	71
197	71
61	70
46	70
184	69
237	69
158	68
118	68
241	68
239	67
236	66

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

20	17
41	12
46	8
13	5
55	3
3	0
9	0
10	0
12	0
23	0
29	0
44	0
45	0
47	0
48	0

14	66
72	64
168	64
254	64
269	64
262	64
280	63
274	62
256	62
125	61
235	60
52	60
16	60
121	58
77	58
85	57
79	57
44	57
70	57
312	56
192	56
56	56
69	55
33	55
30	55
191	55
193	55
64	55
62	55
202	55
240	54
1	54
303	54
246	54
71	54
320	54
304	54
267	53
273	53
90	53
31	53

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

28	51
242	51
17	51
5	50
180	50
270	50
157	50
222	49
230	49
115	48
281	48
91	48
4	48
298	48
311	48
225	48
198	47
89	47
3	47
84	47
308	47
275	47
183	46
40	46
284	46
258	46
231	46
229	46
58	46
164	46
83	45
282	44
18	44
205	43
172	42
296	42
283	42
268	42
80	41
130	41
174	41

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

305	41
199	41
271	40
25	40
32	40
219	40
35	40
151	40
54	39
318	39
187	39
173	39
92	39
21	39
60	38
63	38
8	38
294	37
169	37
287	37
170	36
45	36
53	36
188	34
189	34
299	34
38	33
224	33
39	33
36	33
13	32
309	31
124	31
59	31
48	31
34	30
203	30
163	30
207	28
293	27
300	27

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

57	25
209	25
201	25
315	24
291	24
162	23
20	23
206	23
107	22
166	22
122	22
292	21
213	21
208	20
272	20
317	19
196	18
212	17
165	17
306	14
279	14
200	12
47	10
195	7
2	0
6	0
11	0
15	0
19	0
27	0
50	0
87	0
114	0
175	0
190	0
204	0
210	0
223	0
255	0
263	0
264	0

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

265	0
266	0
277	0
278	0
286	0
297	0
313	0
314	0
321	0

Below we describe how we integrated potential positive and negative influences across the scenarios. We can assume there is some tipping point at which an area becomes so urbanized it is unsuitable for dwarf-flowered heartleaf, but we don't know exactly what that tipping point is. Similarly, we can assume additional populations are likely to be found or rediscovered across the range, but there is no clear way to predict the exact number or location of these populations. Although there is great uncertainty associated with how the species will be influenced by these factors, the three scenarios are intended to capture the range of this uncertainty. Note, changes in climate have potential to exacerbate the effects of urbanization, but these effects are not likely to occur within our projection window (e.g. 2040).

Status Quo Scenario

Under the status quo scenario, we assume a few populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the % increase in urban development and whether a population is protected or not. We assessed population resilience under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

1137 ▪ Protected in perpetuity—no negative impacts from urbanization
1138 ▪ Voluntary protection/non-perpetuity—population drops 1 resilience rank if
1139 % increase in urbanization exceeds >50% threshold
1140 o Non-protected—population drops 1 resilience rank if % increase in urbanization
1141 exceeds >25% threshold; population drops 2 resilience ranks if % increase in
1142 urbanization exceeds >50% threshold
1143

1144 *High Development Scenario*

1145 Under the high development scenario, we assume no additional populations will be identified as
1146 persisting throughout the range, and that impacts from urbanization that are relatively high, and
1147 are also affected by whether a population is protected or not. We assessed population resilience
1148 under the following assumptions:

1149 ● No additional populations are identified as persisting
1150 ● Potential impacts of urban development based on SLEUTH Model projections focused on
1151 current delineated populations:
1152 o Protected areas
1153 ▪ Protected in perpetuity— population drops 1 resilience rank if % increase
1154 in urbanization exceeds >50% threshold
1155 ▪ Voluntary protection/non-perpetuity— population drops 1 resilience rank
1156 if % increase in urbanization exceeds >25% threshold; population drops 2
1157 resilience ranks if % increase in urbanization exceeds >50% threshold
1158 o Non-protected—population drops 1 resilience rank if % increase in urbanization
1159 exceeds >25% threshold; population drops 2 resilience ranks if % increase in
1160 urbanization exceeds >50% threshold; extirpation of populations if % increase in
1161 urbanization exceeds >90% threshold.
1162

1163 *Targeted Conservation Scenario*

1164 Under the targeted conservation scenario, we assume it is likely several additional populations
1165 (i.e. more than status quo scenario) will be identified as persisting throughout the range. The

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resilience under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

Future Resilience

Our focus on future resilience of dwarf-flowered heartleaf is on the potential impacts from urbanization. Table 6.6 shows a summary of currently delineated populations and the predicted urban development to occur within each of the populations. The table only includes those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Populations not included in this table are not predicted to be urbanized at all, so for the purposes of future analysis, will be assumed to retain the same resilience category as current. For those populations included in the table, we focus on those populations that are anticipated to increase in urbanization beyond a threshold value, depending on the scenario, but thresholds include >25% and >50% increases. Also taken into account is whether or not a population is on protected lands, and if so, whether the population is protected in perpetuity or not. Below is a summary of projected future resilience under each of the three scenarios.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Table 6.6. Results of the SLEUTH model. Populations consist of both stand-alone EOs and aggregates of multiple EOs following the definition of delineating demographic populations from Chapter 4. Included are only those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Red cells indicate populations that are predicted to increase >50% in urbanization. Orange cells indicate populations that are predicted to increase >25% in urbanization.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Population Number	Total Area (sq m)	Already classed Urban	80% chance	90% chance	95% chance	97.5% chance	100% chance	>80%
206	17346.37096	0.40%	0.00%	0.00%	0.00%	6.24%	93.41%	99.65%
306	7804.656249	0.00%	15.11%	49.91%	7.83%	0.00%	22.40%	95.24%
208	55360.86786	17.31%	0.00%	0.00%	0.00%	0.00%	82.69%	82.69%
279	1951.661571	0.00%	0.00%	0.00%	0.00%	0.00%	80.85%	80.85%
214	15043.2984	0.00%	0.00%	1.44%	10.97%	0.00%	55.72%	68.13%
248	25486.15611	28.80%	0.00%	3.22%	0.02%	0.02%	53.03%	56.30%
316	43177.79587	20.06%	0.00%	16.68%	7.08%	0.00%	20.67%	44.43%
247	49898.17159	5.87%	0.00%	6.37%	0.00%	0.00%	23.35%	29.73%
291	11666.76374	35.39%	12.28%	13.53%	2.43%	0.00%	0.23%	28.47%
287	7901.775408	0.00%	0.00%	11.50%	0.00%	0.00%	14.25%	25.75%
312	6535.273235	0.00%	25.28%	0.00%	0.00%	0.00%	0.00%	25.28%
32	31220.60253	60.74%	0.00%	20.39%	0.00%	0.00%	0.00%	20.39%
177	26954.54153	25.34%	12.19%	0.92%	0.10%	5.31%	0.13%	18.66%
292	15611.18205	0.00%	0.00%	0.00%	0.00%	0.00%	18.40%	18.40%
261	21644.22924	0.00%	0.00%	13.21%	3.35%	0.00%	0.00%	16.56%
295	23486.00987	18.20%	0.00%	3.41%	11.99%	0.25%	0.00%	15.65%
125	20742.3249	0.00%	1.02%	5.65%	0.00%	6.67%	0.00%	13.34%
59	8172.007769	0.00%	13.09%	0.00%	0.00%	0.00%	0.00%	13.09%
302	120342.0641	1.46%	2.55%	2.55%	0.77%	2.33%	3.98%	12.19%
178	376781.2214	28.59%	2.79%	2.40%	0.68%	0.59%	2.64%	9.11%
93	43754.11642	0.19%	0.00%	0.00%	0.00%	0.00%	7.82%	7.82%
77	6044.427562	0.00%	1.51%	6.14%	0.00%	0.00%	0.00%	7.64%
179	15145.19453	85.06%	1.14%	0.00%	5.12%	0.00%	0.49%	6.75%
44	15081.76951	61.17%	0.27%	0.00%	0.00%	0.00%	4.68%	4.95%
252	39595.93143	63.47%	0.00%	3.80%	0.00%	0.00%	0.00%	3.80%
100	423621.7376	9.01%	1.32%	1.10%	0.72%	0.14%	0.00%	3.27%
276	123688.7819	0.61%	0.36%	1.87%	0.01%	0.00%	0.00%	2.24%
216	66424.06073	0.00%	0.91%	0.00%	0.00%	0.00%	0.00%	0.91%
154	33924.92259	0.00%	0.00%	0.37%	0.00%	0.00%	0.00%	0.37%
29	249998.8742	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.05%
1	30711.68144	0.41%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2	36339.91976	11.32%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3	24498.03483	24.77%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
31	42929.76479	100.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
96	95947.32128	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
130	1168.240433	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
176	39787.48373	0.89%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
195	7805.599588	99.94%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
317	584.7346337	99.70%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
318	5396.859208	99.74%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
320	125.5182447	98.79%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Status Quo Scenario

In the Status Quo scenario, there are predicted to be 75 populations of dwarf-flowered heartleaf on the landscape (Table 6.7). The predicted resilience of the extant populations are as follows:

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the seven additional populations predicted to persist under this scenario, four are in South Carolina, and three in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), and moderate (4).

Table 6.7. Predicted resilience categories for *Hexastylis naniflora* populations under the Status Quo scenario, and comparison to current condition.

Site Name	Current Resilience	Status Quo
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	high
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributray Rare Plant Site	very high	very high

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	Status Quo
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	high
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	Status Quo
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	low
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low
First Broad River (North Carolina)	n/a	present
Cherokee Creek/Bonner and Robin School Roads	n/a	present

High Development Scenario

In the High Development scenario, there are predicted to be 72 populations of dwarf-flowered heartleaf on the landscape (Table 6.8). The predicted resilience of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No new future populations are predicted to be discovered. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to moderate resilience; one high resilience population is predicted to drop to moderate; two moderate populations are predicted to drop to low resilience; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Table 6.8. Predicted resilience categories for *Hexastylis naniflora* populations under the High Development scenario, and comparison to current condition.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	High Development
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	moderate
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributary Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	moderate
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	High Development
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	extirpated
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	High Development
Gateway Elementary School	low	low

Targeted Conservation Scenario

In the Targeted Conservation scenario, there are predicted to be 79 populations of dwarf-flowered heartleaf on the landscape (Table 6.9). The predicted resilience of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations discovered to persist, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the sixteen additional populations predicted to persist under this scenario, ten are in South Carolina, and six in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), moderate (11), and low (2).

Table 6.9. Predicted resilience categories for *Hexastylis naniflora* populations under the Targeted Conservation scenario, and comparison to current condition.

Site Name	Current Resilience	Targeted Conservation
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	Targeted Conservation
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	high
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributray Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	high
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	Targeted Conservation
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	low
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low
First Broad River (North Carolina)	n/a	present
First Broad Hop-Hornbeam NA	n/a	present
Big Island Carolina Hemlock Bluff	n/a	present
Cherokee Creek/Bonner and Robin School Roads	n/a	present
Arrowood Branch	n/a	present
Cherokee Creek/SC 11	n/a	present

Viability Summary

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resilience and extirpation of a few populations is offset by the fact that several additional populations were found to persist in the Status Quo and Targeted Conservation scenarios. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resilience in several additional populations. Regardless of the scenario, the majority of the populations expected to persist on the landscape in 2040 are of at least moderate resilience.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances, however the species range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

Given that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where we have relatively few current populations. As discussed below, we believe there are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, we believe our scenarios do not predict declines in species representation.

Table 6.10. Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	CURRENT	STATUS QUO	HIGH DEVELOPMENT	TARGETED CONSERVATION
VERY HIGH	28	27	27	27
HIGH	5	6	4	6
MODERATE	26	23	25	23
LOW	19	17	16	17

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EXTIRPATED	n/a	5	6	5
PERSISTING	n/a	2	0	6
TOTAL	**78**	**75**	**72**	**79**

Opportunities for Additional Conservation

Although our scenarios focus on areas where dwarf-flowered heartleaf have been found in the past, the Maxent model identifies a number of areas as high quality potential habitat for the species that falls outside the immediately known occurrence areas. A few of these areas are detailed below (Figure 6.2).

1. West of the city of Lenoir, south of Highway 90/Adako Rd., north of Highway 64 within Caldwell County. This area identifies a large block of potential habitat. This area falls just outside the administrative boundary of the Pisgah National Forest. The bluffs and tributaries along the Johns River are identified as the best habitat, but there is also ample habitat identified along the forested areas of Celia, Husband, Abingdon and Greasy Creeks. The only known occurrence within this area is associated with Abingdon Creek and is under a conservation easement.

2. Henry Fork River bluffs and tributaries east of Highway 18 within Burke County. A historic element occurrence is present by the Burke County line, but the entire area is identified as good quality potential habitat for the species where forested habitats remain.

3. South West corner of Catawba County west of Highway 321. Several disjointed patches of high quality potential habitat are identified in this region associated with the river and creek slopes. Rock Creek, Jacob Fork River, Pott Creek, and their associated tributaries all contain blocks of potential habitat. A number of element occurrences are identified within this area, but additional habitat is identified both upstream and downstream of the known occurrences.

4. Clark, Pinch Gut, Maiden, and Allen Creeks, north of the town of Maiden. The slopes along these creeks all contain quality potential habitat. Known element occurrences are in the general area, but none are situated within the creeks listed.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

5. First Broad River North of Highway 74, Rutherford County. Two older element occurrences are located within this area, however, the forested bluffs along the First Broad River and associated tributaries are identified as good quality potential habitat in many additional upstream and downstream areas in this system.

6. Hickory Creek, Sulphur Springs Branch (Little Hickory), Shoal Creek, and tributaries draining into First Broad River South of the Town of Shelby, north of the South Carolina border. The town of Shelby has likely disconnected this site from area 5 listed above. Here, slopes along the creeks and tributaries draining into the First Broad River are identified as potential habitat more so than the slopes along the First Broad River themselves. There in only a single element occurrence known upstream along Hickory Creek.

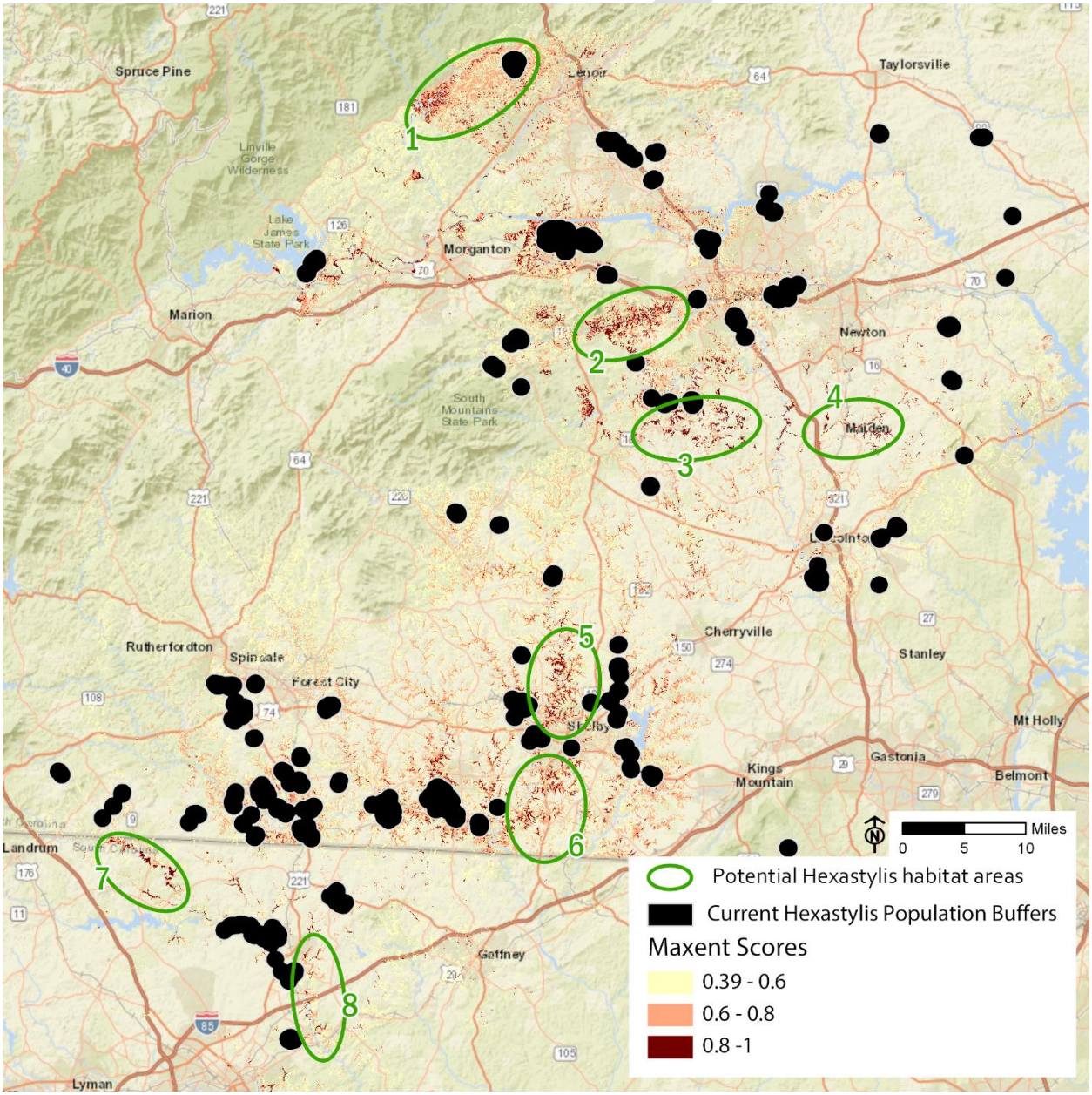
7. North Pacolet River and Obed Creek, north of where they join. The majority of potential habitat falls along the slopes of the North Pacolet River. Two older element occurrences (1991 last observation) are found in the tributaries draining into the North Pacolet River, and many occurrences are found further upstream. The habitat model suggests that additional undiscovered habitat areas are present.

8. Pacolet River and Island Creek, north of Peters Creek, downstream of the Pacolet River dam. This area displays limited amounts of good quality potential habitat. Recent element occurrences are present in the upper headwaters of Peters and Zekial Creeks (Zekial Creek drains into Peters Creek) and in areas north of the Pacolet River dam, but none are known along the areas identified in this immediate area.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Figure 6.2. Areas identified as high quality potential habitat by Maxent model for *Hexastylis naniflora* that fall outside the immediately known occurrence areas.



Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Literature Cited

Amoroso, J.L. 2016. *Hexastylis naniflora* status meeting with USFWS, NCNHP, ASU, and NCDOT [meeting minutes]. North Carolina Department of Natural and Cultural Resources office, Asheville, NC, 11 May 2016.

Baldwin, R.A. 2009. Use of maximum entropy modeling in wildlife research. Entropy. 11:854-866.

Barringer, K. 1993. New combinations in North American *Asarum* (Aristolochiaceae). Novon 3:225-227.

Blomquist, H.L. 1957. A Revision of *Hexastylis* in North America. Brittonia 8:255-281.

Clarke, K.C., Riggan, P., and Brass, J.A., 1995. A cellular automaton model of wildfire propagation and extinction, Photogram. Eng. Rem S. 60, 1355-1367.

Dobzhansky, T. 1937. Genetics and the origin of species. Columbia University Press, New York, NY.

DeWan, A., N. Dubois, K. Theoharides, and J. Boshoven. 2010. Understanding the impacts of climate change on fish and wildlife in North Carolina.

Flora of North America 1997. Flora of North America north of Mexico. Volume 3, Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York, NY. 590 pp. Contains Whittemore and Gaddy's treatment of *Asarum* and *Hexastylis*.

Gaddy, L.L. 1980. Status Report on *Hexastylis naniflora* Blomquist. Prepared for and submitted to USFWS, Endangered Species Office, Region 4, Atlanta, Georgia. July 1980.

Gaddy, L.L. 1981. The status of *Hexastlylis naniflora* Blomquist in North Carolina. Unpublished report prepared under contract to the Plant Conservation Program, North Carolina Department of
Agriculture, Raleigh.

Gaddy, L. 1986. Twelve new ant-dispersed species from the southern Appalachians. *Bulletin of the Torrey Botanical Club* 113: 247-251.

Gaddy, L.L. 1987. A review of the taxonomy and biogeography of *Hexastylis* (Aristolochiaceae). Castanea 52(3):186-196.

Golder Associates, Inc. 2009. Year 5 Monitoring Report, *Hexastylis naniflora*, Foothills Conservation Area, Caldwell County, North Carolina. Submitted to: Republic Services of North Carolina, LLC; copies (per cover letter) distributed to US Army Corps of Engineers, Asheville Regulatory Office and USFWS Asheville ES Office. June 26, 2009.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Golladay SW, Gagnon P, Kearns M, Battle JM. Hicks DW. Response of freshwater mussel assemblages (Bivalvia: Unionidae) to a record drought in the Gulf Coastal Plain of southwest Georgia. J. N. Am. Benthol. Soc. 2004;23:494–506.

Gonzalez, V. C. 1972. The ecology of *Hexastylis arifolia*, an evergreen herb in the North Carolina deciduous forest. Ph.D. disseration, Duke University. Durham, North Carolina, USA. HDR. 2005. Identification of *Hexastylis naniflora*. Notes on characteristics and field observations provided to the North Carolina Natural Heritage Program, Raleigh.

IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

Jones M.S., T. H. Jones, and J. J. English. 2014. The Pollination of *Hexastylis naniflora* in Cleveland County, North Carolina. Castanea: June 2014, Vol. 79, No. 2, pp. 74-77.

Jordan, Jones and Goulding (JJ&G), Inc. 1998. Section 404 Application and Conceptual Mitigation Plan, Lake Blalock Expansion Project. USFWS Log number 4-6-97-358. ACOE Project # 80-97-1732 (S). Section 9: *Hexastylis naniflora* Biological Assessment. Received by the Asheville Field Office July 16, 1998.

Jordan, Jones and Goulding (JJ&G), Inc. 2006. Lake Blalock Buffer Disturbance – Vicinity of Casey Creek Road. Memorandum to: Eddie Dearbury, Spartanburg Water Systems. Date: October 25, 2006.

Karl, T. R., Melillo, J. M., & Peterson, T. C. (Eds.). (2009). Global Climate Change Impacts in the United States. Washington, DC: U.S. Global Change Research Program.

Kelly, L. M. 1997. A Cladistic Analysis of *Asarum* (Aristolochiaceae) and Implications for the Evolution of Herkogamy. American Journal of Botany 84:1752-1765.

Kelly, L. M. 1998. Phylogenetic Relationships in *Asarum* (Aristolochiaceae) Based on Morphology and ITS Sequences. American Journal of Botany 85:1454-1467.

Kelly, L. M. 2001. Taxonomy of *Asarum* Section *Asarum* (Aristolochiaceae). Systematic Botany 26:17-53.

Lengyel, S., A. D. Gove, A. M. Latimer, J. D. Majer, and R. R. Dunn. 2010. Convergent evolution of seed dispersal by ants, and phylogeny and biogeography in flowering plants: A global survey. *Perspectives in Plant Ecology, Evolution and Systematic*s 12: 43-55.

McLaughlin, J.F. et al. (2002). Climate change hastens population extinctions. Proceedings of the National Academy of Sciences 99(9): 6070–6074.

Murrell, Z. et al. 2007. Ecological, Morphological, Micromorphological and Molecular Analyses of the Species in the *Hexastylis heterophylla* Complex. A report to the North Carolina

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Department of Transportation. NCDOT and CTE Joint Project 2002-2004, FHWA/NC/2004-01. May 2007.

Murrell, Z. 2015. Development of molecular and morphological tools to circumscribe and identify the Dwarf Flowered Heartleaf (*Hexastylis naniflora*). Report to the North Carolina Department of Transportation, NCDOT Project 2012-2111, July 2015.

National Climate Change Viewer. 2016. USGS. Accessed at https://www2.usgs.gov/climate_landuse/clu_rd/nccv.asp, January 2018.

NatureServe. 2002. Element Occurrence Data Standard, 6 February 2002. NatureServe, Arlington, Virginia. Accessed at http://www.natureserve.org/library/deliminting_plant_eos_Oct_2004.pdf, August 2016.

NCOSBM. North Carolina Budget and Management County and State Population Projections. Accessed at https://www.osbm.nc.gov/demog/county-projections, March 2018.

Newberry, G. 2006. South Carolina Populations of *Hexastylis naniflora*: 2006 updates. Received by the USFWS Asheville Field Office, September 7, 2006.

Newberry, G. 2009. University of South Carolina at Spartanburg. Evaluation of damage to *Hexastylis naniflora* plants on acreage bordering the hunt club. Letter to Jon Morgan, Lake Warden, Spartanburg Water Systems. Dated February 24, 2009.

North Carolina Natural Heritage Program (NCNHP). 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: August 5, 2016.

North Carolina Natural Heritage Program (NCNHP). 2018. Natural Heritage Element Occurrences. Accessed at https://www.ncnhp.org/activities/conservation/natural-heritage-element-occurrences, January 2018.

Newberry, G. 1993. Progress Report on Monitoring Studies of *Hexastylis naniflora*. Unpublished report. Copy submitted to the USFWS Asheville Field Office, on September 7, 2006.

Niedenberger, B.A. 2010. Molecular phylogeny and comparative pollen morphology of the genus *Hexastylis* (Aristolochiaceae). M.S. thesis. Appalachian State University, Boone, NC.

Otte, D. 1977. The pollination biology of *Hexastylis arifolia* (Michx.) Small var. *arifolia* and *H. minor* (Ashe) Blomquist (Aristolochiaceae) in the area of Chapel Hill, North Carolina. M.S. Thesis, University of North Carolina Chapel Hill, Chapel Hill, North Carolina, USA.

Padgett, J. E. 2004. Biogeographical, ecological, morphological, and micromorphological analyses of the species in the *Hexastylis heterophylla* complex. M.S. thesis. Appalachian State University, Boone, NC.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Phillips, S. J. 2018. A Brief Tutorial on Maxent. Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-02/21.

Renninger, H. 2010. North Carolina Department of Transportation (NCDOT). E-mail communication to Carolyn Wells, USFWS Asheville Field Office. Date: May 28, 2010. Subject: Dwarf-flowered heartleaf research proposal.

Robinson L.G. 2016. Dwarf-flowered Heartleaf range-wide status report. Final report to U.S. Department of Interior—U.S. Fish and Wildlife Service by North Carolina Natural Heritage Program. August 2016.

Robinson, L.G. and J.E. Padgett. 2016. Dwarf-flowered Heartleaf (*Hexastylis naniflora*) comprehensive review and monitoring report. Final report to the U.S. Department of Interior—U.S. Fish and Wildlife Service by the North Carolina Natural Heritage Program. August 2016.

Schneider, S. 2006. Spartanburg Water System (SWS) & Sanitary Sewer District, Assistant General Manager. E-mail communication to Lora Zimmerman, USFWS (formerly with the Charleston Field Office), dated December 18, 2006. Subject: Meeting at SWS on December 21, 2006 [to discuss Lake Blalock Buffer Disturbance].

South Carolina Department of Natural Resources (SCDNR) Heritage Trust. 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: February 4, 2016.

USFWS. 2001. Biological Opinion for Spartanburg Water System, Lake Blalock, P/N 2000-IP-194-W, USFWS log number 4-6-01-F-115. May 10, 2001.

USFWS. 2010. Draft Five Year Review for *Hexastylis naniflora* (dwarf flowered heartleaf). September 30, 2010. Submitted to the USFWS Southeast Regional Office September 30, 2010.

USFWS. 2015, August. Fact sheet for *Hexastylis naniflora*. Retrieved from https://www.fws.gov/raleigh/species/es_dwarf-flowered_heartleaf.html.

USFWS. 2016. USFWS species status assessment framework: an integrated analytical framework for conservation. Version 3.4.8, August 2016.

Wagner, J. 2013. Developing new morphological, geographic, and molecular tools to circumscribe *Hexastylis naniflora*. M.S. thesis. Appalachian State University, Boone, NC.

Walker, J. et al. 2009. What are the effects of prescribed fire on *Hexastylis naniflora*, a federally protected plant species? Unpublished final report prepared by U.S. Forest Service, Southern Research Station, Clemson University, Clemson, SC. Submitted to Timothy Stone, Superintendent, Cowpens National Battlefield. In partial fulfillment for Agreement

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

04-IA-11330138-234, between the NPS and USFS Southern Research Station. Revised March 19, 2009.

Warren II, R. J., 2008. Mechanisms driving understory evergreen herb distributions across slope aspects: as derived from landscape position. *Plant Ecology* 198: 297-308.

Weakley, A. 2010. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Working Draft as of March 8, 2010.

Weakley, A. 2015. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Working Draft as of 21 May 2015.

Whittemore, A. T., and L. L. Gaddy. 1997. Hexastylis. In Flora of North America Editorial Committee [Eds.], Flora of North America north of Mexico, vol. 3, 54–58. Oxford University Press, New York, New York, USA.

Wolf. S., B. Hartl, C. Carroll, M.C. Neel, and D.N. Greenwald. 2015. Beyond PVA: why recovery under the Endangered Species Act is more than population viability. BioScience 65:200-207.

DRAFT

From: London, Paula K
To: Hamilton, Byron
Cc: Marshall, Michael E; Reid, Rebekah N; Merritt, Timothy
Subject: Dwarf-flowered heartleaf peer review sent
Date: Friday, May 11, 2018 3:00:57 PM
Importance: High

I sent the draft SSA for peer review along with the conflict of interest form and the comment matrix to the following from the list:

Wesley Knapp
NC Natural Heritage Program
wesley.knapp@ncdcr.gov

Tim Bassette
NC Department of Transportation
tpbassette@ncdot.gov

Dr. Gillian Newberry
University of South Carolina – Upstate (retired)
gnewberry@charter.net
gnewberry@uscupstate.edu

Dr. Doug Rayner
Wofford College
raynerda@wofford.edu

Dr. LL "Chick" Gaddy
Terra Incognita
llgaddy2@gmail.com

Dr. Zack Murrell
Appalachian State University
murrellze@appstate.edu

Herrick Brown
SC Heritage Trust Program
brownh@dnr.sc.gov

(I also requested a read receipt so will let you know when those come in to ensure the e-mail made it to the intended reviewers.)

Kaye London
Endangered Species Listing Biologist
Species Assessment Team (SAT) Member

U.S. Fish and Wildlife Service
Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.

Atlanta, GA 30345
(404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

From: London, Paula K
To: Rayner, Doug A.
Cc: Merritt, Timothy; Hamilton, Byron; Reid, Rebekah N; Marshall, Michael E
Subject: Re: [EXTERNAL] Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment
Date: Monday, May 21, 2018 7:37:43 AM
Importance: High

Good day Dr. Rayner.

We would appreciate your input in the Dwarf-flowered heartleaf species status assessment. Your review is a valuable part of our peer review process to ensure our document provides the best available scientific and commercial information. Thank you for taking the time to review the document and provide comments.

Kaye London

Kaye London
Endangered Species Listing Biologist
Species Assessment Team (SAT) Member

U.S. Fish and Wildlife Service
Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.
Atlanta, GA 30345
(404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Sat, May 19, 2018 at 11:29 AM, Rayner, Doug A. <RaynerDA@wofford.edu> wrote:

> If you still need another person to review the report, I can do it.
>
> Doug
>
> ---
>
> **From:** Kaye London <kaye_london@fws.gov>
> **Sent:** Monday, May 14, 2018 7:27 AM
> **To:** wesley.knapp@ncdcr.gov; tpbassette@ncdot.gov; gnewberry@uscupstate.edu; Rayner, Doug A.; L L Gaddy; Zack Murrell; brownh@dnr.sc.gov
> **Cc:** Byron Hamilton; Tim Merritt; Rebekah Reid; Michael Marshall; gnewberry@charter.net
> **Subject:** Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment
>
> I have attached the supplemental appendices the go along with the SSA report. You may find these useful when reviewing the document.
>
> Thank you for your time and consideration.

Kaye London

Kaye London
Endangered Species Listing Biologist
Species Assessment Team (SAT) Member

U.S. Fish and Wildlife Service
Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.
Atlanta, GA 30345
(404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Fri, May 11, 2018 at 2:57 PM, Kaye London <kaye_london@fws.gov> wrote:

> Request for Peer Review for dwarf-flowered heartleaf SSA
>
> The Fish and Wildlife Service would like to request your help by asking you to serve as a peer reviewer of our draft Species Status Assessment (SSA) for the dwarf-flowered heartleaf. The SSA process is a tool we are using to improve transparency while conducting listing determinations and other ESA actions, and peer review of the biology of the species is part of that process.
>
> We ask for your comments on the draft SSA report to focus specifically on the quality of the scientific information and analyses and whether the best available information was used. Please identify any oversights, omissions, and inconsistencies; provide advice on reasonableness of judgments made from the scientific evidence; help us ensure that scientific uncertainties are identified and characterized; provide advice on the overall strengths and limitations of the scientific data used in the document; and inform us of any scientific information that we did not use. We request that you direct your review to the scientific issues and assumptions relating to your expertise.
>
> We have attached the report for your review. We need your comments by **4 June 2018** to ensure adequate time to incorporate them into our final report. While we welcome your peer review comments in any format you are most comfortable using, it would be especially helpful if you could use the Comment Matrix Excel spreadsheet we have created. This will make it easier to compile and keep a record of all the comments received and then incorporate them into our report.

As you review the document, please note that this draft SSA report does not result in or predetermine a decision by the Service on whether the dwarf-flowered heartleaf warrants protections of the Act and should be proposed for listing as threatened or endangered under the Act. This document is strictly a characterization of the viability of the species.

The species lead for this report is Rebekah Reid in our Asheville Ecological Services field office. If you have questions specific to the SSA report or would like any of the literature cited, please feel free to contact Rebekah at 828-258-3939 or rebekah_reid@fws.gov for any species-specific information.

I have also attached a Conflict of Interest form that we ask that you fill out and send back with your comments. Thank you very much for your time, and please do not hesitate to contact Tim Merritt if you have questions related to the peer review process.

Sincerely,

Kaye London

U.S. Fish and Wildlife Service

Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.

Atlanta, GA 30345

(404) 679-7094

on behalf of Tim Merritt

Timothy Merritt
Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
404-679-7081 fax
615-574-8812 cell

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

From: Marshall, Michael E
To: London, Paula K; Reid, Rebekah N; Hamilton, Byron; Becker, Drew N
Subject: Re: [EXTERNAL] Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment
Date: Tuesday, June 5, 2018 10:26:22 AM
Importance: High

Hi Kaye,

Did we receive any peer review comments back for the dwarf flowered heartleaf SSA?

Thanks,

Mike

On Mon, May 21, 2018 at 7:37 AM, Kaye London <kaye_london@fws.gov> wrote:

> Good day Dr. Rayner.
> We would appreciate your input in the Dwarf-flowered heartleaf species status assessment. Your review is a valuable part of our peer review process to ensure our document provides the best available scientific and commercial information. Thank you for taking the time to review the document and provide comments.
>
> Kaye London
>
> Kaye London
> Endangered Species Listing Biologist
> Species Assessment Team (SAT) Member
>
> U.S. Fish and Wildlife Service
> Southeast Regional Office
> Ecological Services Program
> 1875 Century Blvd., NE.
> Atlanta, GA 30345
> (404) 679-7094
>
> ***NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***
>
> On Sat, May 19, 2018 at 11:29 AM, Rayner, Doug A. <RaynerDA@wofford.edu> wrote:
>
> > If you still need another person to review the report, I can do it.
> >
> > Doug
> >
> > ---
> >
> > **From:** Kaye London <kaye_london@fws.gov>
> > **Sent:** Monday, May 14, 2018 7:27 AM
> > **To:** wesley.knapp@ncdcr.gov; tpbassette@ncdot.gov; gnewberry@uscupstate.edu; Rayner, Doug A.; L L Gaddy; Zack Murrell; brownh@dnr.sc.gov
> > **Cc:** Byron Hamilton; Tim Merritt; Rebekah Reid; Michael Marshall; gnewberry@charter.net
> > **Subject:** Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status

Assessment

I have attached the supplemental appendices the go along with the SSA report. You may find these useful when reviewing the document.

Thank you for your time and consideration.

Kaye London

Kaye London
Endangered Species Listing Biologist
Species Assessment Team (SAT) Member

U.S. Fish and Wildlife Service
Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.
Atlanta, GA 30345
(404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Fri, May 11, 2018 at 2:57 PM, Kaye London <kaye_london@fws.gov> wrote:

> Request for Peer Review for dwarf-flowered heartleaf SSA
>
> The Fish and Wildlife Service would like to request your help by asking you to serve as a peer reviewer of our draft Species Status Assessment (SSA) for the dwarf-flowered heartleaf. The SSA process is a tool we are using to improve transparency while conducting listing determinations and other ESA actions, and peer review of the biology of the species is part of that process.
>
> We ask for your comments on the draft SSA report to focus specifically on the quality of the scientific information and analyses and whether the best available information was used. Please identify any oversights, omissions, and inconsistencies; provide advice on reasonableness of judgments made from the scientific evidence; help us ensure that scientific uncertainties are identified and characterized; provide advice on the overall strengths and limitations of the scientific data used in the document; and inform us of any scientific information that we did not use. We request that you direct your review to the scientific issues and assumptions relating to your expertise.

We have attached the report for your review. We need your comments by **4 June 2018** to ensure adequate time to incorporate them into our final report. While we welcome your peer review comments in any format you are most comfortable using, it would be especially helpful if you could use the Comment Matrix Excel spreadsheet we have created. This will make it easier to compile and keep a record of all the comments received and then incorporate them into our report.

As you review the document, please note that this draft SSA report does not result in or predetermine a decision by the Service on whether the dwarf-flowered heartleaf warrants protections of the Act and should be proposed for listing as threatened or endangered under the Act. This document is strictly a characterization of the viability of the species.

The species lead for this report is Rebekah Reid in our Asheville Ecological Services field office. If you have questions specific to the SSA report or would like any of the literature cited, please feel free to contact Rebekah at 828-258-3939 or rebekah_reid@fws.gov for any species-specific information.

I have also attached a Conflict of Interest form that we ask that you fill out and send back with your comments. Thank you very much for your time, and please do not hesitate to contact Tim Merritt if you have questions related to the peer review process.

Sincerely,

Kaye London

U.S. Fish and Wildlife Service

Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.

Atlanta, GA 30345

(404) 679-7094

on behalf of Tim Merritt

Timothy Merritt
Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200

Atlanta, GA 30345
404-679-7082 office
404-679-7081 fax
615-574-8812 cell

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Mike Marshall
SSA Program Specialist
U.S. Fish and Wildlife Service Region 4
Cell: 512-461-6217
Alternate email: mmarshall@ag.tamu.edu

Work Schedule 1st Week
Monday-Thursday --> In Office 7:30-4:30 CST

Work Schedule 2nd Week
Monday-Thursday --> In Office 7:30-4:30 CST

This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act and may be disclosed to third parties.

From: London, Paula K
To: Marshall, Michael E
Cc: Reid, Rebekah N; Hamilton, Byron; Becker, Drew N; Merritt, Timothy
Subject: Re: [EXTERNAL] Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment
Date: Tuesday, June 5, 2018 10:35:21 AM
Importance: High

Hi Mike.
I did not receive any. I checked the spam box also and don't see any responses that came to me. If any are returned to me, I will forward to you all. I did include Tim's contact info on the peer review request so it may be worth asking him. He is good about forwarding anything that comes in but worth asking anyway.

Kaye

Kaye London
Endangered Species Listing Biologist
Species Assessment Team (SAT) Member

U.S. Fish and Wildlife Service
Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.
Atlanta, GA 30345
(404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Tue, Jun 5, 2018 at 10:26 AM, Marshall, Michael <michael_marshall@fws.gov> wrote:

> Hi Kaye,
>
> Did we receive any peer review comments back for the dwarf flowered heartleaf SSA?
>
> Thanks,
>
> Mike
>
> On Mon, May 21, 2018 at 7:37 AM, Kaye London <kaye_london@fws.gov> wrote:
>
> > Good day Dr. Rayner.
> > We would appreciate your input in the Dwarf-flowered heartleaf species status assessment. Your review is a valuable part of our peer review process to ensure our document provides the best available scientific and commercial information. Thank you for taking the time to review the document and provide comments.
> >
> > Kaye London
> >
> > Kaye London
> > Endangered Species Listing Biologist
> > Species Assessment Team (SAT) Member
> >
> > U.S. Fish and Wildlife Service
> > Southeast Regional Office

Ecological Services Program
1875 Century Blvd., NE.
Atlanta, GA 30345
(404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Sat, May 19, 2018 at 11:29 AM, Rayner, Doug A. <RaynerDA@wofford.edu> wrote:

> If you still need another person to review the report, I can do it.
>
> Doug
>
> ---
>
> **From:** Kaye London <kaye_london@fws.gov>
> **Sent:** Monday, May 14, 2018 7:27 AM
> **To:** wesley.knapp@ncdcr.gov; tpbassette@ncdot.gov; gnewberry@uscupstate.edu; Rayner, Doug A.; L L Gaddy; Zack Murrell; brownh@dnr.sc.gov
> **Cc:** Byron Hamilton; Tim Merritt; Rebekah Reid; Michael Marshall; gnewberry@charter.net
> **Subject:** Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment
>
> I have attached the supplemental appendices the go along with the SSA report. You may find these useful when reviewing the document.
>
> Thank you for your time and consideration.
>
> Kaye London
>
> Kaye London
> Endangered Species Listing Biologist
> Species Assessment Team (SAT) Member
>
> U.S. Fish and Wildlife Service
> Southeast Regional Office
> Ecological Services Program
> 1875 Century Blvd., NE.
> Atlanta, GA 30345
> (404) 679-7094
>
> ***NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***
>
> On Fri, May 11, 2018 at 2:57 PM, Kaye London <kaye_london@fws.gov> wrote:

Request for Peer Review for dwarf-flowered heartleaf SSA

The Fish and Wildlife Service would like to request your help by asking you to serve as a peer reviewer of our draft Species Status Assessment (SSA) for the dwarf-flowered heartleaf. The SSA process is a tool we are using to improve transparency while conducting listing determinations and other ESA actions, and peer review of the biology of the species is part of that process.

We ask for your comments on the draft SSA report to focus specifically on the quality of the scientific information and analyses and whether the best available information was used. Please identify any oversights, omissions, and inconsistencies; provide advice on reasonableness of judgments made from the scientific evidence; help us ensure that scientific uncertainties are identified and characterized; provide advice on the overall strengths and limitations of the scientific data used in the document; and inform us of any scientific information that we did not use. We request that you direct your review to the scientific issues and assumptions relating to your expertise.

We have attached the report for your review. We need your comments by **4 June 2018** to ensure adequate time to incorporate them into our final report. While we welcome your peer review comments in any format you are most comfortable using, it would be especially helpful if you could use the Comment Matrix Excel spreadsheet we have created. This will make it easier to compile and keep a record of all the comments received and then incorporate them into our report.

As you review the document, please note that this draft SSA report does not result in or predetermine a decision by the Service on whether the dwarf-flowered heartleaf warrants protections of the Act and should be proposed for listing as threatened or endangered under the Act. This document is strictly a characterization of the viability of the species.

The species lead for this report is Rebekah Reid in our Asheville Ecological Services field office. If you have questions specific to the SSA report or would like any of the literature cited, please feel free to contact Rebekah at 828-258-3939 or rebekah_reid@fws.gov for any species-specific information.

I have also attached a Conflict of Interest form that we ask that you fill out and send back with your comments. Thank you very much for your time, and please do not hesitate to contact Tim Merritt if you have questions related to the peer review process.

Sincerely,

Kaye London

U.S. Fish and Wildlife Service

Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.

Atlanta, GA 30345

(404) 679-7094

on behalf of Tim Merritt

Timothy Merritt
Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
404-679-7081 fax
615-574-8812 cell

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Mike Marshall
SSA Program Specialist
U.S. Fish and Wildlife Service Region 4
Cell: 512-461-6217
Alternate email: mmarshall@ag.tamu.edu

Work Schedule 1st Week
Monday-Thursday --> In Office 7:30-4:30 CST

Work Schedule 2nd Week
Monday-Thursday --> In Office 7:30-4:30 CST

This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act and may be disclosed to third parties.

From: Merritt, Timothy
To: London, Paula K
Cc: Marshall, Michael E; Reid, Rebekah N; Hamilton, Byron; Becker, Drew N
Subject: Re: [EXTERNAL] Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment
Date: Tuesday, June 5, 2018 10:52:07 AM
Importance: High

I haven't gotten anything either.
Tim

On Tue, Jun 5, 2018 at 10:35 AM, Kaye London <kaye_london@fws.gov> wrote:

> Hi Mike.
> I did not receive any. I checked the spam box also and don't see any responses that came to me. If any are returned to me, I will forward to you all. I did include Tim's contact info on the peer review request so it may be worth asking him. He is good about forwarding anything that comes in but worth asking anyway.
>
> Kaye
>
> Kaye London
> Endangered Species Listing Biologist
> Species Assessment Team (SAT) Member
>
> U.S. Fish and Wildlife Service
> Southeast Regional Office
> Ecological Services Program
> 1875 Century Blvd., NE.
> Atlanta, GA 30345
> (404) 679-7094
>
> ***NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***
>
> On Tue, Jun 5, 2018 at 10:26 AM, Marshall, Michael <michael_marshall@fws.gov> wrote:
>
> > Hi Kaye,
> >
> > Did we receive any peer review comments back for the dwarf flowered heartleaf SSA?
> >
> > Thanks,
> >
> > Mike
> >
> > On Mon, May 21, 2018 at 7:37 AM, Kaye London <kaye_london@fws.gov> wrote:
> >
> > > Good day Dr. Rayner.
> > > We would appreciate your input in the Dwarf-flowered heartleaf species status assessment. Your review is a valuable part of our peer review process to ensure our document provides the best available scientific and commercial information. Thank you for taking the time to review the document and provide comments.
> > >
> > > Kaye London
> > >
> > > Kaye London

Endangered Species Listing Biologist
Species Assessment Team (SAT) Member

U.S. Fish and Wildlife Service
Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.
Atlanta, GA 30345
(404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Sat, May 19, 2018 at 11:29 AM, Rayner, Doug A. <RaynerDA@wofford.edu> wrote:

> If you still need another person to review the report, I can do it.
>
> Doug
>
> ---
>
> **From:** Kaye London <kaye_london@fws.gov>
> **Sent:** Monday, May 14, 2018 7:27 AM
> **To:** wesley.knapp@ncdcr.gov; tpbassette@ncdot.gov; gnewberry@uscupstate.edu; Rayner, Doug A.; L L Gaddy; Zack Murrell; brownh@dnr.sc.gov
> **Cc:** Byron Hamilton; Tim Merritt; Rebekah Reid; Michael Marshall; gnewberry@charter.net
> **Subject:** Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment
>
> I have attached the supplemental appendices the go along with the SSA report. You may find these useful when reviewing the document.
>
> Thank you for your time and consideration.
>
> Kaye London
>
> Kaye London
> Endangered Species Listing Biologist
> Species Assessment Team (SAT) Member
>
> U.S. Fish and Wildlife Service
> Southeast Regional Office
> Ecological Services Program
> 1875 Century Blvd., NE.
> Atlanta, GA 30345
> (404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Fri, May 11, 2018 at 2:57 PM, Kaye London <kaye_london@fws.gov> wrote:

> Request for Peer Review for dwarf-flowered heartleaf SSA
>
> The Fish and Wildlife Service would like to request your help by asking you to serve as a peer reviewer of our draft Species Status Assessment (SSA) for the dwarf-flowered heartleaf. The SSA process is a tool we are using to improve transparency while conducting listing determinations and other ESA actions, and peer review of the biology of the species is part of that process.
>
> We ask for your comments on the draft SSA report to focus specifically on the quality of the scientific information and analyses and whether the best available information was used. Please identify any oversights, omissions, and inconsistencies; provide advice on reasonableness of judgments made from the scientific evidence; help us ensure that scientific uncertainties are identified and characterized; provide advice on the overall strengths and limitations of the scientific data used in the document; and inform us of any scientific information that we did not use. We request that you direct your review to the scientific issues and assumptions relating to your expertise.
>
> We have attached the report for your review. We need your comments by **4 June 2018** to ensure adequate time to incorporate them into our final report. While we welcome your peer review comments in any format you are most comfortable using, it would be especially helpful if you could use the Comment Matrix Excel spreadsheet we have created. This will make it easier to compile and keep a record of all the comments received and then incorporate them into our report.
>
> As you review the document, please note that this draft SSA report does not result in or predetermine a decision by the Service on whether the dwarf-flowered heartleaf warrants protections of the Act and should be proposed for listing as threatened or endangered under the Act. This document is strictly a characterization of the viability of the species.
>
> The species lead for this report is Rebekah Reid in our Asheville Ecological Services field office. If you have questions specific to the SSA report or would like any of the literature cited, please feel free to contact Rebekah at 828-258-3939 or rebekah_reid@fws.gov for any species-specific information.
>
> I have also attached a Conflict of Interest form that we ask that you fill out

and send back with your comments. Thank you very much for your time, and please do not hesitate to contact Tim Merritt if you have questions related to the peer review process.

Sincerely,

Kaye London

U.S. Fish and Wildlife Service

Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.

Atlanta, GA 30345

(404) 679-7094

on behalf of Tim Merritt

Timothy Merritt
Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
404-679-7081 fax
615-574-8812 cell

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Mike Marshall
SSA Program Specialist
U.S. Fish and Wildlife Service Region 4
Cell: 512-461-6217
Alternate email: mmarshall@ag.tamu.edu

Work Schedule 1st Week
Monday-Thursday --> In Office 7:30-4:30 CST

> **Work Schedule 2nd Week**
> Monday-Thursday --> In Office 7:30-4:30 CST
>
> *This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act and may be disclosed to third parties.*

--

Timothy Merritt
Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
404-679-7081 fax
615-574-8812 cell

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

From: Marshall, Michael E
To: Merritt, Timothy
Cc: London, Paula K; Reid, Rebekah N; Hamilton, Byron; Becker, Drew N
Subject: Re: [EXTERNAL] Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment
Date: Tuesday, June 5, 2018 11:35:44 AM
Importance: High

Thanks guys! Anything I should be worried about from a recommendation meeting perspective when no reviews are returned?....I guess the way I'm seeing it is we gave folks an opportunity to peer review, so we check that box....and at least the Expert Team provided multiple reviews.

Thanks,

Mike

On Tue, Jun 5, 2018 at 10:52 AM, Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> I haven't gotten anything either.
> Tim
>
> On Tue, Jun 5, 2018 at 10:35 AM, Kaye London <kaye_london@fws.gov> wrote:
>
> > Hi Mike.
> > I did not receive any. I checked the spam box also and don't see any responses that came to me. If any are returned to me, I will forward to you all. I did include Tim's contact info on the peer review request so it may be worth asking him. He is good about forwarding anything that comes in but worth asking anyway.
> >
> > Kaye
> >
> > Kaye London
> > Endangered Species Listing Biologist
> > Species Assessment Team (SAT) Member
> >
> > U.S. Fish and Wildlife Service
> > Southeast Regional Office
> > Ecological Services Program
> > 1875 Century Blvd., NE.
> > Atlanta, GA 30345
> > (404) 679-7094
> >
> > ***NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***
> >
> > On Tue, Jun 5, 2018 at 10:26 AM, Marshall, Michael <michael_marshall@fws.gov> wrote:
> >
> > > Hi Kaye,
> > >
> > > Did we receive any peer review comments back for the dwarf flowered heartleaf SSA?
> > >
> > > Thanks,
> > >
> > > Mike

On Mon, May 21, 2018 at 7:37 AM, Kaye London <kaye_london@fws.gov> wrote:

Good day Dr. Rayner.

We would appreciate your input in the Dwarf-flowered heartleaf species status assessment. Your review is a valuable part of our peer review process to ensure our document provides the best available scientific and commercial information. Thank you for taking the time to review the document and provide comments.

Kaye London

Kaye London
Endangered Species Listing Biologist
Species Assessment Team (SAT) Member

U.S. Fish and Wildlife Service
Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.
Atlanta, GA 30345
(404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Sat, May 19, 2018 at 11:29 AM, Rayner, Doug A. <RaynerDA@wofford.edu> wrote:

If you still need another person to review the report, I can do it.

Doug

From: Kaye London <kaye_london@fws.gov>
Sent: Monday, May 14, 2018 7:27 AM
To: wesley.knapp@ncdcr.gov; tpbassette@ncdot.gov; gnewberry@uscupstate.edu; Rayner, Doug A.; L L Gaddy; Zack Murrell; brownh@dnr.sc.gov
Cc: Byron Hamilton; Tim Merritt; Rebekah Reid; Michael Marshall; gnewberry@charter.net
Subject: Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment

I have attached the supplemental appendices the go along with the SSA report. You may find these useful when reviewing the document.

Thank you for your time and consideration.

Kaye London

Kaye London
Endangered Species Listing Biologist
Species Assessment Team (SAT) Member

U.S. Fish and Wildlife Service
Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.
Atlanta, GA 30345
(404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Fri, May 11, 2018 at 2:57 PM, Kaye London <kaye_london@fws.gov> wrote:

> Request for Peer Review for dwarf-flowered heartleaf SSA
>
> The Fish and Wildlife Service would like to request your help by asking you to serve as a peer reviewer of our draft Species Status Assessment (SSA) for the dwarf-flowered heartleaf. The SSA process is a tool we are using to improve transparency while conducting listing determinations and other ESA actions, and peer review of the biology of the species is part of that process.
>
> We ask for your comments on the draft SSA report to focus specifically on the quality of the scientific information and analyses and whether the best available information was used. Please identify any oversights, omissions, and inconsistencies; provide advice on reasonableness of judgments made from the scientific evidence; help us ensure that scientific uncertainties are identified and characterized; provide advice on the overall strengths and limitations of the scientific data used in the document; and inform us of any scientific information that we did not use. We request that you direct your review to the scientific issues and assumptions relating to your expertise.
>
> We have attached the report for your review. We need your comments by **4 June 2018** to ensure adequate time to incorporate them into our final report. While we welcome your peer review comments in any format you are most comfortable using, it would be especially helpful if you could use the Comment Matrix Excel spreadsheet we have created. This will make it easier to compile and keep a record of all the comments received and then incorporate them into our report.

As you review the document, please note that this draft SSA report does not result in or predetermine a decision by the Service on whether the dwarf-flowered heartleaf warrants protections of the Act and should be proposed for listing as threatened or endangered under the Act. This document is strictly a characterization of the viability of the species.

The species lead for this report is Rebekah Reid in our Asheville Ecological Services field office. If you have questions specific to the SSA report or would like any of the literature cited, please feel free to contact Rebekah at 828-258-3939 or rebekah_reid@fws.gov for any species-specific information.

I have also attached a Conflict of Interest form that we ask that you fill out and send back with your comments. Thank you very much for your time, and please do not hesitate to contact Tim Merritt if you have questions related to the peer review process.

Sincerely,

Kaye London

U.S. Fish and Wildlife Service

Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.

Atlanta, GA 30345

(404) 679-7094

on behalf of Tim Merritt

Timothy Merritt
Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
404-679-7081 fax
615-574-8812 cell

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Mike Marshall
SSA Program Specialist
U.S. Fish and Wildlife Service Region 4
Cell: 512-461-6217
Alternate email: mmarshall@ag.tamu.edu

Work Schedule 1st Week
Monday-Thursday --> In Office 7:30-4:30 CST

Work Schedule 2nd Week
Monday-Thursday --> In Office 7:30-4:30 CST

This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act and may be disclosed to third parties.

--

Timothy Merritt
Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
404-679-7081 fax
615-574-8812 cell

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Mike Marshall
SSA Program Specialist
U.S. Fish and Wildlife Service Region 4
Cell: 512-461-6217
Alternate email: mmarshall@ag.tamu.edu

Work Schedule 1st Week
Monday-Thursday --> In Office 7:30-4:30 CST

Work Schedule 2nd Week
Monday-Thursday --> In Office 7:30-4:30 CST

This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act and may be disclosed to third parties.

From:	Peeples, Gary
To:	Koches, Jennifer; Punsalan, April L
Cc:	Reid, Rebekah N
Subject:	Dwarf-flowered heartleaf contacts
Date:	Thursday, February 21, 2019 2:14:04 PM
Attachments:	Dwarf flowered heartleaf contact grid_RNR comments.docx
Importance:	High

Hey Jennifer and April,

As I think you know, we're going to move ahead with a proposal to delist dwarf-flowered heartleaf, which occurs in 10 North Carolina counties, and three South Carolina counties.

I've started a contact grid for our delisting announcement and wonder if you would be kind enough to review it and add/subtract/edit as you see fit.

Thanks a million.

-G

(P.S. No idea when the actual Federal Register notice will be)

--
Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
office 828/258-3939, ext. 234
fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

Dwarf-flowered heartleaf (*Hexastylis naniflora*) Contact Grid

Governors

State	Member	Contact	Position	Email
NC	Roy Cooper	Christy Drew		drew.christy@nc.gov
SC	Henry McMaster			

Congressionals

State	Member	Contact	Position	Email
NC	Richard Burr	Mike Fenley		mike_fenley@burr.senate.gov
NC	Thom Tillis	Jordan Barnes		Jordan_Barnes@tillis.senate.gov
NC	Pat McCrory	David McCrary		David.McCrary@mail.house.gov
NC	Mark Meadows	Martha Peterson		martha.peterson@mail.house.gov
NC	Virginia Foxx	Robert Meek		robert.meek@mail.house.gov
NC	Ted Budd	Todd Poole		todd.poole@mail.house.gov
SC	Lindsay Graham			
SC	Tim Scott			
SC	William Timmons			
SC	Ralph Norman			

Tribes

State	Organization	Name	Position	Email
	Catawba Indian Nation	Darin Steen	Environmental Services Director	darin.steen@catawbaindian.net

State agencies

State	Organization	Name	Position	Email
NC	N.C. Plant Conservation Program	Cheryl Gregory	Administrator	cheryl.gregory@ncagr.gov
NC	N.C. Department of Transportation	Phil Harris	Section head, Natural Environment Section	pharris@ncdot.gov
NC	North Carolina Natural Heritage Program	Misty Buchanan	Director	misty.buchanan@ncdenr.gov
NC	North Carolina Botanical Garden	Damon Waitt	Director	aspain@unc.edu
SC	SC Dept. of Natural Resources – Heritage Trust Program	Herrick Brown	Botanist	brownh@dnr.sc.gov
SC	SC Botanical Gardens	Patrick McMillan	Director	pmcmill@clemson.edu

Federal agencies

State	Organization	Name	Position	Email
NC	Federal Highways Administration	John Sullivan	Division Administrator	john.sullivan@dot.gov
NC	USACE	(b)(6) PII	Field Office Chief, Asheville Regulatory Field Office	(b)(6) PII(b)(6) PII
NC	NRCS	Tim Beard	State conservationist	timothy.beard@nc.usda.gov
SC	NRCS	Ann English	State conservationist	ann.english@sc.usda.gov
SC	Federal Highways Administration	Emily Lawton	Division Administrator	emily.lawton@dot.gov
SC	NPS – Cowpens NBF	John Slaughter	Superintendent	john_slaughter@nps.gov

SC	USACE		Columbia Regulatory Field Office	

Conservation and environmental NGOs

State	Organization	Name	Position	Email
NC	Foothills Conservancy	Andrew Kota	Executive Director	akota@foothillsconservancy.org
NC	Catawba Lands Conservancy	Tom Okel	Executive Director	tom@catawbalands.org
NC	Conserving Carolina	Kieran Roe	Executive Director	Kieran@conservingcarolina.org
SC	The Nature Conservancy	Kristen Austin	Upstate Cons.Director	kaustin@tnc.org
SC	Naturaland Trust	Mac Stone	Executive Director	macstone@naturalandtrust.org
SC	Spartanburg Area Conservancy (SPACE)	Andrew Waters		Andrew@spartanburgconservation.org
SC	Upstate Forever	Andrea Cooper	Executive Director	acooper@upstateforever.org

Trade and industry groups

State	Organization	Name	Position	Email
NC	N.C. Farm Bureau	Larry Wooten	President	Larry.wooten@ncfb.org
NC	N.C. Forestry Assoc.	John Hatcher	Executive VP	jhatcher@ncforestry.org
NC	N.C. Homebuilders	Tim Minton	Dir., government affairs	tminton@nchba.org

Counties

State	County	Name	Position	Email
NC	Iredell	Ron Smith	County manager	rsmith@co.iredell.nc.us
NC	Alexander	Rick French	County manager	rfrench@alexandercountync.gov
NC	Caldwell	Stan Kiser	County manager	skiser@caldwellcountync.org
NC	Burke	Bryan Steen	County manager	Bryan.Steen@burkenc.org
NC	Lincoln	Kelly Atkins	County manager	katkins@lincolncounty.org
NC	Gaston	Earl Mathers	County manager	earl.mathers@gastongov.com
NC	Cleveland	Jeff Richardson	County manager	April.Crotts@clevelandcounty.com
NC	Rutherford	Steve Garrison	County manager	steve.garrison@rutherfordcountync.gov
SC	Cherokee			
SC	Spartanburg			
SC	Greenville			

Corporations

State	Organization	Name	Position	Email
NC	Facebook			

Colleges/Universities

State	Organization	Name	Position	Email
NC	Appalachian State U.	Matt Estep	Asst. Professor	estepmc@appstate.edu
SC	Wofford College	Doug Rayner	Professor	raynerdda@wofford.edu

From: Hamilton, Byron
To: Reid, Rebekah N
Subject: Re: Draft Rule for Dwarf-flowered Heartleaf
Date: Friday, April 5, 2019 7:36:45 AM
Attachments: Dwarf-flowered Heartleaf Proposed Rule_clean to RSOL_SOL20181113 (4) (Autosaved).docx
Importance: High

Sure thing. See attachment.

On Fri, Apr 5, 2019 at 7:24 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Hey Byron,
>
> Can we see a copy of the draft rule? A couple of us in Asheville would like to check it out.
>
> Thanks!
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
> 160 Zillicoa St.
> Asheville, NC 28801
> phone: 828-258-3939 x238
> cell: 828-782-0090
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

The Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2018-XXXX; FXES11130900000-189-FF0932000]

RIN

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; availability of draft post-delisting monitoring plan.

SUMMARY: We, the U.S. Fish & Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicates that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened or endangered species under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan. If this proposal is finalized, the dwarf-flowered heartleaf will be removed from the List.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

Deleted: Dwarf

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: Wildlife

(b)(5) DPP & ACP

Deleted: D

Deleted: D

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p m. Eastern Time on the closing date. We must receive requests for public hearings, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES**:** You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2018–XXXX, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rules link to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2018–XXXX; U.S. Fish and Wildlife Service, MS: BPHC, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see *Public Comments*, below, for more information).

Document availability: The proposed rule, draft PDM plan and supporting documents (including the Species Status Assessment (SSA), references cited, five year review) are available at *http://www.regulations.gov* under Docket No. FWS-R4-ES-2018-XXXX.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC

28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. This action proposes to remove the dwarf-flowered heartleaf from the List of Endangered and Threatened Plants in title 50 of the Code of Federal Regulations (50 CFR 17.11(h)). Removing a species from the List ("delisting") can only be completed by issuing a rule.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposed; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The determination to delist a species must be based on an analysis of the same factors. In addition, the Act's implementing regulations at 50 CFR 424.11 provide that we may delist a species only if the best scientific and commercial data indicate the species is neither a threatened nor an endangered species for one or more of the following reasons: (1) The species is extinct; (2) the species has recovered and is no longer threatened or endangered; or (3) the original data used at the time the species was classified were in error. We have determined that the dwarf-flowered heartleaf should be proposed for delisting under the Act because, based on an analysis of the five listing factors, it no longer meets the definition of an endangered or threatened species, and that it has recovered.

Peer review:

Deleted: D

Deleted: Wildlife

(b)(5) DPP & ACP

Deleted: We

Deleted: D

(b)(5) DPP & ACP(b)(5) DPP & ACP

(b)(5) DPP & ACP

In accordance with our joint policy on peer review published in the **Federal Register** July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we have sought the expert opinions of seven appropriate specialists regarding the Species Status Assessment Report (SSA Report), which informed this proposed rule. The purpose of peer review is to ensure that our determination is based on scientifically sound data, assumptions, and analyses.

Deleted: S

(b)(5) DPP & ACP

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from the public, other concerned governmental agencies (including but not limited to State and Federal agencies and city local governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information received during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

Deleted: ,

(1) Information concerning the biology and ecology of the dwarf-flowered heartleaf;

Deleted: D

(2) Relevant data concerning any threats (or lack thereof) to the dwarf-flowered heartleaf particularly any data on the possible effects of climate change as it relates to habitat, the extent of State protection and management that would be provided to this aster as a delisted species;

Deleted: D

(3) Current or planned activities within the geographic range of the dwarf-flowered heartleaf that may negatively impact or benefit the species; and

Deleted: D

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment – including your personal identifying information – on *http://www.regulations.gov*. You may request at the top of your document that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee that we will be able to do so.

Comments and materials we receive, as well as supporting documentation we used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Service Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is a threatened or endangered species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the **Federal Register**. Such requests must be sent to the address shown in the **FOR FURTHER INFORMATION CONTACT** section. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings,

as well as how to obtain reasonable accommodations, in the **Federal Register** at least 15 days before the hearing.

Previous Federal Actions

On April 14, 1989, we published a final rule in the *Federal* Register (FR 54 14964) listing the dwarf-flowered heartleaf as endangered due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing. A Recovery Plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf SSA to aid in determining the appropriateness of reclassifying the species.

Background

The dwarf-flowered heartleaf (Hexastylis naniflora) is a species of plant endemic to the Upper 4 Piedmont region of western North Carolina and upstate South Carolina. It is a rare, low growing herbaceous plant in the birthwort family (Aristolochiaceae). Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (USFWS 2010, p. 15; NCNHP 2016, p. 4). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the Upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include four additional counties in North Carolina. As of 2016, the distribution of this species consisted of 113 populations distributed across 12 counties in these two states. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Deleted: D

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: D

(b)(5) DPP & ACP

Deleted: u

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: D

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: D

Deleted: u

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: 3

Deleted: ¶

(b)(5) DPP & ACP

Dwarf-flowered heartleaf appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of any population.

Dwarf-flowered heartleaf occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186-196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, p. 114; Weakley 2015, p. 129; USFWS 2015, entire), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). Wagner (2013, pp. 30-32) conducted a habitat suitability study to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants. The unit of measurement for population size in this species is a "clump" (rosette).

A thorough review of the taxonomy, life history, ecology, and overall viability of the dwarf-flowered Heartleaf is presented in the SSA (USFWS 2018, entire; available at https://www.fws.gov/southeast/ and at http://www.regulations.gov under Docket No. FWS-R4-ES-xxxx-xxxx).

Summary of Biological Status and Threats

The Act directs us to determine whether any species is an endangered or a threatened species because of any factors affecting its continued existence. The SSA report documents the

Deleted: D

Deleted: D

Deleted: given

Deleted: on

Deleted: p

Formatted: Font: Italic

(b)(5) DPP & ACP

Deleted: D

results of our comprehensive biological status review for the dwarf-flowered heartleaf, including an assessment of the potential stressors to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for listing as endangered or threatened species under the Act. It does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS-R4-ES-201X-XXXX.

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the three conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate individual life-history needs. In the next stage, we assessedthe historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We utilized this information to inform our decision in this proposed rule.

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect the dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of

Deleted: D

Deleted: T

Deleted: involved an assessment of

Deleted: The

Deleted: of the SSA involved makin

Deleted: g

Deleted: D

Deleted: D

dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered heartleaf ecology that determine whether populations can grow to maximize habitat occupancy.

Deleted: D

Deleted: D

(b)(5) DPP & ACP

The species also needs to exhibit redundancy. We measured redundancy for the dwarf-flowered heartleaf by the number and distribution of resilient populations across the range of the species. It is important to note that dwarf-flowered heartleaf has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area.

Deleted: D

(b)(5) DPP & ACP(b)(5) DPP & ACP

Deleted: D

The third characteristic, representation, can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. In the absence of species-specific genetic and ecological diversity information, we evaluated representation based on the extent and variability of habitat characteristics across the geographical range.

Deleted: R

Current Condition

Resiliency

(b)(5) DPP & ACP

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered heartleaf ecology that determine whether populations can grow to maximize habitat occupancy, thereby increasing resiliency of populations (USFWS 2017, p. 14-15).

The Natural Heritage Program collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member Natural Heritage Programs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2002). Since USFWS does not maintain its own database of known locations of Hexastylis naniflora, it regards the NHP databases as the best repository for this information (USFWS 2010). Based on recent reports using the methods described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple EOs and stand-alone EO records.

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. The EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, provided there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, again depending on habitat conditions; and poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016,

Deleted:

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Formatted: Font:

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: e

Deleted: e

Deleted: also

Deleted: given

p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat level information for every population we assessed, we synthesized all of the above population size information and created four resiliency categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Redundancy

(b)(5) DPP & ACP

Species-level redundancy reflects the ability of a species to withstand catastrophic events, and is best achieved by having multiple, widely distributed populations relative to the spatial occurrence of catastrophic events. Redundancy for dwarf-flowered heartleaf is the total number and resilience of population segments and their distribution across the species range.

An important question when investigating redundancy for dwarf-flowered heartleaf is, "what exactly is a catastrophe?" We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with

(b)(5) DPP & ACP

devastating effects; however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010, pp. 7-10).

Deleted: ,

Representation

(b)(5) DPP & ACP

We lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. For the dwarf-flowered heartleaf, we used the EO Data Standard which provides a Default Separation Distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several dwarf-flowered heartleaf populations

(b)(5) DPP & ACP

(b)(5) DPP & ACP

being stand-alone EOs, as well as many populations being aggregates of several Eos. **Summary of Threats and Conservation Measures that Affect the Species**

Section 4(a)(1) of the Act directs us to determine whether any species is an endangered species or a threatened species because of any factors affecting its continued existence due to one or more of the five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for a delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future following the delisting or downlisting and the removal of the Act's protections. In the SSA Report (Service, 2018, entire) we discuss the factors affecting the dwarf-flowered heartleaf.

Threats were assessed for populations monitored by NCNHP during 2012-2016 (Robinson and Padgett 2016, pp. 7-8, 17-20), and EOs were reviewed for other documented threats to populations. Threats observed during these years included development, incompatible forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and road construction. Indirect or direct threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank for each threat factor determines the overall value

Deleted: ¶
¶

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: ¶
Deleted: D

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Formatted: Indent: First line: 0

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: ¶

for each threat observed at each population. No significant changes in in the degree of threats within populations were noted from 2012-2016.

We assess the specific observed threats, organized by listing factor, below.

Factor A. Present or threatened destruction, modification, or curtailment of habitat or range:

Dwarf-flowered heartleaf populations occur in rapidly growing urban areas with expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

The most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving dwarf-flowered heartleaf, is road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations between the USFWS and the North Carolina Department of Transportation (NCDOT). Collectively, these projects have adversely impacted or are currently expected to impact some 22,135 rosettes. In most cases the Section 7 process has resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection to those plants remaining (post-construction) within NCDOT right-of-way (ROW). Significant portions of other populations have been purchased by NCDOT as off-site conservation measures in association with these consultations. Over the many years of Section 7 consultations between the USFWS and NCDOT, NCDOT has pledged monitoring and/or

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted:

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: NCDOT

(b)(5) DPP & ACP

Deleted: ¶

management for most of the sites it has acquired, as well as some locations where the species is protected within NCDOT rights-of-way (ROW). In recent years USFWS and NCDOT have recognized a need to follow up on these commitments by verifying the number of plants remaining post-construction, the number and survival of transplanted individuals, the number of rosettes protected within ROWs, and/or the number of rosettes protected via off-site land purchases. In particular, there remains a need for monitoring data to be collected in a consistent manner from one year to the next for the purposes of meaningfully accounting for trends. In 2009, NCDOT pledged to provide this information to the USFWS as one of many conservation measures associated with another formal consultation involving adverse effects to the species (USFWS 2009, n.p.). This information, anticipated July 2019, will substantially inform future assessments of the status, threats, and levels of protection afforded to the species.

Deleted: -

Deleted: *H. naniflora*

Deleted: within the next calendar year,

Other forms of economic development have also resulted in the destruction or modification of habitats occupied by the dwarf-flowered heartleaf; in many cases, these activities have also required Section 7 consultations with the USFWS. Examples of these activities include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities (in compliance with Federal Aviation Administration standards) at a regional airport. Collectively, these activities have involved the loss or relocation of several thousand rosettes.

Deleted:

Deleted: *H. naniflora*

Factor B: Overutilization for commercial, sporting, scientific, or educational purposes:

Overutilization is not known to be a threat at this time.

Factor C: Disease or predation:

When the species was listed in 1989, neither disease nor predation were known to be significant factors affecting the status of the species. We have no new information to suggest that this has changed.

Factor D: Inadequacy of existing regulatory mechanisms:

The North Carolina Plant Protection Act lists plants MORE, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. Outside of the Act, the species does not have legal protection from collection or destruction in the state of South Carolina.

In North Carolina, there are 14 sites http://keishalancebottoms.com/wp-content/uploads/2017/06/3-1-1024x683.jpgwith the potential to afford long-term protection to the species. Twelve of these have been associated with ESA section 7 consultations stemming from anticipated impacts to *H. naniflora*. Eight of these 12 sites have served as on-site mitigation for impacts to the species, in which the remaining portions of the population not impacted by the subject activity are expected to be protected in perpetuity (subject to the terms and conditions of a biological opinion authored by the Service). Three other sites were (or will be) acquired as off-site mitigation for projects also expected to adversely affect the species. One final site (the Rhyne Preserve) is already in protective ownership, but will serve as a recipient site for plants that would otherwise be destroyed in conjunction with a project located elsewhere in that same county (approximately 7 miles away) requiring ESA section 7 consultation.

In South Carolina, ESA section 7 consultation afforded some protection to the species at the Lake Blalock population, which would have been reduced by 1/3 as a result of plans to raise lake levels. The remaining portions of this population (above the new high-water mark and on

Deleted: federally

Deleted: this was

Deleted: not

Deleted: a

Deleted: listed under that statute

Deleted: T

(b)(5) DPP & ACP

(b)(5) DPP & ACP

property owned by the Spartanburg Water System) are expected to be protected in perpetuity (subject to a Biological Opinion written by the Service), however this protection needs verification. The Peter's Creek SCDNR Heritage Preserve was also acquired as off-site mitigation for impacts stemming from this ESA Section 7 consultation.

Therefore, the protections afforded to the species as a result of its status under the ESA enabled protection (or additional protection) of 14 of the 20 sites currently capable of providing perpetual protection to the species. It is likely that many of these protection efforts would not have occurred without the protections of the ESA.

(b)(5) DPP & ACP

We also assume that populations currently on protected lands are likely to see smaller impacts from urbanization compared to those that are not protected, but protection status (perpetuity vs non-perpetuity) matters. For example, Registered Heritage Areas are non-binding agreements with a land owner, and if the land changes ownership, or the owner decides not to continue with the agreement, then the Registry is no longer valid. Appendix 4 to the SSA Report shows the protection status of each delineated population which helped to inform our assessment of resilience under each scenario.

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Factor E: Other natural or manmade factors affecting its continued existence:

Invasive exotic plant species are rapidly spreading throughout riparian corridors and ravines across the range of this species. Invasive exotics such as English Ivy, Chinese privet, Japanese honeysuckle and Japanese Nepal grass are known to threaten several sites which contain the species; however, the scope and magnitude of this threat has not been comprehensively assessed. This threat requires active management in order to be successfully abated. Therefore, sites receiving protection via conservation ownership which lack clearly

Formatted: Indent: First line: 0

Deleted: rampantly

(b)(5) DPP & ACP

assigned management responsibilities are not likely to provide perpetual protection to the species (USFWS 2011, p. 15).

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

In recent years, the southeast has experienced moderate to severe droughts that many observers have implicated in population declines and poor transplant survivorship (NC NHP, 2010; and references throughout this review). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). The extent to which these climate changes will significantly affect populations of *H. naniflora* is currently unknown.

Climate Change

There is a growing concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Because typical habitats for this species include moist soils adjacent to creeks, streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams, specific effects of climate change to the dwarf-flowered heartleaf are likely related to changes in soil moisture associated with potential increases in drought.

Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.) which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p.7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p.7).

Despite the recognition of potential climate effects on ecosystem processes, there is uncertainty about what the exact climate future for the Southeastern US will be and how the ecosystems and species in this region will respond. Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. As a result, impacts from rapid urbanization in the region might be exacerbated under even a mild to moderate climate future.

Regardless of a pessimistic, optimistic, or status quo climate future, the following systematic changes are expected to be realized to varying degrees in the Southeastern US (IPCC 2013, p. 7):

- More frequent drought
- More extreme heat (resulting in increases in air and water temperatures, Figure 5-3)
- Increased heavy precipitation events (e.g., flooding)
- More intense storms (e.g., frequency of major hurricanes increases)

Future Condition

(b)(5) DPP & ACP

Deleted: D

Our analysis of the past, current, and future influences on what the dwarf-flowered heartleaf needs for long term viability revealed that there are several influences that pose risks to future viability of the species. These risks are primarily related to invasive species and habitat changes from development and long term climate change. We use projections of urban development to assess potential habitat loss and fragmentation. We also considered how climate change may exacerbate the impacts of development in a qualitative fashion using a narrative approach.

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. The projection to 2040 is based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape (see SSA Report for further explanation). Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

(b)(5) DPP & ACP

Deleted: B

(b)(5) DPP & ACP

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040. SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995, entire). The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a

Formatted: Indent: First line: 0.5

highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations
- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There are no data available on the exact relationships between urbanization and the impacts to dwarf-flowered heartleaf. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative impacts; development increase of at least 50% was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. This is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider under Current Conditions include detections that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to

Deleted: is

Deleted: D

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: for

persist. Several EOs have been revisited after more than 10 years and the species was present. (b)(5) DPP & ACP For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resilience of that population.

Deleted: ,

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resiliency categories were assessed using last known

Deleted: e

Deleted: e

abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000 foot buffer. The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 foot buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 foot buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-flowered heartleaf is likely to persist.

Status Quo Scenario

Under the status quo scenario, we assume a small number of populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

(b)(5) DPP & ACP

Deleted: few

Deleted: %

Deleted: e

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.

- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no negative impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

High Development Scenario

Under the high development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

Deleted: e

- No additional populations are identified as persisting
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
        - Voluntary protection/non-perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

- Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold; extirpation of populations if % increase in urbanization exceeds >90% threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we assume it is likely several additional populations (i.e. more than status quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resiliency under the following assumptions:

Deleted: e

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
  - Protected areas
    - Protected in perpetuity—no impacts from urbanization
    - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
  - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

Future Resiliency

Deleted: *e*

Status Quo Scenario

In the Status Quo scenario, 75 populations of dwarf-flowered heartleaf are predicted in 2040. The predicted resiliency of the extant populations is as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be highly resilient. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the seven additional populations predicted to persist under this scenario, four are in South Carolina, and three in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), and moderate (4).

High Development Scenario

In the High Development scenario, 72 populations of dwarf-flowered heartleaf are predicted in 2040. The predicted resilience of the extant populations is as follows: very high (27); high (4); moderate (25); and low (16). No new future populations are predicted to be discovered. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resilience is predicted to drop to moderate resilience; one high resilience population is predicted to drop to moderate; two

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: D
Deleted: on the landscape
Deleted: e
Deleted: are
Deleted: e
Deleted: e
Deleted: of very high
Deleted: ce

Deleted: there are predicted to be
Deleted: D
Deleted: on the landscape
Deleted: are

Deleted: e

(b)(5) DPP & ACP

moderate populations are predicted to drop to low resilience; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the Targeted Conservation scenario, 79 populations of dwarf-flowered heartleaf are predicted in 2040. The predicted resilience of the extant populations is as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations discovered to persist, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the sixteen additional populations predicted to persist under this scenario, ten are in South Carolina, and six in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), moderate (11), and low (2).

(b)(5) DPP & ACP

Deleted: are

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resilience and extirpation of a few populations is offset in the Status Quo and Targeted Conservation scenarios by the persistence of several additional populations. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resiliency in several additional populations. However, in all three

(b)(5) DPP & ACP

(b)(5) DPP & ACP

scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

(b)(5) DPP & ACP

Deleted: e

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances; however the species range is relatively small, making it potentially vulnerable to long-term catastrophic events over the next 20-30 years, such as climate change.

Deleted: D

Deleted: ,

(b)(5) DPP & ACP

Based on the assumption that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. As discussed below, there are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Deleted: Given

Deleted: D

Deleted: for this species

Deleted: we have

Table 1 Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	Current	Status Quo	High Development	Targeted Conservation
Very High	28	27	27	27
High	5	6	4	6
Moderate	26	23	25	23
Low	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total	**78**	**75**	**72**	**79**

Determination

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Section 4 of the Act, and its implementing regulations at 50 CFR part 424, set forth the procedures for listing species on, reclassifying species on, or removing species from the Federal Lists of Endangered and Threatened Wildlife and Plants. We may determine that a species is an endangered or threatened species due to one or more of the five factors described in section 4(a)(1) of the Act: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for a delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future following the delisting or downlisting and the removal of the Act's protections.

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the dwarf-flowered heartleaf. Currently, there are a total of 78 known populations in 12 counties with occurrences documented since 2005, 75 percent of which are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend. At the end of the projection period (2040), under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small

Formatted: Indent: First line: 0.5

Deleted: D

(b)(5) DPP & ACP
(b)(5) DPP & ACP

number (5-6) of currently low resilient populations are projected to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Approximately 30 percent of the 78 currently known populations are permanently protected, and another 25 or so percent are somewhat protected (voluntary agreements or provided some level of protection) reducing the likelihood of development impacting those populations. We therefore propose to remove the dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife at 50 CFR 17.11(h) due to recovery.

Deleted: D

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Even with continued risks from urban development and invasive species (Factor E), the best scientific and commercial information indicates that this species is viable and will remain viable in the foreseeable future. Therefore, this species is no longer in danger of extinction, nor is it likely to become in danger of extinction in the foreseeable future. Based on the analysis above and after considering the best available scientific and commercial information, we conclude that the dwarf-flowered heartleaf does not currently meet the Act's definition of either an endangered or a threatened species throughout its range.

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect Dwarf-flowered heartleaf. There is no critical habitat designated for this species.

Deleted: D

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as a threatened or endangered species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2018-XXXX. Copies can also be obtained from the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT** section). We seek information, data, and comments from the public regarding the dwarf-flowered heartleaf and the PDM plan. We are also seeking peer review of this draft plan concurrently with this comment period. We anticipate finalizing this plan, considering all public

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: , Asheville, North Carolina 28801

Deleted: D

and peer review comments, prior to making a final determination on the proposed delisting rule.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(a) Be logically organized;

(b) Use the active voice to address readers directly;

(c) Use clear language rather than jargon;

(d) Be divided into short sections and sentences; and

(e) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc. Send a copy of any comments on how we can make this rule easier to understand to: Office of Regulatory Affairs, Department of the Interior, room 7229, 1849 C Street NW., Washington, DC 20240. You may also email the comments to this address: Exsec@ios.doi.gov.

National Environmental Policy Act

We have determined that we do not need to prepare an Environmental Assessment or Environmental Impact Statement, as defined in the National Environmental Policy Act (42 USC 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered

Species Act. We published a notice outlining our reasons for this determination in the Federal Register October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribal lands associated with this proposed regulation.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket Number FWS-R4-ES-2018-XXXX and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville ecological Services Field Office.

Deleted: is

Deleted: South Carolina/

Deleted: E

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

2. Amend § 17.11(h), by removing the entries for "Heartleaf, Dwarf-flowered" under "PLANTS" from the List of Endangered and Threatened Wildlife.

§ 17.11 Endangered and threatened wildlife.

Dated: _____

_____

Deputy Director, U.S. Fish and Wildlife Service, Exercising the Authority of the Director, U.S. Fish and Wildlife Service.

From: Reid, Rebekah N
To: Mizzi, Janet; Peeples, Gary
Subject: Fwd: Draft Rule for Dwarf-flowered Heartleaf
Date: Friday, April 5, 2019 7:40:18 AM
Attachments: Dwarf-flowered Heartleaf Proposed Rule_clean to RSOL_SOL20181113 (4) (Autosaved).docx

---

Draft of the proposed rule.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville, NC 28801
phone: 828-258-3939 x238
cell: 828-782-0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

---------- Forwarded message ---------
From: **Hamilton, Byron** <byron_hamilton@fws.gov>
Date: Fri, Apr 5, 2019 at 7:36 AM
Subject: Re: Draft Rule for Dwarf-flowered Heartleaf
To: Reid, Rebekah <rebekah_reid@fws.gov>

Sure thing. See attachment.

On Fri, Apr 5, 2019 at 7:24 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Hey Byron,
>
> Can we see a copy of the draft rule? A couple of us in Asheville would like to check it out.
>
> Thanks!
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
> 160 Zillicoa St.
> Asheville, NC 28801
> phone: 828-258-3939 x238
> cell: 828-782-0090
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

The Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2018-XXXX; FXES11130900000-189-FF0932000]

RIN

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; availability of draft post-delisting monitoring plan.

SUMMARY: We, the U.S. Fish & Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicates that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened or endangered species under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan. If this proposal is finalized, the dwarf-flowered heartleaf will be removed from the List.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

Deleted: Dwarf

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: Wildlife

(b)(5) DPP & ACP

Deleted: D

Deleted: D

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p m. Eastern Time on the closing date. We must receive requests for public hearings, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES**:** You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2018–XXXX, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rules link to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2018–XXXX; U.S. Fish and Wildlife Service, MS: BPHC, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see *Public Comments*, below, for more information).

Document availability: The proposed rule, draft PDM plan and supporting documents (including the Species Status Assessment (SSA), references cited, five year review) are available at *http://www.regulations.gov* under Docket No. FWS-R4-ES-2018-XXXX.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC

28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. This action proposes to remove the dwarf-flowered heartleaf from the List of Endangered and Threatened Plants in title 50 of the Code of Federal Regulations (50 CFR 17.11(h)). Removing a species from the List ("delisting") can only be completed by issuing a rule.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposed; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The determination to delist a species must be based on an analysis of the same factors. In addition, the Act's implementing regulations at 50 CFR 424.11 provide that we may delist a species only if the best scientific and commercial data indicate the species is neither a threatened nor an endangered species for one or more of the following reasons: (1) The species is extinct; (2) the species has recovered and is no longer threatened or endangered; or (3) the original data used at the time the species was classified were in error. We have determined that the dwarf-flowered heartleaf should be proposed for delisting under the Act because, based on an analysis of the five listing factors, it no longer meets the definition of an endangered or threatened species, and that it has recovered.

Peer review:

Deleted: D

Deleted: Wildlife

(b)(5) DPP & ACP

Deleted: We

Deleted: D

(b)(5) DPP & ACP

(b)(5) DPP & ACP

In accordance with our joint policy on peer review published in the **Federal Register** July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we have sought the expert opinions of seven appropriate specialists regarding the Species Status Assessment Report (SSA Report), which informed this proposed rule. The purpose of peer review is to ensure that our determination is based on scientifically sound data, assumptions, and analyses.

Deleted: S

(b)(5) DPP & ACP

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from the public, other concerned governmental agencies (including but not limited to State and Federal agencies and city local governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information received during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

Deleted: ,

(1) Information concerning the biology and ecology of the dwarf-flowered heartleaf;

Deleted: D

(2) Relevant data concerning any threats (or lack thereof) to the dwarf-flowered heartleaf particularly any data on the possible effects of climate change as it relates to habitat, the extent of State protection and management that would be provided to this aster as a delisted species;

Deleted: D

(3) Current or planned activities within the geographic range of the dwarf-flowered heartleaf that may negatively impact or benefit the species; and

Deleted: D

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment – including your personal identifying information – on *http://www.regulations.gov*. You may request at the top of your document that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee that we will be able to do so.

Comments and materials we receive, as well as supporting documentation we used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Service Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is a threatened or endangered species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the **Federal Register**. Such requests must be sent to the address shown in the **FOR FURTHER INFORMATION CONTACT** section. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings,

as well as how to obtain reasonable accommodations, in the **Federal Register** at least 15 days before the hearing.

Previous Federal Actions

On April 14, 1989, we published a final rule in the *Federal* Register (FR 54 14964) listing the dwarf-flowered heartleaf as endangered due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing. A Recovery Plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf SSA to aid in determining the appropriateness of reclassifying the species.

Background

The dwarf-flowered heartleaf (Hexastylis naniflora) is a species of plant endemic to the Upper 4 Piedmont region of western North Carolina and upstate South Carolina. It is a rare, low growing herbaceous plant in the birthwort family (Aristolochiaceae). Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (USFWS 2010, p. 15; NCNHP 2016, p. 4). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the Upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include four additional counties in North Carolina. As of 2016, the distribution of this species consisted of 113 populations distributed across 12 counties in these two states. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Deleted: D
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
Deleted: D
(b)(5) DPP & ACP
Deleted: u
(b)(5) DPP & ACP
(b)(5) DPP & ACP
Deleted: D
(b)(5) DPP & ACP
(b)(5) DPP & ACP
Deleted: D
Deleted: u
(b)(5) DPP & ACP
(b)(5) DPP & ACP
Deleted: 3
Deleted: ¶
(b)(5) DPP & ACP

Dwarf-flowered heartleaf appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of any population.

Dwarf-flowered heartleaf occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186-196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, p. 114; Weakley 2015, p. 129; USFWS 2015, entire), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). Wagner (2013, pp. 30-32) conducted a habitat suitability study to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants. The unit of measurement for population size in this species is a "clump" (rosette).

A thorough review of the taxonomy, life history, ecology, and overall viability of the dwarf-flowered Heartleaf is presented in the SSA (USFWS 2018, entire; available at https://www.fws.gov/southeast/ and at http://www.regulations.gov under Docket No. FWS-R4-ES-xxxx-xxxx).

Summary of Biological Status and Threats

The Act directs us to determine whether any species is an endangered or a threatened species because of any factors affecting its continued existence. The SSA report documents the

Deleted: D

Deleted: D

Deleted: given

Deleted: on

Deleted: p

Formatted: Font: Italic

(b)(5) DPP & ACP

Deleted: D

results of our comprehensive biological status review for the dwarf-flowered heartleaf, including an assessment of the potential stressors to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for listing as endangered or threatened species under the Act. It does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS-R4-ES-201X-XXXX.

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the three conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate individual life-history needs. In the next stage, we assessedthe historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We utilized this information to inform our decision in this proposed rule.

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect the dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of

Deleted: D

Deleted: T

Deleted: involved an assessment of

Deleted: The

Deleted: of the SSA involved makin

Deleted: g

Deleted: D

Deleted: D

dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered heartleaf ecology that determine whether populations can grow to maximize habitat occupancy.

Deleted: D

Deleted: D

(b)(5) DPP & ACP

The species also needs to exhibit redundancy. We measured redundancy for the dwarf-flowered heartleaf by the number and distribution of resilient populations across the range of the species. It is important to note that dwarf-flowered heartleaf has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area.

Deleted: D

Deleted: in terms of

Deleted: D

The third characteristic, representation, can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. In the absence of species-specific genetic and ecological diversity information, we evaluated representation based on the extent and variability of habitat characteristics across the geographical range.

Deleted: R

Current Condition

Resiliency

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered heartleaf ecology that determine whether populations can grow to maximize habitat occupancy, thereby increasing resiliency of populations (USFWS 2017, p. 14-15).

(b)(5) DPP & ACP

The Natural Heritage Program collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member Natural Heritage Programs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2002). Since USFWS does not maintain its own database of known locations of Hexastylis naniflora, it regards the NHP databases as the best repository for this information (USFWS 2010). Based on recent reports using the methods described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple EOs and stand-alone EO records.

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. The EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, provided there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, again depending on habitat conditions; and poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016,

Deleted:

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Formatted: Font:

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: e

Deleted: e

Deleted: also

Deleted: given

p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat level information for every population we assessed, we synthesized all of the above population size information and created four resiliency categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Redundancy

Species-level redundancy reflects the ability of a species to withstand catastrophic events, and is best achieved by having multiple, widely distributed populations relative to the spatial occurrence of catastrophic events. Redundancy for dwarf-flowered heartleaf is the total number and resilience of population segments and their distribution across the species range.

An important question when investigating redundancy for dwarf-flowered heartleaf is, "what exactly is a catastrophe?" We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with

Deleted: e

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

(b)(5) DPP & ACP

devastating effects; however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010, pp. 7-10).

Deleted: ,

Representation

(b)(5) DPP & ACP

We lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. For the dwarf-flowered heartleaf, we used the EO Data Standard which provides a Default Separation Distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several dwarf-flowered heartleaf populations

(b)(5) DPP & ACP

(b)(5) DPP & ACP

being stand-alone EOs, as well as many populations being aggregates of several Eos. **Summary of Threats and Conservation Measures that Affect the Species**

Section 4(a)(1) of the Act directs us to determine whether any species is an endangered species or a threatened species because of any factors affecting its continued existence due to one or more of the five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for a delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future following the delisting or downlisting and the removal of the Act's protections. In the SSA Report (Service, 2018, entire) we discuss the factors affecting the dwarf-flowered heartleaf.

Threats were assessed for populations monitored by NCNHP during 2012-2016 (Robinson and Padgett 2016, pp. 7-8, 17-20), and EOs were reviewed for other documented threats to populations. Threats observed during these years included development, incompatible forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and road construction. Indirect or direct threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank for each threat factor determines the overall value

Deleted: ¶
¶

(b)(5) DPP & ACP
(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: ¶
Deleted: D

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Formatted: Indent: First line: 0

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: ¶

for each threat observed at each population. No significant changes in in the degree of threats within populations were noted from 2012-2016.

We assess the specific observed threats, organized by listing factor, below.

Factor A. Present or threatened destruction, modification, or curtailment of habitat or range:

Dwarf-flowered heartleaf populations occur in rapidly growing urban areas with expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

The most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving dwarf-flowered heartleaf, is road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations between the USFWS and the North Carolina Department of Transportation (NCDOT). Collectively, these projects have adversely impacted or are currently expected to impact some 22,135 rosettes. In most cases the Section 7 process has resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection to those plants remaining (post-construction) within NCDOT right-of-way (ROW). Significant portions of other populations have been purchased by NCDOT as off-site conservation measures in association with these consultations. Over the many years of Section 7 consultations between the USFWS and NCDOT, NCDOT has pledged monitoring and/or

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted:

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: NCDOT

(b)(5) DPP & ACP

Deleted: ¶

management for most of the sites it has acquired, as well as some locations where the species is protected within NCDOT rights-of-way (ROW). In recent years USFWS and NCDOT have recognized a need to follow up on these commitments by verifying the number of plants remaining post-construction, the number and survival of transplanted individuals, the number of rosettes protected within ROWs, and/or the number of rosettes protected via off-site land purchases. In particular, there remains a need for monitoring data to be collected in a consistent manner from one year to the next for the purposes of meaningfully accounting for trends. In 2009, NCDOT pledged to provide this information to the USFWS as one of many conservation measures associated with another formal consultation involving adverse effects to the species (USFWS 2009, n.p.). This information, anticipated July 2019, will substantially inform future assessments of the status, threats, and levels of protection afforded to the species.

Deleted: -

Deleted: *H. naniflora*

Deleted: within the next calendar year,

Other forms of economic development have also resulted in the destruction or modification of habitats occupied by the dwarf-flowered heartleaf; in many cases, these activities have also required Section 7 consultations with the USFWS. Examples of these activities include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities (in compliance with Federal Aviation Administration standards) at a regional airport. Collectively, these activities have involved the loss or relocation of several thousand rosettes.

Deleted:

Deleted: *H. naniflora*

Factor B: Overutilization for commercial, sporting, scientific, or educational purposes:

Overutilization is not known to be a threat at this time.

Factor C: Disease or predation:

When the species was listed in 1989, neither disease nor predation were known to be significant factors affecting the status of the species. We have no new information to suggest that this has changed.

Factor D: Inadequacy of existing regulatory mechanisms:

The North Carolina Plant Protection Act lists plants MORE, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. Outside of the Act, the species does not have legal protection from collection or destruction in the state of South Carolina.

In North Carolina, there are 14 sites http://keishalancebottoms.com/wp-content/uploads/2017/06/3-1-1024x683.jpgwith the potential to afford long-term protection to the species. Twelve of these have been associated with ESA section 7 consultations stemming from anticipated impacts to *H. naniflora*. Eight of these 12 sites have served as on-site mitigation for impacts to the species, in which the remaining portions of the population not impacted by the subject activity are expected to be protected in perpetuity (subject to the terms and conditions of a biological opinion authored by the Service). Three other sites were (or will be) acquired as off-site mitigation for projects also expected to adversely affect the species. One final site (the Rhyne Preserve) is already in protective ownership, but will serve as a recipient site for plants that would otherwise be destroyed in conjunction with a project located elsewhere in that same county (approximately 7 miles away) requiring ESA section 7 consultation.

In South Carolina, ESA section 7 consultation afforded some protection to the species at the Lake Blalock population, which would have been reduced by 1/3 as a result of plans to raise lake levels. The remaining portions of this population (above the new high-water mark and on

Deleted: federally

Deleted: this was

Deleted: not

Deleted: a

Deleted: listed under that statute

Deleted: T

(b)(5) DPP & ACP

(b)(5) DPP & ACP

property owned by the Spartanburg Water System) are expected to be protected in perpetuity (subject to a Biological Opinion written by the Service), however this protection needs verification. The Peter's Creek SCDNR Heritage Preserve was also acquired as off-site mitigation for impacts stemming from this ESA Section 7 consultation.

Therefore, the protections afforded to the species as a result of its status under the ESA enabled protection (or additional protection) of 14 of the 20 sites currently capable of providing perpetual protection to the species. It is likely that many of these protection efforts would not have occurred without the protections of the ESA.

(b)(5) DPP & ACP

We also assume that populations currently on protected lands are likely to see smaller impacts from urbanization compared to those that are not protected, but protection status (perpetuity vs non-perpetuity) matters. For example, Registered Heritage Areas are non-binding agreements with a land owner, and if the land changes ownership, or the owner decides not to continue with the agreement, then the Registry is no longer valid. Appendix 4 to the SSA Report shows the protection status of each delineated population which helped to inform our assessment of resilience under each scenario.

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Factor E: Other natural or manmade factors affecting its continued existence:

Invasive exotic plant species are rapidly spreading throughout riparian corridors and ravines across the range of this species. Invasive exotics such as English Ivy, Chinese privet, Japanese honeysuckle and Japanese Nepal grass are known to threaten several sites which contain the species; however, the scope and magnitude of this threat has not been comprehensively assessed. This threat requires active management in order to be successfully abated. Therefore, sites receiving protection via conservation ownership which lack clearly

Formatted: Indent: First line: 0

Deleted: rampantly

(b)(5) DPP & ACP

assigned management responsibilities are not likely to provide perpetual protection to the species (USFWS 2011, p. 15).

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

In recent years, the southeast has experienced moderate to severe droughts that many observers have implicated in population declines and poor transplant survivorship (NC NHP, 2010; and references throughout this review). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). The extent to which these climate changes will significantly affect populations of *H. naniflora* is currently unknown.

Climate Change

There is a growing concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Because typical habitats for this species include moist soils adjacent to creeks, streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams, specific effects of climate change to the dwarf-flowered heartleaf are likely related to changes in soil moisture associated with potential increases in drought.

Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.) which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p.7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p.7).

Despite the recognition of potential climate effects on ecosystem processes, there is uncertainty about what the exact climate future for the Southeastern US will be and how the ecosystems and species in this region will respond. Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. As a result, impacts from rapid urbanization in the region might be exacerbated under even a mild to moderate climate future.

Regardless of a pessimistic, optimistic, or status quo climate future, the following systematic changes are expected to be realized to varying degrees in the Southeastern US (IPCC 2013, p. 7):

- More frequent drought
- More extreme heat (resulting in increases in air and water temperatures, Figure 5-3)
- Increased heavy precipitation events (e.g., flooding)
- More intense storms (e.g., frequency of major hurricanes increases)

Future Condition

(b)(5) DPP & ACP

Deleted: D

Our analysis of the past, current, and future influences on what the dwarf-flowered heartleaf needs for long term viability revealed that there are several influences that pose risks to future viability of the species. These risks are primarily related to invasive species and habitat changes from development and long term climate change. We use projections of urban development to assess potential habitat loss and fragmentation. We also considered how climate change may exacerbate the impacts of development in a qualitative fashion using a narrative approach.

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. The projection to 2040 is based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape (see SSA Report for further explanation). Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

(b)(5) DPP & ACP

Deleted: B

(b)(5) DPP & ACP

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040. SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995, entire). The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a

Formatted: Indent: First line: 0.5

highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations
- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There are no data available on the exact relationships between urbanization and the impacts to dwarf-flowered heartleaf. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative impacts; development increase of at least 50% was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. This is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider under Current Conditions include detections that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to

Deleted: is

Deleted: D

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: for

persist. Several EOs have been revisited after more than 10 years and the species was present. (b)(5) DPP & ACP For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resilience of that population.

Deleted: ,

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resiliency categories were assessed using last known

Deleted: e

Deleted: e

abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000 foot buffer. The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 foot buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 foot buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-flowered heartleaf is likely to persist.

Status Quo Scenario

Under the status quo scenario, we assume a small number of populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

(b)(5) DPP & ACP

Deleted: few

Deleted: %

Deleted: e

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.

- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no negative impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

High Development Scenario

Under the high development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

Deleted: e

- No additional populations are identified as persisting
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
        - Voluntary protection/non-perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

- Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold; extirpation of populations if % increase in urbanization exceeds >90% threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we assume it is likely several additional populations (i.e. more than status quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resiliency under the following assumptions:

Deleted: e

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
  - Protected areas
    - Protected in perpetuity—no impacts from urbanization
    - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
  - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

Future Resiliency

Deleted: *e*

Status Quo Scenario

In the Status Quo scenario, 75 populations of dwarf-flowered heartleaf are predicted in 2040. The predicted resiliency of the extant populations is as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be highly resilient. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the seven additional populations predicted to persist under this scenario, four are in South Carolina, and three in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), and moderate (4).

High Development Scenario

In the High Development scenario, 72 populations of dwarf-flowered heartleaf are predicted in 2040. The predicted resilience of the extant populations is as follows: very high (27); high (4); moderate (25); and low (16). No new future populations are predicted to be discovered. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resilience is predicted to drop to moderate resilience; one high resilience population is predicted to drop to moderate; two

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: D
Deleted: on the landscape
Deleted: e
Deleted: are
Deleted: e
Deleted: e
Deleted: of very high
Deleted: ce

Deleted: there are predicted to be
Deleted: D
Deleted: on the landscape
Deleted: are

Deleted: e

(b)(5) DPP & ACP

moderate populations are predicted to drop to low resilience; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the Targeted Conservation scenario, 79 populations of dwarf-flowered heartleaf are predicted in 2040. The predicted resilience of the extant populations is as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations discovered to persist, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the sixteen additional populations predicted to persist under this scenario, ten are in South Carolina, and six in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), moderate (11), and low (2).

(b)(5) DPP & ACP

Deleted: are

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resilience and extirpation of a few populations is offset in the Status Quo and Targeted Conservation scenarios by the persistence of several additional populations. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resiliency in several additional populations. However, in all three

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

(b)(5) DPP & ACP

Deleted: e

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances; however the species range is relatively small, making it potentially vulnerable to long-term catastrophic events over the next 20-30 years, such as climate change.

Deleted: D

Deleted: ,

(b)(5) DPP & ACP

Based on the assumption that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. As discussed below, there are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Deleted: Given

Deleted: D

Deleted: for this species

Deleted: we have

Table 1 Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	Current	Status Quo	High Development	Targeted Conservation
Very High	28	27	27	27
High	5	6	4	6
Moderate	26	23	25	23
Low	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total	**78**	**75**	**72**	**79**

Determination

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Section 4 of the Act, and its implementing regulations at 50 CFR part 424, set forth the procedures for listing species on, reclassifying species on, or removing species from the Federal Lists of Endangered and Threatened Wildlife and Plants. We may determine that a species is an endangered or threatened species due to one or more of the five factors described in section 4(a)(1) of the Act: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for a delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future following the delisting or downlisting and the removal of the Act's protections.

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the dwarf-flowered heartleaf. Currently, there are a total of 78 known populations in 12 counties with occurrences documented since 2005, 75 percent of which are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend. At the end of the projection period (2040), under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small

Formatted: Indent: First line: 0.5

Deleted: D

(b)(5) DPP & ACP
(b)(5) DPP & ACP

number (5-6) of currently low resilient populations are projected to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Approximately 30 percent of the 78 currently known populations are permanently protected, and another 25 or so percent are somewhat protected (voluntary agreements or provided some level of protection) reducing the likelihood of development impacting those populations. We therefore propose to remove the dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife at 50 CFR 17.11(h) due to recovery.

Deleted: D

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Even with continued risks from urban development and invasive species (Factor E), the best scientific and commercial information indicates that this species is viable and will remain viable in the foreseeable future. Therefore, this species is no longer in danger of extinction, nor is it likely to become in danger of extinction in the foreseeable future. Based on the analysis above and after considering the best available scientific and commercial information, we conclude that the dwarf-flowered heartleaf does not currently meet the Act's definition of either an endangered or a threatened species throughout its range.

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect Dwarf-flowered heartleaf. There is no critical habitat designated for this species.

Deleted: D

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as a threatened or endangered species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2018-XXXX. Copies can also be obtained from the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT** section). We seek information, data, and comments from the public regarding the dwarf-flowered heartleaf and the PDM plan. We are also seeking peer review of this draft plan concurrently with this comment period. We anticipate finalizing this plan, considering all public

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: , Asheville, North Carolina 28801

Deleted: D

and peer review comments, prior to making a final determination on the proposed delisting rule.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(a) Be logically organized;

(b) Use the active voice to address readers directly;

(c) Use clear language rather than jargon;

(d) Be divided into short sections and sentences; and

(e) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc. Send a copy of any comments on how we can make this rule easier to understand to: Office of Regulatory Affairs, Department of the Interior, room 7229, 1849 C Street NW., Washington, DC 20240. You may also email the comments to this address: Exsec@ios.doi.gov.

National Environmental Policy Act

We have determined that we do not need to prepare an Environmental Assessment or Environmental Impact Statement, as defined in the National Environmental Policy Act (42 USC 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered

Species Act. We published a notice outlining our reasons for this determination in the Federal Register October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribal lands associated with this proposed regulation.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket Number FWS-R4-ES-2018-XXXX and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville ecological Services Field Office.

Deleted: is

Deleted: South Carolina/

Deleted: E

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

2. Amend § 17.11(h), by removing the entries for "Heartleaf, Dwarf-flowered" under "PLANTS" from the List of Endangered and Threatened Wildlife.

§ 17.11 Endangered and threatened wildlife.

Dated: _____

_____

Deputy Director, U.S. Fish and Wildlife Service, Exercising the Authority of the Director, U.S. Fish and Wildlife Service.

From: Hamilton, Byron
To: Reid, Rebekah N
Subject: Heartleaf rule
Date: Friday, May 10, 2019 8:22:00 AM
Attachments: Dwarf-flowered Heartleaf Proposed Rule_clean to RSOL_SOL20181113_SOL20190417 (2).docx
Importance: High

Hi Rebekah,

Can you take a look at Mike Stevens comments and give me some feedback? I have to get this to HQ by June. Thanks!

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

The Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2018-XXXX; FXES11130900000-189-FF0932000]

RIN

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; availability of draft post-delisting monitoring plan.

SUMMARY: We, the U.S. Fish & Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicates that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened or endangered species under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan. If this proposal is finalized, the dwarf-flowered heartleaf will be removed from the List.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p m. Eastern Time on the closing date. We must receive requests for public hearings, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES**:** You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2018–XXXX, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rules link to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2018–XXXX; U.S. Fish and Wildlife Service, MS: BPHC, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see *Public Comments*, below, for more information).

Document availability: The proposed rule, draft PDM plan and supporting documents (including the Species Status Assessment (SSA), references cited, five year review) are available at *http://www.regulations.gov* under Docket No. FWS-R4-ES-2018-XXXX.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC

28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. This action proposes to remove the dwarf-flowered heartleaf from the List of Endangered and Threatened Plants in title 50 of the Code of Federal Regulations (50 CFR 17.11(h)). Removing a species from the List ("delisting") can only be completed by issuing a rule.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposed; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The determination to delist a species must be based on an analysis of the same factors. In addition, the Act's implementing regulations at 50 CFR 424.11 provide that we may delist a species only if the best scientific and commercial data indicate the species is neither a threatened nor an endangered species for one or more of the following reasons: (1) The species is extinct; (2) the species has recovered and is no longer threatened or endangered; or (3) the original data used at the time the species was classified were in error. We have determined that the dwarf-flowered heartleaf should be proposed for delisting under the Act because, based on an analysis of the five listing factors, it no longer meets the definition of an endangered or threatened species, and that it has recovered.

(b)(5) DPP & ACP

Peer review:

In accordance with our joint policy on peer review published in the **Federal Register** July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we have sought the expert opinions of seven appropriate specialists regarding the Species Status Assessment Report (SSA Report), which informed this proposed rule. The purpose of peer review is to ensure that our determination is based on scientifically sound data, assumptions, and analyses.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from the public, other concerned governmental agencies (including but not limited to State and Federal agencies and city local governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information received during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

Deleted: ,

(1) Information concerning the biology and ecology of the dwarf-flowered heartleaf;

(2) Relevant data concerning any threats (or lack thereof) to the dwarf-flowered heartleaf particularly any data on the possible effects of climate change as it relates to habitat, the extent of State protection and management that would be provided to this aster as a delisted species;

(3) Current or planned activities within the geographic range of the dwarf-flowered heartleaf that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment – including your personal identifying information – on *http://www.regulations.gov*. You may request at the top of your document that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee that we will be able to do so.

Comments and materials we receive, as well as supporting documentation we used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Service Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is a threatened or endangered species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the **Federal Register**. Such requests must be sent to the address shown in the **FOR FURTHER INFORMATION CONTACT** section. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings,

as well as how to obtain reasonable accommodations, in the **Federal Register** at least 15 days before the hearing.

Previous Federal Actions

On April 14, 1989, we published a final rule in the *Federal* Register (FR 54 14964) listing the dwarf-flowered heartleaf as endangered due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing. A Recovery Plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf SSA to aid in determining the appropriateness of reclassifying the species.

Background

Deleted:

The dwarf-flowered heartleaf (Hexastylis naniflora) is a species of plant endemic to the Upper 4 Piedmont region of western North Carolina and upstate South Carolina. It is a rare, low growing herbaceous plant in the birthwort family (Aristolochiaceae). Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (USFWS 2010, p. 15; NCNHP 2016, p. 4). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the Upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include four additional counties in North Carolina. As of 2016, the distribution of this species consisted of 113 populations distributed across 12 counties in these two states. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Dwarf-flowered heartleaf appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of any population.

Dwarf-flowered heartleaf occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186-196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, p. 114; Weakley 2015, p. 129; USFWS 2015, entire), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). Wagner (2013, pp. 30-32) conducted a habitat suitability study to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants. The unit of measurement for population size in this species is a "clump" (rosette).

A thorough review of the taxonomy, life history, ecology, and overall viability of the dwarf-flowered heartleaf is presented in the SSA (USFWS 2018, entire; available at https://www fws.gov/southeast/ and at http://www regulations.gov under Docket No. FWS-R4-ES-xxxx-xxxx).

Deleted: Heartleaf

Summary of Biological Status and Threats

The Act directs us to determine whether any species is an endangered or a threatened species because of any factors affecting its continued existence. The SSA report documents the

results of our comprehensive biological status review for the dwarf-flowered heartleaf, including an assessment of the potential stressors to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for listing as endangered or threatened species under the Act. It does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS-R4-ES-201X-XXXX.

Deleted: D

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the three conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate individual life-history needs. In the next stage, we assessed the historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We utilized this information to inform our decision in this proposed rule.

Deleted:

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect the dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of

dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered heartleaf ecology that determine whether populations can grow to maximize habitat occupancy.

The species also needs to exhibit redundancy. We measured redundancy for the dwarf-flowered heartleaf by the number and distribution of resilient populations across the range of the species. It is important to note that dwarf-flowered heartleaf has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area.

The third characteristic, representation, can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. In the absence of species-specific genetic and ecological diversity information, we evaluated representation based on the extent and variability of habitat characteristics across the geographical range.

Current Condition

Resiliency

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered heartleaf ecology that determine whether populations can grow to maximize habitat occupancy, thereby increasing resiliency of populations (USFWS 2017, p. 14-15).

The Natural Heritage Program collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member Natural Heritage Programs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2002). Since USFWS does not maintain its own database of known locations of dwarf-flowered heartleaf, it regards the NHP databases as the best repository for this information (USFWS 2010). Based on recent reports using the methods described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple EOs and stand-alone EO records.

Deleted: Hexastylis naniflora

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. The EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, provided there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, again depending on habitat conditions; and poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016,

p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat level information for every population we assessed, we synthesized all of the above population size information and created four resiliency categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Redundancy

Species-level redundancy reflects the ability of a species to withstand catastrophic events, and is best achieved by having multiple, widely distributed populations relative to the spatial occurrence of catastrophic events. Redundancy for dwarf-flowered heartleaf is the total number and resilience of population segments and their distribution across the species range.

An important question when investigating redundancy for dwarf-flowered heartleaf is, "what exactly is a catastrophe?" We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with

devastating effects; however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010, pp. 7-10).

Representation

We lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. Instead, we used the EO Data Standard which provides a Default Separation Distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all)

(b)(5) DPP & ACP

situations. This results in several dwarf-flowered heartleaf populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Deleted: Eos

Summary of Threats and Conservation Measures that Affect the Species

Section 4(a)(1) of the Act directs us to determine whether any species is an endangered species or a threatened species because of any factors affecting its continued existence due to one or more of the five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for a delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future following the delisting or downlisting and the removal of the Act's protections. In the SSA Report (Service, 2018, entire) we discuss the factors affecting the dwarf-flowered heartleaf.

.

Threats were assessed for populations monitored by NCNHP during 2012-2016 (Robinson and Padgett 2016, pp. 7-8, 17-20), and EOs were reviewed for other documented threats to populations. Threats observed during these years included development, incompatible forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and road construction.

Deleted: ¶

Indirect or direct threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank for each threat factor determines the overall value for each threat observed at each population. No significant changes in in the degree of threats within populations were noted from 2012-2016.

We assess the specific observed threats, organized by listing factor, below.

Factor A. Present or threatened destruction, modification, or curtailment of habitat or range:

Dwarf-flowered heartleaf populations occur in rapidly growing urban areas with expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

The most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving dwarf-flowered heartleaf, is road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations between the USFWS and the North Carolina Department of Transportation (NCDOT). Collectively, these projects have adversely impacted or are currently expected to impact some 22,135 rosettes. In most cases the Section 7 process has resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection to those plants remaining (post-construction) within NCDOT right-of-way

(ROW). Significant portions of other populations have been purchased by NCDOT as off-site conservation measures in association with these consultations. Over the many years of Section 7 consultations between the USFWS and NCDOT, NCDOT has pledged monitoring and/or management for most of the sites it has acquired, as well as some locations where the species is protected within NCDOT rights-of-way (ROW). In recent years USFWS and NCDOT have recognized a need to follow up on these commitments by verifying the number of plants remaining post-construction, the number and survival of transplanted individuals, the number of rosettes protected within ROWs, and/or the number of rosettes protected via off-site land purchases. In particular, there remains a need for monitoring data to be collected in a consistent manner from one year to the next for the purposes of meaningfully accounting for trends. In 2009, NCDOT pledged to provide this information to the USFWS as one of many conservation measures associated with another formal consultation involving adverse effects to the species (USFWS 2009, n.p.). This information, anticipated by July 2019, will substantially inform future assessments of the status, threats, and levels of protection afforded to the species.

Deleted:

Deleted: -

Other forms of economic development have also resulted in the destruction or modification of habitats occupied by the dwarf-flowered heartleaf; in many cases, these activities have also required Section 7 consultations with the USFWS. Examples of these activities include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities (in compliance with Federal Aviation Administration standards) at a regional airport. Collectively, these activities have involved the loss or relocation of several thousand rosettes.

Factor B: Overutilization for commercial, sporting, scientific, or educational purposes:

Overutilization is not known to be a threat at this time.

Factor C: Disease or predation:

When the species was listed in 1989, neither disease nor predation were known to be significant factors affecting the status of the species. We have no new information to suggest that this has changed.

Factor D: Inadequacy of existing regulatory mechanisms:

The North Carolina Plant Protection Act, N.C. Gen. Stat. § 106-202.12 et seq., lists native plants as threatened or endangered, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. Outside of the Act, the species does not have legal protection from collection or destruction in the state of South Carolina.

Deleted:

In North Carolina, there are 14 sites with the potential to afford long-term protection to the species. Twelve of these have been associated with ESA section 7 consultations stemming from anticipated impacts to *H. naniflora*. Eight of these 12 sites have served as on-site mitigation for impacts to the species, in which the remaining portions of the population not impacted by the subject activity are expected to be protected in perpetuity (subject to the terms and conditions of a biological opinion authored by the Service). Three other sites were (or will be) acquired as off-site mitigation for projects also expected to adversely affect the species. One final site (the Rhyne Preserve) is already in protective ownership, but will serve as a recipient site for plants that would otherwise be destroyed in conjunction with a project located elsewhere in that same county (approximately 7 miles away) requiring ESA section 7 consultation.

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

In South Carolina, ESA section 7 consultation afforded some protection to the species at the Lake Blalock population, which would have been reduced by 1/3 as a result of plans to raise lake levels. The remaining portions of this population (above the new high-water mark and on property owned by the Spartanburg Water System) are expected to be protected in perpetuity (subject to a Biological Opinion written by the Service), however this protection needs verification. The Peter's Creek SCDNR Heritage Preserve was also acquired as off-site mitigation for impacts stemming from this ESA Section 7 consultation.

(b)(5) DPP & ACP

Therefore, the protections afforded to the species as a result of its status under the ESA enabled protection (or additional protection) of 14 of the 20 sites currently capable of providing perpetual protection to the species. It is likely that many of these protection efforts would not have occurred without the protections of the ESA.

(b)(5) DPP & ACP

We also assume that populations currently on protected lands are likely to see smaller impacts from urbanization compared to those that are not protected, but protection status (perpetuity vs non-perpetuity) matters. For example, Registered Heritage Areas are non-binding agreements with a land owner, and if the land changes ownership, or the owner decides not to continue with the agreement, then the Registry is no longer valid. Appendix 4 to the SSA Report shows the protection status of each delineated population which helped to inform our assessment of resiliency under each scenario.

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: resilience

Formatted: Indent: First line: 0

Factor E: Other natural or manmade factors affecting its continued existence:

Invasive exotic plant species are rapidly spreading throughout riparian corridors and ravines across the range of this species. Invasive exotics such as English Ivy, Chinese privet, Japanese honeysuckle and Japanese Nepal grass are known to threaten several sites which

contain the species; however, the scope and magnitude of this threat has not been comprehensively assessed. This threat requires active management in order to be successfully abated. Therefore, sites receiving protection via conservation ownership are not likely to provide perpetual protection to the species unless management responsibilities are clearly assigned (USFWS 2011, p. 15).

(b)(5) DPP & ACP

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

In recent years, the southeast has experienced moderate to severe droughts that many observers have implicated in population declines and poor transplant survivorship (NC NHP, 2010; and references throughout this review). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). The extent to which these climate changes will significantly affect populations of *H. naniflora* is currently unknown.

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Climate Change

There is a growing concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Because typical habitats for this species include moist soils adjacent to creeks, streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams, specific effects of climate change to the dwarf-flowered heartleaf are likely related to changes in soil moisture associated with potential increases in drought.

Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.) which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p.7; NCCV 2016, n.p.).

Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p.7).

Despite the recognition of potential climate effects on ecosystem processes, there is uncertainty about what the exact climate future for the Southeastern US will be and how the ecosystems and species in this region will respond. Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. As a result, impacts from rapid urbanization in the region might be exacerbated under even a mild to moderate climate future.

Regardless of a pessimistic, optimistic, or status quo climate future (see below), the following systematic changes are expected to be realized to varying degrees in the Southeastern US (IPCC 2013, p. 7):

- More frequent drought
- More extreme heat (resulting in increases in air and water temperatures, Figure 5-3)
- Increased heavy precipitation events (e.g., flooding)
- More intense storms (e.g., frequency of major hurricanes increases)

Future Condition

Our analysis of the past, current, and future influences on what the dwarf-flowered heartleaf needs for long term viability revealed that there are several influences that pose risks to future viability of the species. These risks are primarily related to invasive species and habitat changes from development and long term climate change. We use projections of urban

development to assess potential habitat loss and fragmentation. We also considered how climate change may exacerbate the impacts of development in a qualitative fashion using a narrative approach.

(b)(5) DPP & ACP

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. The projection to 2040 is based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape (see SSA Report for further explanation),. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040. SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995, entire). The SLEUTH model predictions are broken down by

probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations
- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There are no data available on the exact relationships between urbanization and the impacts to dwarf-flowered heartleaf. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative impacts; development increase of at least 50% was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. This is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider under Current Conditions include detections

that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years and the species was present. For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resiliency of that population.

Deleted: ,

Deleted: resilience

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH

model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000 foot buffer. The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 foot buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 foot buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-flowered heartleaf is likely to persist.

Status Quo Scenario

Under the status quo scenario, we assume a small number of populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

(b)(5) DPP & ACP
(b)(5) DPP & ACP

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH

modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.

- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no negative impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold

Deleted: resilience

Deleted: resilience

High Development Scenario

Under the high development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

- No additional populations are identified as persisting
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold

- Voluntary protection/non-perpetuity— population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold

Deleted: resilience

Deleted: resilience

- Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold; extirpation of populations if % increase in urbanization exceeds >90% threshold.

Deleted: resilience

Deleted: resilience

Targeted Conservation Scenario

Under the targeted conservation scenario, we assume it is likely several additional populations (i.e. more than status quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resiliency under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
  - Protected areas
    - Protected in perpetuity—no impacts from urbanization
    - Voluntary protection/non-perpetuity—population drops 1 resiliency rank if % increase in urbanization exceeds >50% threshold

Deleted: resilience

- Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold

Future Resiliency

Status Quo Scenario

In the Status Quo scenario, 75 populations of dwarf-flowered heartleaf are predicted in 2040. The predicted resiliency of the extant populations is as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be highly resilient. When comparing future population resiliency to current condition a few populations drop in their resilience category. One current population of very high resiliency is predicted to drop to high resilience; two moderate populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the seven additional populations predicted to persist under this scenario, four are in South Carolina, and three in North Carolina. We did not assess resiliency for these additional populations, but it is worth mentioning that the last time these populations were detected, resiliency was very high (2), high (1), and moderate (4).

High Development Scenario

In the High Development scenario, 72 populations of dwarf-flowered heartleaf are predicted in 2040. The predicted resiliency of the extant populations is as follows: very high (27); high (4); moderate (25); and low (16). No new future populations are predicted to be

Deleted: resilience

Deleted: resilience

Deleted: resilience

Deleted: resilience

Deleted: resilience

Deleted: resilience

Deleted: resilience

Deleted: resilience

discovered. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resilience; one high resiliency population is predicted to drop to moderate; two moderate populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the Targeted Conservation scenario, 79 populations of dwarf-flowered heartleaf are predicted in 2040. The predicted resiliency of the extant populations is as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations discovered to persist, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resilience category. One current population of very high resiliency is predicted to drop to high resilience; two moderate populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the sixteen additional populations predicted to persist under this scenario, ten are in South Carolina, and six in North Carolina. We did not assess resiliency for these additional populations, but it is worth mentioning that the last time these populations were detected, resiliency was very high (2), high (1), moderate (11), and low (2).

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few

Deleted: e
Deleted: e
Deleted: e
Deleted: resilience
Deleted: resilience
Deleted: e
Deleted: resilience
Deleted: resilience
Deleted: resilience
Deleted: e
Deleted: e

populations is offset in the Status Quo and Targeted Conservation scenarios by the persistence of several additional populations. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resiliency in several additional populations. However, in all three scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances; however the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events over the next 20-30 years, such as climate change.

Based on the assumption that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. As discussed below, there are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Table 1 Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	Current	Status Quo	High Development	Targeted Conservation
Very High	28	27	27	27
High	5	6	4	6
Moderate	26	23	25	23
Low	19	17	16	17

Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total	**78**	**75**	**72**	**79**

Determination

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the dwarf-flowered heartleaf. Currently, there are a total of 78 known populations in 12 counties with occurrences documented since 2005, 75 percent of which are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend. At the end of the projection period (2040), under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (5-6) of currently low resilient populations are projected to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Approximately 30 percent of the 78 currently known populations are permanently protected, and another 25 or so percent are somewhat protected (voluntary agreements or provided some level of protection) reducing the likelihood of development impacting those populations. Even with continued risks from urban development (Factor A) and invasive species (Factor E), the best scientific and commercial information indicates that this species is viable and will remain viable in the foreseeable future. Therefore, this species is no longer in danger of extinction, nor is it likely to become in danger of extinction in the foreseeable future. Based on the analysis above and after considering the best available

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: ¶

Deleted: D

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted:

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

scientific and commercial information, we conclude that the dwarf-flowered heartleaf does not currently meet the Act's definition of either an endangered or a threatened species throughout its range. We therefore propose to remove the dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Plants at 50 CFR 17.11(h).

(b)(5) DPP & ACP

Formatted: Indent: First line: 0.5

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect Dwarf-flowered heartleaf. There is no critical habitat designated for this species.

Deleted: D

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as a threatened or endangered species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Deleted:

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2018-XXXX. Copies can also be obtained from the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT** section). We seek information, data, and comments from the public regarding the dwarf-flowered heartleaf and the PDM plan. We are also seeking peer review of this draft plan concurrently with this comment period. We anticipate finalizing this plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(a) Be logically organized;

(b) Use the active voice to address readers directly;

(c) Use clear language rather than jargon;

(d) Be divided into short sections and sentences; and

(e) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc. Send a copy of any comments on how we can make this rule easier to understand to: Office of Regulatory Affairs, Department of the Interior, room 7229, 1849 C Street NW., Washington, DC 20240. You may also email the comments to this address: Exsec@ios.doi.gov.

National Environmental Policy Act

We have determined that we do not need to prepare an Environmental Assessment or Environmental Impact Statement, as defined in the National Environmental Policy Act (42 USC 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act. We published a notice outlining our reasons for this determination in the Federal Register October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to

the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands associated with this proposed regulation.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket Number FWS-R4-ES-2018-XXXX and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

2. Amend § 17.11(h), by removing the entries for "Heartleaf, Dwarf-flowered" under "PLANTS" from the List of Endangered and Threatened Wildlife.

§ 17.11 Endangered and threatened wildlife.

Dated: _____

_____

Deputy Director, U.S. Fish and Wildlife Service, Exercising the Authority of the Director, U.S. Fish and Wildlife Service.

From: Reid, Rebekah N
To: Mizzi, Janet; Peeples, Gary
Subject: Re: Heartleaf rule
Date: Thursday, May 16, 2019 11:25:29 AM
Attachments: Dwarf-flowered Heartleaf Proposed Rule_clean to RSOL_SOL20181113_SOL20190417 (2).docx

---

Trying again since attachment did not go through...

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville, NC 28801
phone: 828-258-3939 x238
cell: 828-782-0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Wed, May 15, 2019 at 7:13 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Janet and Gary,
>
> Byron Hamilton sent the latest draft of the dwarf-flowered heartleaf proposed rule with solicitor comments and asked for some feedback. After I asked, he said this is our opportunity to provide comments. I can work on this when I get back from NCTC. Let me know if you all would like to provide comments, as well. If you do, we can throw all the comments into one document (if appropriate).
>
> Thanks and see you next week!
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
> 160 Zillicoa St.
> Asheville, NC 28801
> phone: 828-258-3939 x238
> cell: 828-782-0090
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***
>
> ---------- Forwarded message ---------
> From: **Hamilton, Byron** <byron_hamilton@fws.gov>
> Date: Wed, May 15, 2019 at 6:30 AM
> Subject: Re: Heartleaf rule
> To: Reid, Rebekah <rebekah_reid@fws.gov>

Good morning Rebekah

This is the opportunity. You can address the comments when you get back to the FO.

On Tue, May 14, 2019 at 8:45 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Also, will we (Asheville FO) be given the opportunity to provide official comments on the proposed rule? Or, is this our opportunity?
>
> Thanks.
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
> 160 Zillicoa St.
> Asheville, NC 28801
> phone: 828-258-3939 x238
> cell: 828-782-0090
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***
>
> On Mon, May 13, 2019 at 5:28 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
>
> > Hey Byron,
> >
> > There are quite a few comments. Can you narrow it down? Which comments are you having trouble with?
> >
> > I'm at NCTC this week without all of my files. I'll be back next week and can take a more thorough look at it then.
> >
> > Rebekah Reid
> >
> > US Fish and Wildlife Service
> > Asheville Ecological Services Field Office
> > 160 Zillicoa St.
> > Asheville, NC 28801
> > phone: 828-258-3939 x238
> > cell: 828-782-0090
> >
> > ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***
> >
> > On Fri, May 10, 2019 at 8:22 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> >
> > > Hi Rebekah,
> > >
> > > Can you take a look at Mike Stevens comments and give me some feedback? I have to

> > get this to HQ by June. Thanks!
> > --
> > **Byron Hamilton, Sr.**
> > **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> > **U.S. Fish & Wildlife Service**
> > **1875 Century Blvd.**
> > **Atlanta, GA 30345**
> > **Work - (404) 679-4119**
> > **Cell - (803) 707-9518**

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

The Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2018-XXXX; FXES11130900000-189-FF0932000]

RIN

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; availability of draft post-delisting monitoring plan.

SUMMARY: We, the U.S. Fish & Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicates that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened or endangered species under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan. If this proposal is finalized, the dwarf-flowered heartleaf will be removed from the List.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p m. Eastern Time on the closing date. We must receive requests for public hearings, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES**:** You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2018–XXXX, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rules link to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2018–XXXX; U.S. Fish and Wildlife Service, MS: BPHC, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see *Public Comments*, below, for more information).

Document availability: The proposed rule, draft PDM plan and supporting documents (including the Species Status Assessment (SSA), references cited, five year review) are available at *http://www.regulations.gov* under Docket No. FWS-R4-ES-2018-XXXX.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC

28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. This action proposes to remove the dwarf-flowered heartleaf from the List of Endangered and Threatened Plants in title 50 of the Code of Federal Regulations (50 CFR 17.11(h)). Removing a species from the List ("delisting") can only be completed by issuing a rule.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposed; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The determination to delist a species must be based on an analysis of the same factors. In addition, the Act's implementing regulations at 50 CFR 424.11 provide that we may delist a species only if the best scientific and commercial data indicate the species is neither a threatened nor an endangered species for one or more of the following reasons: (1) The species is extinct; (2) the species has recovered and is no longer threatened or endangered; or (3) the original data used at the time the species was classified were in error. We have determined that the dwarf-flowered heartleaf should be proposed for delisting under the Act because, based on an analysis of the five listing factors, it no longer meets the definition of an endangered or threatened species, and that it has recovered.

(b)(5) DPP & ACP

Peer review:

In accordance with our joint policy on peer review published in the **Federal Register** July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we have sought the expert opinions of seven appropriate specialists regarding the Species Status Assessment Report (SSA Report), which informed this proposed rule. The purpose of peer review is to ensure that our determination is based on scientifically sound data, assumptions, and analyses.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from the public, other concerned governmental agencies (including but not limited to State and Federal agencies and city local governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information received during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

Deleted: ,

(1) Information concerning the biology and ecology of the dwarf-flowered heartleaf;

(2) Relevant data concerning any threats (or lack thereof) to the dwarf-flowered heartleaf particularly any data on the possible effects of climate change as it relates to habitat, the extent of State protection and management that would be provided to this aster as a delisted species;

(3) Current or planned activities within the geographic range of the dwarf-flowered heartleaf that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment – including your personal identifying information – on *http://www.regulations.gov*. You may request at the top of your document that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee that we will be able to do so.

Comments and materials we receive, as well as supporting documentation we used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Service Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is a threatened or endangered species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the **Federal Register**. Such requests must be sent to the address shown in the **FOR FURTHER INFORMATION CONTACT** section. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings,

as well as how to obtain reasonable accommodations, in the **Federal Register** at least 15 days before the hearing.

Previous Federal Actions

On April 14, 1989, we published a final rule in the *Federal* Register (FR 54 14964) listing the dwarf-flowered heartleaf as endangered due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing. A Recovery Plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf SSA to aid in determining the appropriateness of reclassifying the species.

Background

Deleted:

The dwarf-flowered heartleaf (Hexastylis naniflora) is a species of plant endemic to the Upper 4 Piedmont region of western North Carolina and upstate South Carolina. It is a rare, low growing herbaceous plant in the birthwort family (Aristolochiaceae). Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (USFWS 2010, p. 15; NCNHP 2016, p. 4). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the Upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include four additional counties in North Carolina. As of 2016, the distribution of this species consisted of 113 populations distributed across 12 counties in these two states. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Dwarf-flowered heartleaf appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of any population.

Dwarf-flowered heartleaf occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186-196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, p. 114; Weakley 2015, p. 129; USFWS 2015, entire), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). Wagner (2013, pp. 30-32) conducted a habitat suitability study to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants. The unit of measurement for population size in this species is a "clump" (rosette).

A thorough review of the taxonomy, life history, ecology, and overall viability of the dwarf-flowered heartleaf is presented in the SSA (USFWS 2018, entire; available at https://www fws.gov/southeast/ and at http://www regulations.gov under Docket No. FWS-R4-ES-xxxx-xxxx).

Deleted: Heartleaf

Summary of Biological Status and Threats

The Act directs us to determine whether any species is an endangered or a threatened species because of any factors affecting its continued existence. The SSA report documents the

results of our comprehensive biological status review for the dwarf-flowered heartleaf, including an assessment of the potential stressors to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for listing as endangered or threatened species under the Act. It does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS-R4-ES-201X-XXXX.

Deleted: D

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the three conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate individual life-history needs. In the next stage, we assessed the historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We utilized this information to inform our decision in this proposed rule.

Deleted:

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect the dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of

dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered heartleaf ecology that determine whether populations can grow to maximize habitat occupancy.

The species also needs to exhibit redundancy. We measured redundancy for the dwarf-flowered heartleaf by the number and distribution of resilient populations across the range of the species. It is important to note that dwarf-flowered heartleaf has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area.

The third characteristic, representation, can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. In the absence of species-specific genetic and ecological diversity information, we evaluated representation based on the extent and variability of habitat characteristics across the geographical range.

Current Condition

Resiliency

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered heartleaf ecology that determine whether populations can grow to maximize habitat occupancy, thereby increasing resiliency of populations (USFWS 2017, p. 14-15).

The Natural Heritage Program collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member Natural Heritage Programs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2002). Since USFWS does not maintain its own database of known locations of dwarf-flowered heartleaf, it regards the NHP databases as the best repository for this information (USFWS 2010). Based on recent reports using the methods described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple EOs and stand-alone EO records.

Deleted: Hexastylis naniflora

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. The EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, provided there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, again depending on habitat conditions; and poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016,

p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat level information for every population we assessed, we synthesized all of the above population size information and created four resiliency categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Redundancy

Species-level redundancy reflects the ability of a species to withstand catastrophic events, and is best achieved by having multiple, widely distributed populations relative to the spatial occurrence of catastrophic events. Redundancy for dwarf-flowered heartleaf is the total number and resilience of population segments and their distribution across the species range.

An important question when investigating redundancy for dwarf-flowered heartleaf is, "what exactly is a catastrophe?" We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with

devastating effects; however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010, pp. 7-10).

Representation

We lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. Instead, we used the EO Data Standard which provides a Default Separation Distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all)

(b)(5) DPP & ACP

situations. This results in several dwarf-flowered heartleaf populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Deleted: Eos

Summary of Threats and Conservation Measures that Affect the Species

Section 4(a)(1) of the Act directs us to determine whether any species is an endangered species or a threatened species because of any factors affecting its continued existence due to one or more of the five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for a delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future following the delisting or downlisting and the removal of the Act's protections. In the SSA Report (Service, 2018, entire) we discuss the factors affecting the dwarf-flowered heartleaf.

.

Threats were assessed for populations monitored by NCNHP during 2012-2016 (Robinson and Padgett 2016, pp. 7-8, 17-20), and EOs were reviewed for other documented threats to populations. Threats observed during these years included development, incompatible forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and road construction.

Deleted: ¶

Indirect or direct threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank for each threat factor determines the overall value for each threat observed at each population. No significant changes in in the degree of threats within populations were noted from 2012-2016.

We assess the specific observed threats, organized by listing factor, below.

Factor A. Present or threatened destruction, modification, or curtailment of habitat or range:

Dwarf-flowered heartleaf populations occur in rapidly growing urban areas with expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

The most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving dwarf-flowered heartleaf, is road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations between the USFWS and the North Carolina Department of Transportation (NCDOT). Collectively, these projects have adversely impacted or are currently expected to impact some 22,135 rosettes. In most cases the Section 7 process has resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection to those plants remaining (post-construction) within NCDOT right-of-way

(ROW). Significant portions of other populations have been purchased by NCDOT as off-site conservation measures in association with these consultations. Over the many years of Section 7 consultations between the USFWS and NCDOT, NCDOT has pledged monitoring and/or management for most of the sites it has acquired, as well as some locations where the species is protected within NCDOT rights-of-way (ROW). In recent years USFWS and NCDOT have recognized a need to follow up on these commitments by verifying the number of plants remaining post-construction, the number and survival of transplanted individuals, the number of rosettes protected within ROWs, and/or the number of rosettes protected via off-site land purchases. In particular, there remains a need for monitoring data to be collected in a consistent manner from one year to the next for the purposes of meaningfully accounting for trends. In 2009, NCDOT pledged to provide this information to the USFWS as one of many conservation measures associated with another formal consultation involving adverse effects to the species (USFWS 2009, n.p.). This information, anticipated by July 2019, will substantially inform future assessments of the status, threats, and levels of protection afforded to the species.

Deleted:

Deleted: -

Other forms of economic development have also resulted in the destruction or modification of habitats occupied by the dwarf-flowered heartleaf; in many cases, these activities have also required Section 7 consultations with the USFWS. Examples of these activities include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities (in compliance with Federal Aviation Administration standards) at a regional airport. Collectively, these activities have involved the loss or relocation of several thousand rosettes.

Factor B: Overutilization for commercial, sporting, scientific, or educational purposes:

Overutilization is not known to be a threat at this time.

Factor C: Disease or predation:

When the species was listed in 1989, neither disease nor predation were known to be significant factors affecting the status of the species. We have no new information to suggest that this has changed.

Factor D: Inadequacy of existing regulatory mechanisms:

The North Carolina Plant Protection Act, N.C. Gen. Stat. § 106-202.12 et seq., lists native plants as threatened or endangered, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. Outside of the Act, the species does not have legal protection from collection or destruction in the state of South Carolina.

Deleted:

In North Carolina, there are 14 sites with the potential to afford long-term protection to the species. Twelve of these have been associated with ESA section 7 consultations stemming from anticipated impacts to *H. naniflora*. Eight of these 12 sites have served as on-site mitigation for impacts to the species, in which the remaining portions of the population not impacted by the subject activity are expected to be protected in perpetuity (subject to the terms and conditions of a biological opinion authored by the Service). Three other sites were (or will be) acquired as off-site mitigation for projects also expected to adversely affect the species. One final site (the Rhyne Preserve) is already in protective ownership, but will serve as a recipient site for plants that would otherwise be destroyed in conjunction with a project located elsewhere in that same county (approximately 7 miles away) requiring ESA section 7 consultation.

In South Carolina, ESA section 7 consultation afforded some protection to the species at the Lake Blalock population, which would have been reduced by 1/3 as a result of plans to raise lake levels. The remaining portions of this population (above the new high-water mark and on property owned by the Spartanburg Water System) are expected to be protected in perpetuity (subject to a Biological Opinion written by the Service), however this protection needs verification. The Peter's Creek SCDNR Heritage Preserve was also acquired as off-site mitigation for impacts stemming from this ESA Section 7 consultation.

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Therefore, the protections afforded to the species as a result of its status under the ESA enabled protection (or additional protection) of 14 of the 20 sites currently capable of providing perpetual protection to the species. It is likely that many of these protection efforts would not have occurred without the protections of the ESA.

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

We also assume that populations currently on protected lands are likely to see smaller impacts from urbanization compared to those that are not protected, but protection status (perpetuity vs non-perpetuity) matters. For example, Registered Heritage Areas are non-binding agreements with a land owner, and if the land changes ownership, or the owner decides not to continue with the agreement, then the Registry is no longer valid. Appendix 4 to the SSA Report shows the protection status of each delineated population which helped to inform our assessment of resiliency under each scenario.

Deleted: resilience

Formatted: Indent: First line: 0

Factor E: Other natural or manmade factors affecting its continued existence:

Invasive exotic plant species are rapidly spreading throughout riparian corridors and ravines across the range of this species. Invasive exotics such as English Ivy, Chinese privet, Japanese honeysuckle and Japanese Nepal grass are known to threaten several sites which

contain the species; however, the scope and magnitude of this threat has not been comprehensively assessed. This threat requires active management in order to be successfully abated. Therefore, sites receiving protection via conservation ownership are not likely to provide perpetual protection to the species unless management responsibilities are clearly assigned (USFWS 2011, p. 15).

(b)(5) DPP & ACP

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

In recent years, the southeast has experienced moderate to severe droughts that many observers have implicated in population declines and poor transplant survivorship (NC NHP, 2010; and references throughout this review). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). The extent to which these climate changes will significantly affect populations of *H. naniflora* is currently unknown.

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Climate Change

There is a growing concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Because typical habitats for this species include moist soils adjacent to creeks, streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams, specific effects of climate change to the dwarf-flowered heartleaf are likely related to changes in soil moisture associated with potential increases in drought.

Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.) which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p.7; NCCV 2016, n.p.).

Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p.7).

Despite the recognition of potential climate effects on ecosystem processes, there is uncertainty about what the exact climate future for the Southeastern US will be and how the ecosystems and species in this region will respond. Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. As a result, impacts from rapid urbanization in the region might be exacerbated under even a mild to moderate climate future.

Regardless of a pessimistic, optimistic, or status quo climate future (see below), the following systematic changes are expected to be realized to varying degrees in the Southeastern US (IPCC 2013, p. 7):

- More frequent drought
- More extreme heat (resulting in increases in air and water temperatures, Figure 5-3)
- Increased heavy precipitation events (e.g., flooding)
- More intense storms (e.g., frequency of major hurricanes increases)

Future Condition

Our analysis of the past, current, and future influences on what the dwarf-flowered heartleaf needs for long term viability revealed that there are several influences that pose risks to future viability of the species. These risks are primarily related to invasive species and habitat changes from development and long term climate change. We use projections of urban

development to assess potential habitat loss and fragmentation. We also considered how climate change may exacerbate the impacts of development in a qualitative fashion using a narrative approach.

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. The projection to 2040 is based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape (see SSA Report for further explanation),. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040. SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995, entire). The SLEUTH model predictions are broken down by

probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations
- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There are no data available on the exact relationships between urbanization and the impacts to dwarf-flowered heartleaf. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative impacts; development increase of at least 50% was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. This is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider under Current Conditions include detections

that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years and the species was present. For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resiliency of that population.

Deleted: ,

Deleted: resilience

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH

model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000 foot buffer. The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 foot buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 foot buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-flowered heartleaf is likely to persist.

Status Quo Scenario

Under the status quo scenario, we assume a small number of populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH

modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.

- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no negative impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold

Deleted: resilience

Deleted: resilience

High Development Scenario

Under the high development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

- No additional populations are identified as persisting
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold

- Voluntary protection/non-perpetuity— population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold

Deleted: resilience

Deleted: resilience

- Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold; extirpation of populations if % increase in urbanization exceeds >90% threshold.

Deleted: resilience

Deleted: resilience

Targeted Conservation Scenario

Under the targeted conservation scenario, we assume it is likely several additional populations (i.e. more than status quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resiliency under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
  - Protected areas
    - Protected in perpetuity—no impacts from urbanization
    - Voluntary protection/non-perpetuity—population drops 1 resiliency rank if % increase in urbanization exceeds >50% threshold

Deleted: resilience

- Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold

Future Resiliency

Status Quo Scenario

In the Status Quo scenario, 75 populations of dwarf-flowered heartleaf are predicted in 2040. The predicted resiliency of the extant populations is as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be highly resilient. When comparing future population resiliency to current condition a few populations drop in their resilience category. One current population of very high resiliency is predicted to drop to high resilience; two moderate populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the seven additional populations predicted to persist under this scenario, four are in South Carolina, and three in North Carolina. We did not assess resiliency for these additional populations, but it is worth mentioning that the last time these populations were detected, resiliency was very high (2), high (1), and moderate (4).

High Development Scenario

In the High Development scenario, 72 populations of dwarf-flowered heartleaf are predicted in 2040. The predicted resiliency of the extant populations is as follows: very high (27); high (4); moderate (25); and low (16). No new future populations are predicted to be

Deleted: resilience

Deleted: resilience

Deleted: resilience

Deleted: resilience

Deleted: resilience

Deleted: resilience

Deleted: resilience

Deleted: resilience

discovered. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resilience; one high resiliency population is predicted to drop to moderate; two moderate populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the Targeted Conservation scenario, 79 populations of dwarf-flowered heartleaf are predicted in 2040. The predicted resiliency of the extant populations is as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations discovered to persist, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resilience category. One current population of very high resiliency is predicted to drop to high resilience; two moderate populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the sixteen additional populations predicted to persist under this scenario, ten are in South Carolina, and six in North Carolina. We did not assess resiliency for these additional populations, but it is worth mentioning that the last time these populations were detected, resiliency was very high (2), high (1), moderate (11), and low (2).

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few

Deleted: e
Deleted: e
Deleted: e
Deleted: resilience
Deleted: resilience
Deleted: e
Deleted: resilience
Deleted: resilience
Deleted: resilience
Deleted: e
Deleted: e

populations is offset in the Status Quo and Targeted Conservation scenarios by the persistence of several additional populations. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resiliency in several additional populations. However, in all three scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances; however the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events over the next 20-30 years, such as climate change.

Based on the assumption that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. As discussed below, there are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Table 1 Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	Current	Status Quo	High Development	Targeted Conservation
Very High	28	27	27	27
High	5	6	4	6
Moderate	26	23	25	23
Low	19	17	16	17

Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total	**78**	**75**	**72**	**79**

Determination

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the dwarf-flowered heartleaf. Currently, there are a total of 78 known populations in 12 counties with occurrences documented since 2005, 75 percent of which are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend. At the end of the projection period (2040), under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (5-6) of currently low resilient populations are projected to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Approximately 30 percent of the 78 currently known populations are permanently protected, and another 25 or so percent are somewhat protected (voluntary agreements or provided some level of protection) reducing the likelihood of development impacting those populations. Even with continued risks from urban development (Factor A) and invasive species (Factor E), the best scientific and commercial information indicates that this species is viable and will remain viable in the foreseeable future. Therefore, this species is no longer in danger of extinction, nor is it likely to become in danger of extinction in the foreseeable future. Based on the analysis above and after considering the best available

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: ¶

Deleted: D

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted:

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

scientific and commercial information, we conclude that the dwarf-flowered heartleaf does not currently meet the Act's definition of either an endangered or a threatened species throughout its range. We therefore propose to remove the dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Plants at 50 CFR 17.11(h).

(b)(5) DPP & ACP

Formatted: Indent: First line: 0.5

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect Dwarf-flowered heartleaf. There is no critical habitat designated for this species.

Deleted: D

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as a threatened or endangered species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Deleted:

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2018-XXXX. Copies can also be obtained from the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT** section). We seek information, data, and comments from the public regarding the dwarf-flowered heartleaf and the PDM plan. We are also seeking peer review of this draft plan concurrently with this comment period. We anticipate finalizing this plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(a) Be logically organized;

(b) Use the active voice to address readers directly;

(c) Use clear language rather than jargon;

(d) Be divided into short sections and sentences; and

(e) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc. Send a copy of any comments on how we can make this rule easier to understand to: Office of Regulatory Affairs, Department of the Interior, room 7229, 1849 C Street NW., Washington, DC 20240. You may also email the comments to this address: Exsec@ios.doi.gov.

National Environmental Policy Act

We have determined that we do not need to prepare an Environmental Assessment or Environmental Impact Statement, as defined in the National Environmental Policy Act (42 USC 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act. We published a notice outlining our reasons for this determination in the Federal Register October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to

the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands associated with this proposed regulation.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket Number FWS-R4-ES-2018-XXXX and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

2. Amend § 17.11(h), by removing the entries for "Heartleaf, Dwarf-flowered" under "PLANTS" from the List of Endangered and Threatened Wildlife.

§ 17.11 Endangered and threatened wildlife.

Dated: _____

_____

Deputy Director, U.S. Fish and Wildlife Service, Exercising the Authority of the Director, U.S. Fish and Wildlife Service.

From: Herrick Brown
To: Reid, Rebekah N
Subject: RE: [EXTERNAL] RE: Looking for Report
Date: Friday, June 7, 2019 1:14:02 PM
Attachments: Hexastylis_naniflora_1993_Lake_Saranac.pdf
Hexastylis_naniflora_1993_Peters_Creek_HP.pdf
Importance: High

Rebekah,

Scanned copies attached. We have about ½ bankers box full of files dating back to the 1970s at least on this species. Some of it is pretty dated, but let me know if you come across something else that seems relevant to current efforts.

Cheers,
Herrick

Herrick Brown - Assistant Botanist
SC Dept. of Natural Resources
Heritage Trust Program
P. O. Box 167, Columbia, SC 29202
1000 Assembly St., Columbia, SC 29201
office: 803-734-4320 fax: 803-734-9200
BrownH@dnr.sc.gov

DNR protects and manages South Carolina's natural resources by making wise and balanced decisions for the benefit of the state's natural resources and its people. Find out more about DNR at www.dnr.sc.gov

---

From: Reid, Rebekah [mailto:rebekah_reid@fws.gov]
Sent: Friday, June 07, 2019 1:03 PM
To: Herrick Brown <BrownH@dnr.sc.gov>
Subject: Re: [EXTERNAL] RE: Looking for Report

Yay! I'll take the other report you have, as well.

Thanks.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville, NC 28801
phone: 828-258-3939 x42238
cell: 828-782-0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Fri, Jun 7, 2019 at 1:02 PM Herrick Brown <BrownH@dnr.sc.gov> wrote:

> Hi Rebekah,
>
> I think I've found it. Are you only interested in this one? I found another report for populations around Lake Saranac also dated 1993.
>
> Herrick
>
> ---
>
> **From:** Reid, Rebekah [mailto:rebekah_reid@fws.gov]
> **Sent:** Friday, June 07, 2019 11:10 AM
> **To:** Herrick Brown <BrownH@dnr.sc.gov>
> **Subject:** Re: [EXTERNAL] RE: Looking for Report
>
> Hi Herrick,
>
> Any luck with this?
>
> Thanks!
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
> 160 Zillicoa St.
> Asheville, NC 28801
> phone: 828-258-3939 x42238
> cell: 828-782-0090
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***
>
> On Fri, May 31, 2019 at 9:20 AM Herrick Brown <BrownH@dnr.sc.gov> wrote:
>
> > We should have that. Let me look around, this might take a little leg work. More soon…
> > Herrick
> >
> > ---
> >
> > **From:** Reid, Rebekah [mailto:rebekah_reid@fws.gov]
> > **Sent:** Friday, May 31, 2019 9:17 AM
> > **To:** Herrick Brown <BrownH@dnr.sc.gov>
> > **Subject:** Looking for Report

> Hi Herrick,
>
> I'm trying to track down a report from 1993 - Newberry, G. 1993. Progress Report on Monitoring Studies of Hexastylis naniflora. Unpublished.
>
> Monitoring was conducted at Peter's Creek Heritage Preserve. Do you all have a copy?
>
> Thanks.
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
> 160 Zillicoa St.
> Asheville, NC 28801
> phone: 828-258-3939 x238
> cell: 828-782-0090
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***
>
> EXTERNAL EMAIL: Do not click any links or open any attachments unless you trust the sender and know the content is safe.

EXTERNAL EMAIL: Do not click any links or open any attachments unless you trust the sender and know the content is safe.

EXTERNAL EMAIL: Do not click any links or open any attachments unless you trust the sender and know the content is safe.

Report of monitoring of Lake Saranac Population
of Hexastylis naniflora,
Fall, 1993

GENERAL OBSERVATIONS:

Hexastylis naniflora, an evergreen perennial with slow growth rate and apparent longevity, blooms from mid-February to the beginning of June. Plants may die back when disturbed but regenerate from underground rhizomes the following spring. Although populations are more numerous on the mid-portions of north facing slopes, the most vigorous growth and perfuse flowering occurs in well hydrated soils with a protected litter layer.

Although this study has divided the study population into upper slope, mid-slope, and basal populations, in the Saranac Lake area Hexastylis naniflora dominates the mid-slope. Hexastylis is not found at the very upper reaches of the slope, in dry more open woods where Vaccinium vacillans is common. It is restricted to the more mesic portions of the slope where shade and litter provide more moisture.

Associated species include Kalmia latiflora, Fagus grandiflora, Quercus alba, Ilex opaca, Carya pallida, Calacanthus floridus, Sassafras albidum, and Corylus cornuta.

STUDY PARAMETERS

The 777 Hexastylis naniflora plants in the Saranac Lake Population were labeled with numbered white plastic flags and numbered metal tags. All visible plants were tagged. During the first week of April from 1990 through the spring of 1993 all tagged plants were relocated and the number of leaves and flowers present were recorded. In July of 1993 in an effort to evaluate actual survival rates, all labeled plants were revisited. 756 of the original 777 plants were relocated (97.3% survival rate) (Table #1). The major plant losses were in the floodplain and on the upper portions of the north facing slope. Heavy rains during the Spring and Fall of '91 eroded the stream bank resulting in the loss of 6 plants. The loss of plants from the upper slope was due to tree falls and was concentrated around a dying Ilex opaca and a fallen Quercus.

TABLE #1 % SURVIVAL

ASPECT	#OF PLANTS		%SURVIVAL
	1990	1993	
Floodplain	86	81	94.2
Base of slope	74	74	100.0
Lower 1/3 of slope	195	192	98.5
Mid-slope	241	235	97.5
Upper 1/3 of slope	181	173	95.5
TOTAL	777	756	97.3

Over the 4 year sampling period the flowering percentage for the population as a whole was 72.4% (Table 2). The floodplain portion of the population consistently produced the largest percentage of plants in flower. A good supply of water throughout the spring of 92 may have contributed to the increased flowering that year.

TABLE #2 FLOWERING PERCENTAGE

ASPECT	% FLOWERING			
	1990	1991	1992	1993
Floodplain	82.6	88.1	79.0	90.1
Base of slope	55.4	67.1	63.5	68.9
Lower 1/3 of slope	73.3	69.2	78.1	70.8
Mid-slope	65.6	67.3	73.2	71.1
Upper 1/3 of slope	54.1	67.2	73.4	65.7
TOTAL	70.0	70.3	75.5	72.3

All segments of the populations showed an increase in average numbers of leaves/plant. (Table #3). The increase in size of the leaf rosettes is slow with the largest clumps and more rapid growth occurring in the floodplain portion of the population. The wide variation is to be expected in a population containing a wide range of clump sizes.

TABLE #3: COMPARISON OF 90, 91, 92, 93 DATA ON #OF LEAVES/PLANT

ASPECT	1990	1991	1992	1993
Floodplain	8.14 ± 10.2	9.47 ± 13.67	9.92 ± 12.47	11.74 ± 12.91
Base of slope	2.91 ± 2.31	3.34 ± 2.44	3.24 ± 2.58	4.19 ± 4.05
Lower 1/3 of slope	3.54 ± 3.53	3.91 ± 4.04	4.92 ± 5.98	5.33 ± 6.60
Mid-slope	3.04 ± 2.87	3.09 ± 2.84	3.94 ± 3.21	4.05 ± 3.92
Upper 1/3 of slope	3.64 ± 41.4	4.04 ± 5.72	4.91 ± 4.36	4.34 ± 4.13

In the population as a whole during this 3 year sampling period 54.1 percent of the plants increased the number of leaves per plant. This

increase was seen throughout the population. However, slightly larger percentages were noted in the floodplain (68% increased in size) and at the base of the slope (58.1% increased in size. (Table * 4)

TABLE * 4: COMPARISON OF 1990 AND 1993 DATA ON *LEAVES/PLANT

ASPECT	%INCREASED	% SAME	% DECREASED
Floodplain	64.2	13.6	22.2
Base of slope	58.1	23.0	18.9
Lower 1/3 of slope	53.6	26.6	19.8
Mid-slope	49.8	30.2	20.0
Upper 1/3 of slope	54.4	21.1	24.5

Plants were grouped into the following size classes: 1-2 leaves/plant, 3-5 leaves/plant, 6-10 leaves/plant, 11-15 leaves/plant, 16-20 leaves/plant, and clumps greater than 20 leaves. The larger plants (those with more than 16 leaves) were more common to the floodplain. Twenty-eight point six (28.6%) percent of all plants found here were in this class and these 24 plants accounted for 42.9 percent of all plants found in this size class. The lower, mid and upper slopes each had 6 plants in this category and the base slope population contained only 3 plants with 16 or more leaves.

Plants with only one or two leaves made up only 17.3% of the floodplain specimens (14 plants) but 45.5% (107 plants) of the mid-slope plants. On the upper 1/3 of the slope 39.3% (68 plants) had two leaves or less while at the base of the slope 39.2% (29 plants) of the plants were in this size class. Thirty-six point five percent (70 plants) of the lower 1/3 plants grouping were in this size class. Plants in the 3-5 leaf/clump class were most abundant at the base of the slope where 40.5% of the plants fell into this size class.

When one looks at clumps that have five or fewer leaves the difference between floodplain and slope populations is even more pronounced. Only 39.5% (32 plants) of the floodplain plants fell within these two groups compared with 79.7% (59 plants) of the slope base plants, 68.8%(132 plants) in the lower 1/3, 79.5% (187 plants) of the mid-slope plants, and 75.7% (131 plants) of the uppers slope plants contained 5 or fewer leaves.

Plants with 6-10 leaves/clump were most common in the floodplain where 28.9% of the plants fell in this size range. At all other locations plants with 6 to 10 leaves made up less than 20% of the population (Table 5). Plants having between 11 to 15 leaves were not abundant anywhere in the population. Only 31 plants of the 777 plants in the

study fell into this category. Fifteen of these were located on the lower 1/3 of the slope but accounted for only 7.8% of the population tagged here.

TABLE # 5: NUMBER OF PLANTS AND PERCENTAGE OF POPULATION IN EACH SIZE CLASS

ASPECT	1-2 LEAVES	3-5 LEAVES	6-10 LEAVES	11-15 LEAVES	16-20 LEAVES	>20 LEAVES
Floodplain	14(17.3%)	18(22.2%)	23(28.4%)	2(02.5%)	11(13.5%)	13(16.1%)
Base of slope	29(39.2%)	30(40.5%)	12(16.2%)	0(00.0%)	2(02.7%)	1(01.4%)
Lower 1/3	70(36.5%)	62(32.3%)	38(19.8%)	15(07.8%)	2(01.0%)	5(02.6%)
Mid-slope	107(45.5%)	80(34.0%)	33(14.0%)	9(03.8%)	4(01.8%)	2(00.9%)
Upper 1/3	68(39.3%)	63(36.5%)	31(17.9%)	5(02.9%)	4(02.3%)	2(01.2%)

The vigor of the Hexastylis plants in the floodplain is probably due to the greater availability of moisture. Seeps are located throughout this floodplain providing soil moisture throughout the year. Runoff slows in the floodplain resulting in an increase in depth of hydration during rains. Decreased winds and increased litter layers in this lowlying area reduce evaporation pressure and contribute to the retention of water.

The soil on the north facing slope is shallow and rocky. Any litter layer that collects occurs around fallen limbs and in the lee of rocks. The slope is also swept by winds that come off Lake Saranac to the west. The base of the slope and the floodplain are in the lee of the dam which forms the lake. In contrast the soil in the floodplain is black loam with a well developed litter layer. These edaphic factors result in a more nutrient rich environment for the floodplain plants

The data for number of flowers/plant and percentage of plants that increased flowers production corresponds with the leaf data. The larger plants in the floodplain produced more flowers. The more favorable water and nutrient availability in the floodplain also contributed to the increase in percentage of plants in flower. The overall increase in flower production reflects the aging of the population as a whole.

TABLE #7: COMPARISON OF 90, 91, 92, 93 DATA ON # OF FLOWERS/PLANT

ASPECT	1990	1991	1992	1993
Floodplain	6.87 ± 8.15	7.41 ± 7.41	8.00 ± 10.43	8.20 ± 8.90
Base of slope	2.12 ± 1.48	2.41 ± 1.41	2.66 ± 2.70	2.71 ± 3.13
Lower 1/3 of slop	3.01 ± 3.31	2.93 ± 2.99	3.42 ± 4.06	3.77 ± 4.90
Mid-slope	2.18 ± 1.82	2.39 ± 2.19	2.88 ± 2.42	2.46 ± 2.30
Upper 1/3 of slope	3.11 + 3.17	3.47 + 3.94	3.49 + 3.47	2.80 + 2.30

TABLE #8: COMPARISON OF 1990 AND 1993 DATA ON # OF FLOWERS/PLANT

ASPECT	% INCREASED	% SAME	% DECREASED
Floodplain	57.6	10.6	30.8
Base of slope	45.9	33.8	20.3
Lower 1/3 of slope	39.0	37.4	23.6
Mid-slope	37.4	39.4	23.2
Upper 1/3 of slope	37.0	34.8	28.2

TRANSPLANTS:

In the spring of 1991, 103 plants were transplanted from a slope heavily impacted by dam repair. Each plant was removed with a trowel, placed with the surrounding dirt in a numbered plastic bag. The bag was tied to prevent the roots from drying. After the flowers and flower buds were removed the plants were replanted in the same ecological aspect on the eastern portion of the slope away from the construction site. The plants were labeled with numbered yellow plastic flags at the time of replanting. All but 8 of these plants were still present in the spring of 1993 (92.2% survival rate). Forty-two percent of these plants flowered in 1993 compared with only thirty-five plants (34.3%) in 1992 and 32 (31.4%) in 1991. Transplanting appears to be a viable option which could be used to preserve endangered populations of Hexastylis naniflora. Care should be taken to prevent the roots from drying and removal of the flowers promotes vegetational growth.

BUDGET

SALARY

5 days at $200.00/day..... 1,000.00

Peter's Creek Dwarf-flowered Heartleaf Site

LOCATION: Spartanburg County, Pacolet 7.5' topo quad: north of US Highway 29 and east of Plainview Drive, just east of Saranac Lake Subdivision, at the east edge of the City of Spartanburg.

AREA: Approximately 150 acres make up the Peter's Creek site. The whole population including the Mineral Springs Creek populations comprises approximately 300 acres.

DESCRIPTION AND SIGNIFICANCE: Peter's Creek and its tributary, Mineral Springs Creek, are sandy bottom streams draining eastward into the Pacolet River just north of the town of Converse in Spartanburg County. Their steep, mesic, north-facing slopes are very well shaded by upland hardwoods, principally, Quercus alba, Q. rubra, Q. marilandica, Carya pallida, C. tomentosa, and, towards the base of the slope, by Fagus grandifolia, and Liriodendron tulipifera. The sparse shrub layer is dominated by Ilex opaca, Kalmia latifolia, Calycanthus floridus, Carpinus caroliniana and Asimina parviflora. Notable in the shrub layer on the upper slopes of Peter's Creek is a small population (circa 25 shoots) of Nestronia umbellula, a federal candidate plant species. Small trees which are well dispersed in the understory include Cornus florida, Amelanchier arborea, Sassafras albidum, and Oxydendrum arboreum. The sparseness of the understory gives the north-facing bluffs a very park-like aspect, particularly along the Mineral Springs Branch.

Although this Oak-Hickory community type is quite common in the Piedmont, very few unaltered examples remain (Nelson, 1986). The restriction of pine to the very edges of the forest and the lack of aggressive, weedy, exotic species attest to the lack of disturbance along these two sheltered ravines.

The most significant conservation consideration of Peter's Creek and Mineral Springs Creek is the 6,000 clumps of Hexastylis naniflora, dwarf-flowered heartleaf, along the north-facing slopes (2,500 in Hull's Woods, 1000 in Ponderosa Gardens, and 2,500 along Peter's Creek west of junction with Mineral Springs Creek (Newberry, 1991). In 1989, this species was listed by the US Fish and Wildlife Service (USF&WS) as a "threatened" species under the authority of the 1973 Endangered Species Act (Federal Register, 1989). An endemic to the Piedmont region of the Carolinas (Radford, and others, 1968), only 24 extant populations as defined by the USF&WS have been documented for this species (Federal Register, 1989). Extensive field searches by the North Carolina and South Carolina Heritage Programs and other local professional botanists indicate that many of these sites have been completely or seriously degraded (Powell, 1990), (Hill, 1992), and (Rayner, 1992). The construction of small ponds, introduction of cattle, road construction and flooding of streams have significantly reduced potential habitat or destroyed whole sites. The populations of Hexastylis naniflora in the Peter's Creek-Mineral Springs Creek

drainage represent the largest population known from South Carolina. The proposed acquisition project to protect the north-facing bluff of Peter's Creek, coupled with conservation easements along Mineral Springs Creek, would effectively insure the long term conservation of this species.

SURROUNDING LAND USE: Saranac Lake Subdivision west of the site and the Ponderosa Gardens Subdivision south of the site are the two main residential areas impending on the site. Both have been developed for over 20 years. Recent tree cutting on the north side of Peter's Creek has not affected the site. Currently the Spartanburg Conservation Endowment (S.P.A.C.E.) has acquired one conservation easement protection circa 1,000 plants and is beginning negotiations on a second easement which will protect an additional 1,000 clumps.

Given the steep topography and the personal and professional interest of Dr. Gillian Newberry, the biological integrity of both sites can be maintained even though the area is confined by the residential development of the city of Spartanburg. The Peter's Creek ravine population may be unique due to the presence of dense stands of dwarf pawpaw (Asimina parviflora) dominating the Ponderosa Gardens site. These pawpaw thickets and dense stands of mountain laurel found on all other slopes are very effective impediments to human foot traffic and will help insure the protection of these slopes in an otherwise urban environment. Finally, the stream corridor itself is free of intensive use except at Saranac Lake upstream of the Mineral Springs Creek population.

THREATS: The only disturbance to the area is a bike trail which cuts along the top of the north facing slopes along Peter's Creek and criss-crosses in the floodplain. Trails also cut down the north- facing slopes just west of Ponderosa Gardens. However, most slopes are too steep and rocky for such traffic.

Horses have access to the creek on Dr. D.C. Hull's property; S.P.A.C.E. is currently negotiating with Dr. Hull to place an easement on this Mineral Springs Creek Population.

MANAGEMENT NEEDS: A minimum buffer is needed for this site. The steep slopes and holly spines serve as a deterrent.

CONCLUSIONS: The ravine bluffs and bottoms of Peter's Creek and Mineral Springs Creek harbor the most significant population of the threatened dwarf-flowered heartleaf anywhere in its range. An additional small population of Nestronia is also significant. The surrounding mesic hardwood ravines are relatively undisturbed and are continuous with the floodplains of the Pacolet River, thus affording protection of this habitat in an otherwise suburban environment. The conservation easements already in place will serve as a platform for additional protection efforts for these rare species and their habitats.

ELEMENTS OF CONCERN

Element	SRANK	GRANK	STATUS
Hexastylis naniflora dwarf-flowered heartleaf	S2	G2G3	FT
Nestronia umbellula nestronia	S2	G3G4	CU
Oak-Hickory forest	S5	G5	
Mesic Mixed Hardwood	S4	G5	

Gillian Newberry, PhD
Professor of Biology
USC-Spartanburg

Albert Pittman, PhD
Botanist, Nongame
& Heritage Trust

February 4, 1993

LITERATURE CITED

Hill, S. 1992. Unpublished Data. Clemson University Herbarium.

Newberry, G. 1991. Progress Report on Monitoring Studies of Hexastylis naniflora. Report submitted to S. C. Wildlife and Marine Resources Department.

Nelson, J. 1986. The Natural Communities of South Carolina . South Carolina Wildlife and Marine Resources Department, Columbia, SC.

Federal Register, 1989. Threatened Status of Hexastylis naniflora (Dwarf-flowered Heartleaf). Vol. 54, No. 71.

Powell, R. 1990. Personal communication. Converse College, Spartanburg, S.C.

Radford, A., H. Ahles, and C. Bell, 1968. Manual of the Vascular Flora of the Carolinas, UNC Press, Chapel Hill.

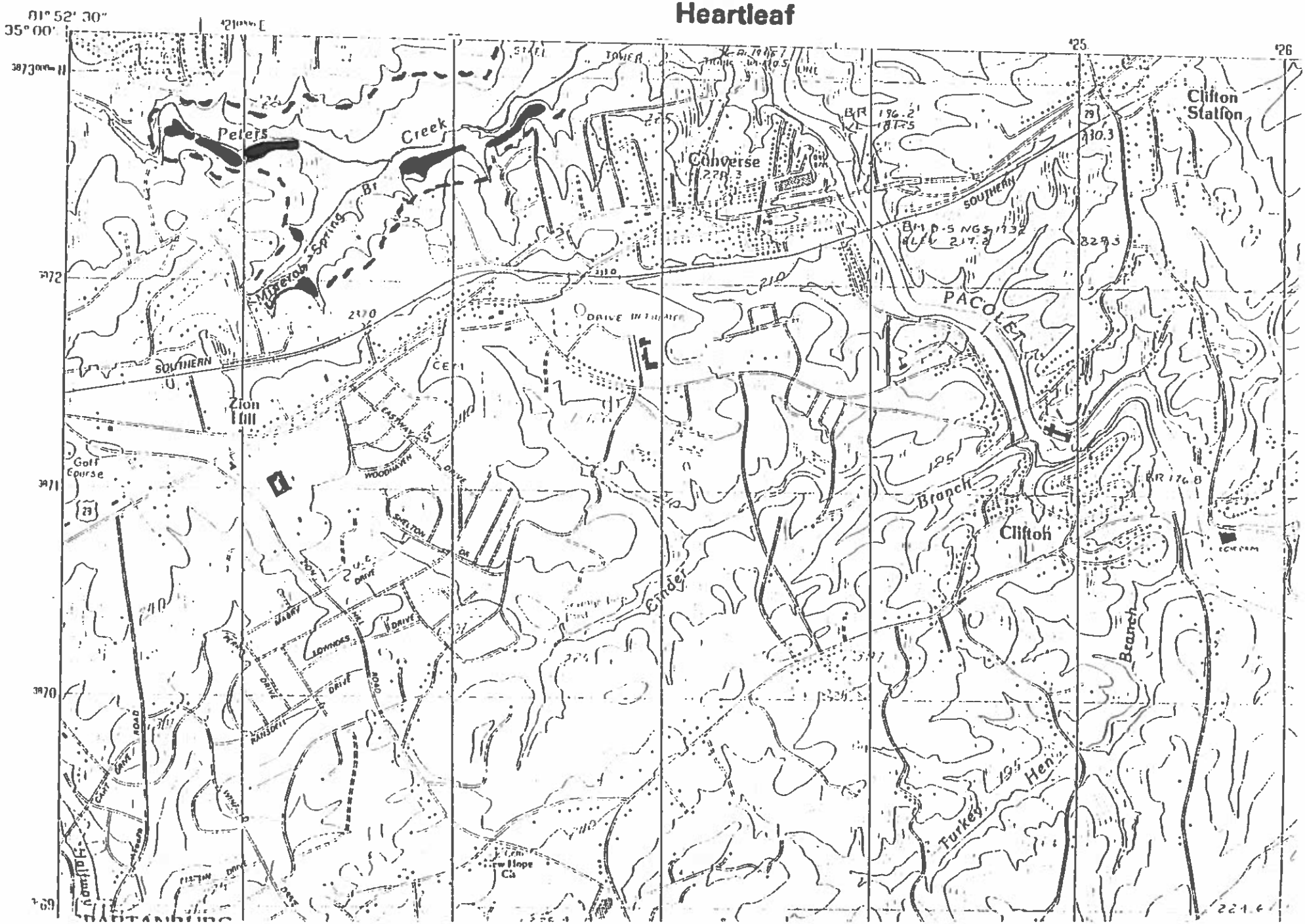
Rayner, D. 1992. Unpublished Data. Wofford College, Biology Dept.

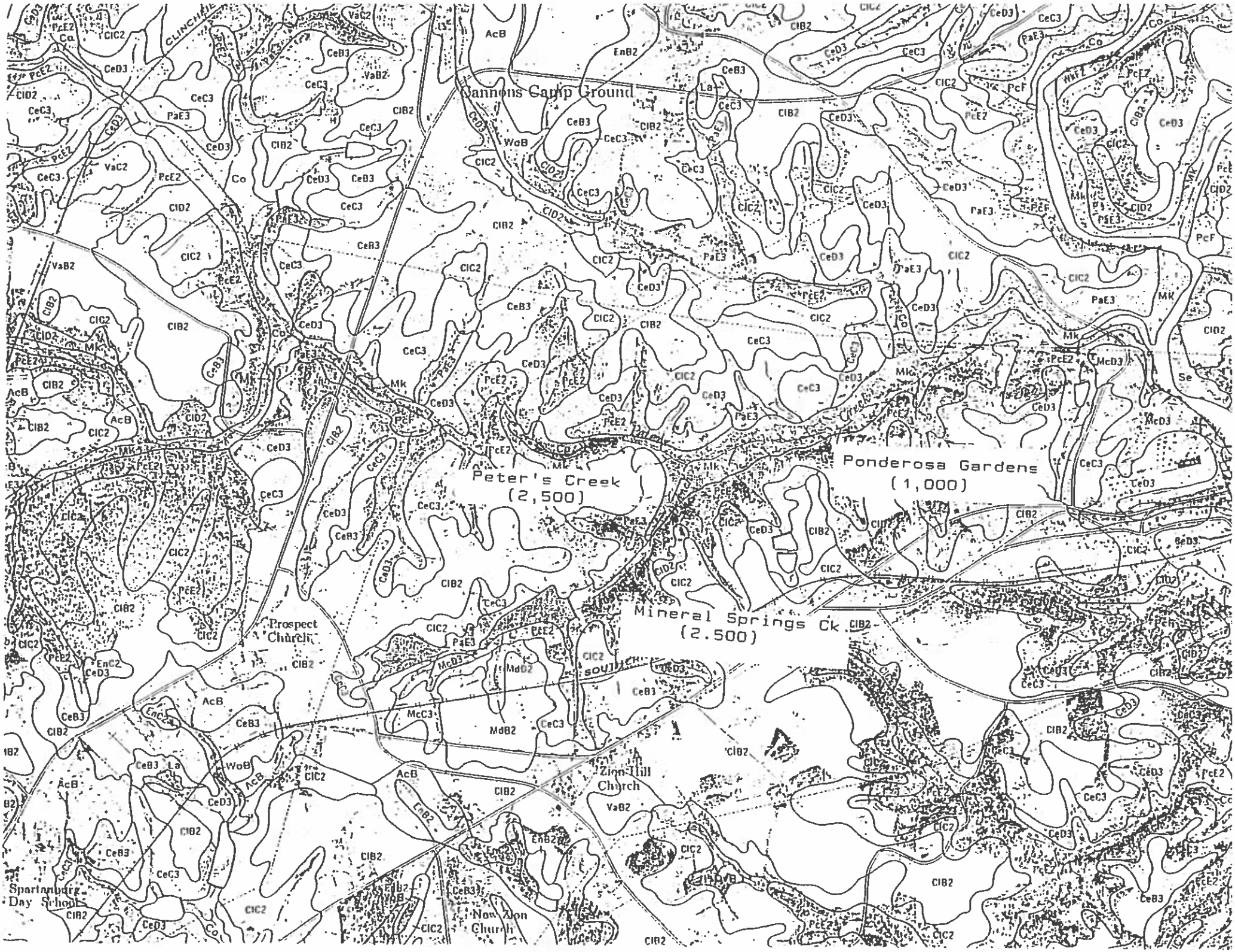
Sutter, R. 1988. Unpublished Data. State of North Carolina Department of Agriculture - Plant Protection Section.

O R T H C A R O L I N A
RUTHERFORD COUNTY
CHEROKEE COUNTY
SPARTANBURG COUNTY
N
SPARTANBURG
WELLFORD
DUNCAN
COWPENS
PACOLET MILLS
CENTRAL PACOLET
PACOLET
01
04

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

County: Spartanburg
Quad: PACOLET 7.5
Site: Peter's Creek Dwarf-flowered Heartleaf




Cannons Camp Ground
Peter's Creek
(2,500)
Ponderosa Gardens
(1,000)
Mineral Springs Ck.
(2,500)
Prospect Church
Zion Hill Church
New Zion Church
Spartanburg Day Schools

SITE SUMMARIES FOR HEXASTYLIS NANIFLORA IN SOUTH CAROLINA

COUNTY	LOCATION	IDENTIFIED BY	OLD ESTIMATE OF POPULATION	1992 ESTIMATE OF POPULATION	COMMENTS
Spart. 1	Alverson Grove	Rayner, 1991	74	-	New Alverson Grove Church in in west flowing stream flat
Spart. 2	Arrowwood	Rayner, 1991	13	-	7300 ft. due east of Brooklyn near Rutherford Co. Line, streamside of Arrowwood Branch
Spart. 3	Branch Creek	Rayner, 1991	303	-	1800 ft. NE of jct. of SR-208 & SR-183, N slopes and stream edge
Spart. 4	Camp Mary Elizabeth	Newberry, 1990	100	100	Verbal protection by Girl Scout Camp, on NW slope above Holston Ck, S end of camp
Spart. 5	Chinquapin Ck. City of Spart.	Johnson, 1981*	2	2	Banks of Chinquapin Ck, E of Jct of Magness and Crockett Sts., Spart.
Spart. 6	Christopher	Rayner, 1991	500	-	1.55 mi. due E 5 S From Center of Landrum, flats about seepage bog
Spart. 7	Fairview Farms	Pierce, 1970*	75	75	Cattle impacting population, site ravine east of Fairview Farms Rd. 2 small populations
Spart. 8	Glenwood City of Spart.	Powell, 1990	50	?	Some plants still there overgrown with poison ivy. At stream edge near Jct. of Elmwood & Hawthorne
Spart. 9	Hull woods	McMilian, Voyles, 1967*	700	2500	Slope with 1000 plants protected with easement with SPACE, E of Saranac L. dam on N facing slope
Spart. 10	Harris	Rayner, 1992	56	-	1.35 miles NW of Fairview Church in Little Africa NE bluff of Bear Ck
Spart. 11	Ingleside Seeps and Bluff	Rayner, 1991	1,000 +	-	3800 ft. NW from jct. SR-209 & US 176 in Ingleside along unnamed branch of Spivey Creek. SPACE will seek easement.
Spart. 12	Ingleside #4	Rayner, 1991	66	-	1 mi. WSW from Jct of SR-209 & US 176 in Ingleside, N-NW bluff
Spart. 13	Ingleside #5	Rayner, 1991	221	-	0.6 mi. W 5 S from jct. SR-209 & US 176 in Inglesides,lower slopes N facing bluff above unnamed branch of Branch Creek
Spart. 14	Lake Blalock	Gaddy, 1980*	1,454	1,500	Fishing trails, and raising of lake level threaten population, on bluffs S side of lake and along Buck Creek
Spart. 15	Lake Bowen	Newberry, 1990	10	circa 20	North of Fagan road, opposite Green property, N facing bluff
Spart. 16	Little Buck Ck.	Biggs, Newberry, 1990	10-50	same	Close to Blalock population, N of Ridings Rd and E of Burnett Rd. on N facing slope and river edge
Spart. 17	Lyman Lake	Rollins, Newberry 1990	50-100	same	2 small clusters along Tyger R. tributary S of Spenser Rd.
Spart. 18	Metlow Creek	Rollins, Newberry,1990	50-100	same	West edge of Metlow Ck NE of Metlow Ck. Road

Spart. 19	Page Creek	Rayner,1991	155	-	At Landrum High School
Spart. 20	Peter's Creek	Newberry,1991	2500	2500	In 3 pop along creek, N facing slope W of Mineral Spring Creek
Spart. 21	Ponderosa Gardens Sub.	Newberry, 1992	1000	-	North facing slope on Mineral Springs Creek 2 mi E of lake
Spart. 22	Raintree Subdivision	Newberry, 1988	700	700	Environmental Easment with Nature Conservancy protects site in floodplain west edge of City of Spartanburg
Spart. 23	Rayner #12	Rayner, 1991	51-100	-	Just NE of Jct of High Farm Rd and SC 14, in seeps an on slope steam stream
Spart. 24	Rayner #15	Rayner, 1991	8	-	0.1 mi. NE from jct. of SC 14 & SR-340 on both sides of 340. seepage stream
Spart. 25	S. Pacolet River	Rayner, 1991	198	-	.25 mi due E from Jct. of SC 14 & South Pacolet River with Rhododendron maximum
Spart. 26	USCS	Newberry, 1989	25	25	Verbal protection with USCS, nature trail on campus,floodplain
Chrk. 1	NE Cowpens Battleground	Hill, 1989	-	125	8.7 mi. NW of Gaffnee, S side highway ll, floodplain
Chrk. 2	Cowpens Battleground	Newberry, 1990	175	175	3 populations, Creek base of Picnic ground slope largest with 100 clumps
Chrk. 3	McKee Drive	Hill, 1989	-	20	Atypical, slope back of 184 Mc-Kee Dr., T. Kiser owner
Chrk. 4	Type locality	Ahles, 1956*	150	200	Surveying in area north of Hwy 11 impacting 1/3 of population, but both sides of highway in ravine, 5.45 NW of RT. 85
Gnv. 1	Beaverdam Ck.	Rayner,1981*	-	150	Many large clumps on hummock SE of Jct of SC 903 & SC 290 tributary of Beaverdam Ck.
Gnv. 2	Beaverdam Ck. West	Rayner, 1981*	-	75-100	Hummocks, cattle have access to site, 800 Ft. S of Jct of S-173 & S-263
Gnv. 3	Blue Ridge Rd.	Rayner, 1981*	-	150-200	Development on west side & run-off from Blue Ridge road are impacting population on N edge of road in east most tributary of Enoree River
Gnv. 4	Gowensville	Rayner, 1991	168	-	2100 ft. NW of Jct of Hwy 11 & 14 N and NW slopes of intermittent stream
Gnv. 5	Jackson Grove	Vernon, 1964*			Could not relocate
Gnv. 6	Mark Hall Farms (north of	Newberry powerlines)	1	1	1 sq. foot patch In Heritage Trust Preserve
Gnv. 7	Mark Hall Farms S of Power line	Rayner, 1981*	-	25	In Heritage Trust Preserve
Gnv. 8	Gowensville	Freeman, 1956*	50	150	Stream flat of tributary of Tyger R. west edge of US 14 1.5 mi S of Gowensville

* Information from Sutter, 1988

Conservation of Hexastylis naniflora in South Carolina

32 Sites ≤ 500 individual clumps..... (84%)

4 Formal Protection

3 Informal Protection

25 No Protection

38 Total Number of Sites

6 Sites > 500 individual clumps..... (16%)

2 Formal Protection

1 Informal Protection

3 No Protection

From: Hamilton, Byron
To: Peeples, Gary
Cc: Reid, Rebekah N
Subject: Re: Heartleaf rule
Date: Wednesday, July 3, 2019 9:18:39 AM
Attachments: Dwarf flowered heartleaf to SOL 20190610_SOL20190702.docx
Importance: High

I've attached the updated document.

On Wed, Jul 3, 2019 at 8:46 AM Peeples, Gary <gary_peeples@fws.gov> wrote:

> Greetings Byron,
>
> This week is a little tight for us - between the holiday and some other deadlines. Does the solicitor have new comments? I didn't see any in the document.
>
> -Gary
>
> On Wed, Jul 3, 2019 at 8:27 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
>
> > Good morning,
> >
> > Are you available to answer some solicitor comments for the heartleaf today?
> >
> > On Tue, Jun 25, 2019 at 6:53 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> >
> > > Awesome, thanks!
> > >
> > > On Mon, Jun 24, 2019 at 3:21 PM Gary Peeples <gary_peeples@fws.gov> wrote:
> > >
> > > > Hey Byron,
> > > >
> > > > I'm on AL right now, but I can tell you external affairs has the outreach package and I think they may have completed their surname.
> > > >
> > > > Sent from my iPhone
> > > >
> > > > On Jun 24, 2019, at 1:46 PM, Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> > > >
> > > > > Good afternoon
> > > > >
> > > > > Could you send me a copy of the press release for the heartleaf?
> > > > >
> > > > > On Thu, Jun 20, 2019 at 8:10 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> > > > >
> > > > > > Awesome, thanks!
> > > > > >
> > > > > > On Thu, Jun 20, 2019 at 8:08 AM Peeples, Gary <gary_peeples@fws.gov> wrote:
> > > > > >
> > > > > > > Hey Byron,
> > > > > > >
> > > > > > > Here's our stakeholder list for the heartleaf: https://docs.google.com/spreadsheets/d/1JYzoXLeDthEgnTXbw8i0z5P-aiWdWSRIYIgHU7l46M4/edit#gid=1710077126

We'd say those on the "federal" tab are affected, those on all the other tabs are interested.

-Gary

On Wed, Jun 19, 2019 at 9:21 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good morning
>
> I'm filling out the RIN application for the dwarf-flowered heartleaf. I need to know:
>
> > **B. What populations, groups, Indian tribes, States/regions, or organizations may be affected by this rule, and how?**
> >
> > **B. What populations, groups, Indian tribes, States/regions, or organizations may be interested in this rule, and why?**
> >
> > Thanks in advance!
>
> On Thu, Jun 6, 2019 at 12:53 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
>
> > Thanks!!!!
> >
> > On Thu, Jun 6, 2019 at 12:46 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> >
> > > Yes, I see "view only". I requested access to edit. Maybe that's the issue.
> > >
> > > On Thu, Jun 6, 2019 at 12:44 PM Peeples, Gary <gary_peeples@fws.gov> wrote:
> > >
> > > > Hey Byron,
> > > >
> > > > We're seeing the edits when we open on our end. When you look at the document, in the upper right corner is it set for "viewing" or "editing"?
> > > >
> > > > -Gary
> > > >
> > > >
> > > >
> > > > On Thu, Jun 6, 2019 at 12:33 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> > > >
> > > > > Hello Rebekah
> > > > >
> > > > > Can you send me the version of the rule with the tracked changes? The google docs version that I have looks clean with no edits. Thanks.
> > > > >
> > > > > On Fri, May 31, 2019 at 3:35 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
> > > > >
> > > > > > Byron,

Gary and I have added our suggested changes in the following Google Doc: https://docs.google.com/document/d/1BLY2KusGjbPIPIRkFE-e3prAW2ttpL_HpMpO4EStFNg/edit?usp=sharing If additional information is needed, I suggest we have a conference call to work out the final details.

Some of the language in the proposed rule was cut-and-paste from an older version of the SSA. I changed it where I noticed but you should go back through and make sure all info is updated as well. I sent you an updated version of the SSA on Aug 1, 2018. Since August, we did find on error on one map and in reviewing the solicitor comments, we realized there was (b)(5) DPP(b)(5) DPP(b)(5) DPP In the attached version of the SSA the map has been corrected and the discussion of invasives has been added.

I realize you will also need the PDM. I have that finished, I'm just waiting on one minor bit of info and then I'll send that to you.

Thanks.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville, NC 28801
phone: 828-258-3939 x238
cell: 828-782-0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Wed, May 15, 2019 at 6:30 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good morning Rebekah
>
> This is the opportunity. You can address the comments when you get back to the FO.
>
> On Tue, May 14, 2019 at 8:45 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
>
> > Also, will we (Asheville FO) be given the opportunity to provide official comments on the proposed rule? Or, is this our opportunity?
> >
> > Thanks.
> >
> > Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville, NC 28801
phone: 828-258-3939 x238
cell: 828-782-0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Mon, May 13, 2019 at 5:28 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Hey Byron,
>
> There are quite a few comments. Can you narrow it down? Which comments are you having trouble with?
>
> I'm at NCTC this week without all of my files. I'll be back next week and can take a more thorough look at it then.
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
> 160 Zillicoa St.
> Asheville, NC 28801
> phone: 828-258-3939 x238
> cell: 828-782-0090
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***

On Fri, May 10, 2019 at 8:22 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> > Hi Rebekah,
> >
> > Can you take a look at Mike Stevens comments and give me some feedback? I have to get this to HQ by June. Thanks!
> > --
> > **Byron Hamilton, Sr.**
> > **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> > **U.S. Fish & Wildlife Service**
> > **1875 Century Blvd.**
> > **Atlanta, GA 30345**

Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
office 828/258-3939, ext. 234
fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
office 828/258-3939, ext. 42234
fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service

1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
office 828/258-3939, ext. 42234
fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

The Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2018-XXXX; FXES11130900000-189-FF0932000]

RIN

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; availability of draft post-delisting monitoring plan.

SUMMARY: We, the U.S. Fish & Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicates that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened or endangered species under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan. If this proposal is finalized, *Hexastylis naniflora* will be removed from the List.

Deleted: the dwarf-flowered heartleaf

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p m. Eastern Time on the closing date. We must receive requests for public hearings, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES**:** You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2018–XXXX, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rules link to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2018–XXXX; U.S. Fish and Wildlife Service, MS: BPHC, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see *Public Comments*, below, for more information).

Document availability: The proposed rule, draft PDM plan and supporting documents (including the Species Status Assessment (SSA), references cited, five year review) are available at *http://www.regulations.gov* under Docket No. FWS-R4-ES-2018-XXXX.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC

28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. This action proposes to remove the dwarf-flowered heartleaf from the List of Endangered and Threatened Plants in title 50 of the Code of Federal Regulations (50 CFR 17.11(h)). Removing a species from the List ("delisting") can only be completed by issuing a rule.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The determination to delist a species must be based on an analysis of the same factors. In addition, the Act's implementing regulations at 50 CFR 424.11 provide that we may delist a species only if the best scientific and commercial data indicate the species is neither a threatened nor an endangered species for one or more of the following reasons: (1) The species is extinct; (2) the species has recovered and is no longer threatened or endangered; or (3) the original data used at the time the species was classified were in error. We have determined that the dwarf-flowered heartleaf should be proposed for delisting under the Act because, based on an analysis of the five listing factors, it no longer meets the definition of an endangered or threatened species, and that it has recovered.

Deleted: d

(b)(5) DPP & ACP

Peer review:

In accordance with our joint policy on peer review published in the **Federal Register** July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we have sought the expert opinions of seven appropriate specialists regarding the Species Status Assessment Report (SSA), which informed this proposed rule. The purpose of peer review is to ensure our determination is based on scientifically sound data, assumptions, and analyses.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from the public, other concerned governmental agencies (including but not limited to State and Federal agencies and city or county governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information received during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

(1) Information concerning the biology and ecology of the *Hexastylis naniflora*;

(2) Relevant data concerning any threats (or lack thereof) to the *Hexastylis naniflora*, particularly any data on the possible effects of climate change as it relates to habitat, the extent of State protection and management that would be provided to this plant as a delisted species;

(3) Current or planned activities within the geographic range of the *Hexastylis naniflora* that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Deleted: SSA Report

Deleted: that

Deleted: ,

Deleted:

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment – including your personal identifying information – on *http://www.regulations.gov*. You may request, at the top of your document, that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee we will be able to do so.

Comments and materials we receive, as well as supporting documentation used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Service Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Deleted: we

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is a threatened or endangered species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the **Federal Register**. Such requests must be sent to the address shown in the **FOR FURTHER INFORMATION CONTACT** section. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings,

as well as how to obtain reasonable accommodations, in the **Federal Register** at least 15 days before the hearing.

Previous Federal Actions

On April 14, 1989, we published a final rule in the *Federal* Register (FR 54 14964) listing the *Hexastylis naniflora* as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing. A recovery plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf SSA to aid in determining the appropriateness of reclassifying the species.

Background

Hexastylis naniflora is a species of plant endemic to the Upper Piedmont region of western North Carolina and upstate South Carolina. It is a rare, low-growing herbaceous plant in the birthwort family (Aristolochiaceae). Although *Hexastylis naniflora* is restricted in range, it is not as rare as once thought (Service 2010, p. 15; NCNHP 2016, p. 4). When *Hexastylis naniflora* was federally listed in 1989, the listing rule described 24 extant populations (and one extirpated population) distributed across eight counties in the Upper Piedmont of North and South Carolina.. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two states. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Hexastylis naniflora appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This

Deleted: dwarf-flowered heartleaf

Deleted: The dwarf-flowered heartleaf (

Deleted:)

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

Deleted: Dwarf-flowered heartleaf

unique combination of factors limits not only the range of *Hexastylis naniflora*, but also the size of any population.

Hexastylis naniflora occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186-196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, p. 114; Weakley 2015, p. 129; Service 2015, entire), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). Wagner (2013, pp. 30-32) conducted a habitat suitability study to quantify the habitat requirements for *Hexastylis naniflora*, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants. The unit of measurement for population size in this species is a "clump" (rosette).

(b)(5) DPP & ACP

A thorough review of the taxonomy, life history, ecology, and overall viability of the *Hexastylis naniflora* is presented in the SSA (Service 2018, entire; available at https://www fws.gov/southeast/ and at http://www regulations.gov under Docket No. FWS-R4-ES-xxxx-xxxx).

Summary of Biological Status and Threats

The Act directs us to determine whether any species is endangered or threatened by factors affecting its continued existence. The SSA documents the results of our comprehensive biological status review for the *Hexastylis naniflora*, including an assessment of the potential stressors to the species. The SSA does not represent a decision by the Service on whether the species should be proposed for delisting as an endangered or threatened species under the Act. It

Deleted: dwarf-flowered heartleaf

Deleted: Dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

Deleted:

Deleted: dwarf-flowered heartleaf

does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA; the full SSA can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS-R4-ES-201X-XXXX.

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the the conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate individual life-history needs. In the next stage, we assessed the historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We utilized this information to inform our decision in this proposed rule.

Current Condition

Resiliency

Deleted: ¶

For *Hexastylis naniflora*, to maintain viability, its populations, or some portion thereof, must be resilient. Resiliency is assessed at the level of populations and reflects a species' ability to withstand stochastic events (events arising from random factors). Resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates and fecundity (demographic stochasticity), variations in rainfall (environmental stochasticity), and

Deleted: the

Deleted: dwarf-flowered heartleaf

the effects of anthropogenic activities. Stochastic factors that have the potential to affect the *Hexastylis naniflora*, include habitat impacts, particularly human development pressures, but also climate change, and exotic, invasive species. Factors influencing the resiliency of *Hexastylis naniflora*, populations include population size, available habitat, and elements of *Hexastylis naniflora*, ecology that determine whether populations can maximize habitat occupancy.

The Natural Heritage Program (NHP) collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member NHPs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2004, n.p.). Since the Service does not maintain its own database of known locations of *Hexastylis naniflora*, it regards the NHP databases as the best repository for this information (Service 2010, p.41). Based on recent reports using the methods described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple sub-EOs and stand-alone EO records. For the purpose of assessing resiliency, only the 78 populations observed since 2005 were assessed due to the high confidence in their persistence.

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

Deleted: Natural ¶
Heritage Program

Deleted:

Deleted:

Deleted: dwarf-flowered heartleaf

primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Of the 78 populations assessed, 28 had very high resilience, five had high, 26 had moderate, while 19 had low resiliency.

Formatted: Indent: First line: 0.5

(b)(5) DPP & ACP

Deleted: e

Redundancy

Formatted: Font: Italic

Redundancy is also assessed at the species level and reflects a species' ability to withstand catastrophic events (such as a rare destructive natural event or episode involving many populations) by spreading the risk of such an event across multiple, resilient populations. We

measured redundancy for the *Hexastylis naniflora*, by the number and distribution of resilient populations across the range of the species. It is important to note that *Hexastylis naniflora*, has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area.. Redundancy for *Hexastylis naniflora*, is the total number and resiliency of population segments and their distribution across the species range.

We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with devastating effects; however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of *Hexastylis naniflora*, ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010, pp. 7-10). There are 119 populations of *Hexastylis naniflora*, spread across 13 counties. This is an increase from 24 populations across eight states at the time of listing.

(b)(5) DPP & ACP

Representation

We lack genetic and ecological diversity data to characterize representation for *Hexastylis naniflora*. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

Deleted: e

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

Deleted:

Formatted: Font: Italic

Deleted: dwarf-flowered heartleaf

characteristics across the geographical range. However, the *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. Instead, we used the EO Data Standard which provides a Default Separation Distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several *Hexastylis naniflora* populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

Summary of Threats and Conservation Measures that Affect the Species

Section 4(a)(1) of the Act directs us to determine whether any species is an endangered species or a threatened species because of any factors affecting its continued existence due to one or more of the five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future. In the SSA (Service 2018, entire) we discuss the threats affecting the *Hexastylis naniflora*

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: dwarf-flowered heartleaf

The NC Natural Heritage Program assessed threats in populations they monitored from 2012-2016 (Robinson and Padgett 2016, pp. 7-8, 17-20). Threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank (A-G) for each threat factor determined an overall value for each threat observed at each population. Threats observed during these years included development, incompatible forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and road construction. Despite threats observed in many of the populations surveyed, several of the populations appear to be stable during the five-year survey and no significant changes in threats within populations were noted between 2012 and 2016.

Development

Formatted: Indent: First line: 0

Hexastylis naniflora populations occur in rapidly-growing urban areas within expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

Deleted: Dwarf-flowered heartleaf

The most recent 5 year review for the species identified the most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving *Hexastylis naniflora*, as road and bridge improvement projects. Ten of the 27 largest populations

Deleted: dwarf-flowered heartleaf

(containing more than 1,000 rosettes) have been the subject of Section 7 consultations. Collectively, these projects have adversely impacted or were expected to impact approximately 22,135 rosettes. In most cases, the Section 7 process resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection. Significant portions of other populations have been purchased by the NC Department of Transportation (NCDOT) as off-site conservation measures in association with these consultations. Other forms of economic development have also resulted in the destruction or modification of habitats occupied by the *Hexastylis naniflora*; in many cases, these activities have also required Section 7 consultations with the Service. Examples include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities at a regional airport. Collectively, these activities involved the loss or relocation of several thousand rosettes.

Deleted: dwarf-flowered heartleaf

The North Carolina Plant Protection and Conservation Act, N.C. Gen. Stat. § 106-202.12 et seq., lists native plants as threatened, endangered, or species of concern, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. In South Carolina, plants are protected only from disturbance where they occur on those properties owned by the State and specifically managed as South Carolina Heritage Preserves (SC State Code of Regulations Part 123 § 200-204).

The overwhelming majority of *Hexastylis naniflora* populations have been discovered as a direct result of surveys conducted to ensure compliance with the Endangered Species Act. Even more significantly, the majority of sites that have the potential to afford long-term protection to the species have been protected as a direct result of the provisions of Section 7 of

(b)(5) DPP & ACP

Deleted: H naniflora

the ESA, which directs consulting agencies to minimize adverse effects to federally listed species through conservation measures pledged as a part of the project description.

The section 7 consultation process has resulted in avoidance or minimization of adverse impacts, the protection of unaffected portions of *Hexastylis naniflora* populations, and/or monitoring of the species within protected areas. However, while conducting this review the USFWS discovered numerous examples in which conservation measures pledged during prior section 7 consultations had yet to be satisfactorily completed, or for which satisfactory evidence of completion was lacking. The USFWS is actively working to follow-up on commitments previously pledged on behalf of *Hexastylis naniflora*. It is unlikely that any of these sites would have been afforded protection without this statutory protection.

Deleted: H naniflora

Deleted: H naniflora

(b)(5) DPP & ACP

Invasive exotic plant species occur across the range of this species. Plants such as English ivy, Chinese privet, Japanese honeysuckle and Japanese stiltgrass are known at several sites which contain *Hexastylis naniflora*, (Service 2011, p. 15). Invasive, exotic species were identified as a threat at eight of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17-19). The eight populations include four stand-alone EOs and four parent EOs with 19 sub-EOs. Of the four stand-alone EOs, one has an invasive threat rank of B (moderate to severe, imminent threat for a significant portion (20-60%) of the population, occurrences, or area), two have a rank of F (low severity threat for most or significant proportion of population, occurrences, or area), and one has a rank of G (low severity threat for a small proportion of population, occurrences, or area). Of the 19 sub-EOs, nine have invasive, exotic species identified as a threat. Of the nine sub-EOs, one has an invasive threat rank of A (moderate to severe, imminent threat for most (>60%) of population, occurrences, or area), four have a rank of B (moderate to severe, imminent threat for a significant portion (20-60%) of the

Deleted: I

Deleted: dwarf-flowered heartleaf

population, occurrences, or area), two have a rank of E (moderate to severe threat for small proportion of population, occurrences, or area), and two have a rank of G (low severity threat for a small proportion of population, occurrences, or area). The one stand-alone and five sub-EOs with the highest threat ranks (A and B) are located in three populations. Based on the most recent monitoring data, one is increasing, one is stable, and one is decreasing (Robinson and Padgett 2016, p.11).

Invasive exotic species were identified as a threat at all (three) South Carolina populations monitored by NCNHP and all sites had an invasive threat rank of F (low severity threat for most or significant proportion of population, occurrences, or area) (Robinson and Padgett 2016, pp. 20). Based on the most recent monitoring data, all populations are stable (Robinson and Padgett 2016, p.11).

In short, the data indicate that *Hexastylis naniflora* populations can persist and increase in the presence of exotic invasive species. Despite the long-term presence of invasive, exotic plants, from 2012 to 2016 there were no significant changes in the threats facing the plant (NCNHP 2016, p. 8). Additionally, over the many years of Section 7 consultations between the Service and NCDOT, NCDOT has pledged monitoring and/or management for most of the sites it has acquired, as well as some locations where the species is protected within NCDOT rights-of-way (ROW).

Deleted: This

Deleted: s

Deleted: dwarf-flowered heartleaf

(b)(5) DPP & ACP

Deleted: USFWS

(b)(5) DPP & ACP

Climate Change

There is concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Because typical habitats for this species include moist soils adjacent to creeks, streamheads, or along lakes and rivers, and plants have been

observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams, specific effects of climate change to the *Hexastylis naniflora*, are likely related to changes in soil moisture associated with potential increases in drought. Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.) which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p.7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p.7). Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats.. In recent years, the southeast has experienced moderate to severe droughts which many observers have implicated in population declines and poor transplant survivorship (NC NHP, 2010; and references throughout this review). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). Although climate change is likely to affect terrestrial habitats in the Southeast, there is uncertainty about the specific effects of climate change on *Hexastylis naniflora*. Currently, we have no evidence that climate change effects observed to date have had any adverse impact on the species or its habitats, and we are uncertain about how projected future changes in temperature, precipitation, and other factors will influence the species; however, *Hexastylis*

Deleted: dwarf-flowered heartleaf

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: dwarf-flowered heartleaf

naniflora is found in 13 counties, up from eight at listing, and is up to 119 known populations, up from 24 at listing, providing it with significantly increased redundancy in light of future climate changes.

Future Condition

Our analysis of the past, current, and future influences on what the *Hexastylis naniflora* needs for long term viability revealed that there are several influences that may pose risks to future viability of the species. These risks are primarily related to invasive species, climate change, and habitat changes from development. Invasive, exotic plants were identified as a threat at the time of listing. However, in the ensuing years, the number of populations has increased dramatically; the invasive, exotic plant threat posed at many of the largest populations is low (NCNHP, pp. 8, 17-20); and the number of populations under conservation ownership with management has increased. As noted above, there is no evidence climate change has been a factor in species decline, and today the species has such significant redundancy on the landscape (119 populations) and resilience (33 populations of high or very high condition), any species-level negative impacts of climate change would likely not be realized until well into the future. We use projections of urban development to assess potential habitat loss and fragmentation.

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. We have identified 2040 as our foreseeable future based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape (see SSA for

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted:

further explanation). Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040, a time period for which the models would provide reliable data. SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995, entire). The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations
- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There are no data available on the exact relationships between urbanization and the impacts to *Hexastylis naniflora*. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative impacts; development increase of at least 50% was likely to have significant impacts to populations.

Deleted: dwarf-flowered heartleaf

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. This is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider under Current Conditions include detections that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years and the species was present. For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where *Hexastylis naniflora* is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where *Hexastylis naniflora* is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resiliency of that population.

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000 meterbuffer.

The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 meterbuffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 meterbuffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where *Hexastylis naniflora* is likely to persist.

Deleted: dwarf-flowered heartleaf

Status Quo Scenario

Under the status quo scenario, we assume populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no negative impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold

- Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold

High Development Scenario

Under the high development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

- No additional populations are identified as persisting
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
  - Protected areas
    - Protected in perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Voluntary protection/non-perpetuity— population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold
  - Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold; extirpation of populations if % increase in urbanization exceeds >90% threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we assume it is likely several additional populations (i.e. more than status quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resiliency under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resiliency rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold

Future Resiliency

Status Quo Scenario

In the Status Quo scenario, there are predicted to be 75 populations of *Hexastylis naniflora*, on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and two additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated

Formatted: Indent: First line: 0.5 , Line spacing: Double

Deleted: dwarf-flowered heartleaf

populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

High Development Scenario

In the High Development scenario, there are predicted to be 72 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate; two moderate populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the Targeted Conservation scenario, there are predicted to be 79 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and six additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist,

Formatted: Tab stops: 0.69 , Left

Formatted: Font: Not Italic

Deleted: dwarf-flowered heartleaf

Formatted: Font: Not Italic

Deleted: dwarf-flowered heartleaf

but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few populations is offset in the Status Quo and Targeted Conservation scenarios by the persistence of several additional populations. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resiliency in several additional populations. However, in all three scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press catastrophic disturbances; however the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events over the next 20-30 years, such as climate change.

Deleted: dwarf-flowered heartleaf

Based on the assumption that *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current

Deleted: dwarf-flowered heartleaf

populations. Here are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Deleted:

Deleted: h

Table 1 Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	Current	Status Quo	High Development	Targeted Conservation
Very High	28	27	27	27
High	5	6	4	6
Moderate	26	23	25	23
Low	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total	**78**	**75**	**72**	**79**

Determination

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the *Hexastylis naniflora*. Currently, there are a total of 119 known populations in 13 counties, 78 of which have been documented since 2005. This is a significant increase from 24 known populations in eight counties at the time of listing. Of the 78 populations, 75 percent are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend.

Deleted: dwarf-flowered heartleaf

When the *Hexastylis naniflora* was placed on the threatened and endangered species list, the two prominent threats identified were invasive, exotic plants and habitat loss or destruction. A near 400% increase in the number of known populations during a period of minimal, but growing, management suggests the threat of invasive, exotic plants may not be as significant as

Deleted: dwarf-flowered heartleaf

previously thought. Additionally, since listing, several populations have entered into conservation ownership by organizations with management staff (e.g. Broad River Greenway) or commitments of management (e.g. N.C. Department of Transportation). We conclude that the species is currently not in danger of extinction throughout its range.

(b)(5) DPP & ACP

In order to more closely examine the future threat posed by habitat loss or destruction, the Service analyzed three different development scenarios into the future until 2040. Under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (5-6) of currently low resilient populations are projected to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Approximately 30 percent of the 78 currently known populations are permanently protected, and another 25 or so percent are somewhat protected (voluntary agreements or provided some level of protection) reducing the likelihood of development impacting those populations. Recent examination of the species identified climate change as a potential threat. The broadened range (eight counties to thirteen) and significantly increased population numbers (24 to 119) since initial listing indicate the species benefits from sufficient redundancy and resiliency to withstand perturbations from climate change.

Although we did not directly consider the continued risks from urban development (Factor A) and invasive species and climate change (Factor E), in our future conditions scenarios, we analyzed them qualitatively. Based on this analysis, we conclude that the species is not likely to become in danger of extinction in the foreseeable future.

Deleted: Even with

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: is it

We conclude that the *Hexastylis naniflora* does not currently meet the Act's definition of either an endangered or a threatened species throughout its range. We propose removing the *Hexastylis naniflora* from the Federal List of Endangered and Threatened Plants at 50 CFR 17.11(h).

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

(b)(5) DPP & ACP

Determination of Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range (SPR). Where the best available information allows the Services to determine a status for the species rangewide, that determination should be given conclusive weight because a rangewide determination of status more accurately reflects the species' degree of imperilment and better promotes the purposes of the Act. Under this reading, we should first consider whether the species warrants listing "throughout all" of its range and proceed to conduct a "significant portion of its range" analysis if, and only if, a species does not qualify for listing as either an endangered or a threatened species according to the "throughout all" language.

Having determined that the *Hexastylis naniflora* is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in an SPR. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do the "screening" analysis, we ask whether there are portions of the species' range for which there is substantial information indicating that: (1) the portion may be significant; and, (2) the species may be, in that portion, either in danger of extinction or likely to become so in the foreseeable future. For a particular portion, if we cannot answer both

Deleted: dwarf-flowered heartleaf

questions in the affirmative, then that portion does not warrant further consideration and the species does not warrant listing because of its status in that portion of its range. We emphasize that answering these questions in the affirmative is not a determination that the species is in danger of extinction or likely to become so in the foreseeable future throughout a significant portion of its range—rather, it is a step in determining whether a more detailed analysis of the issue is required.

If we answer these questions in the affirmative, we then conduct a more thorough analysis to determine whether the portion does indeed meet both of the SPR prongs: (1) the portion is significant and (2) the species is, in that portion, either in danger of extinction or likely to become so in the foreseeable future. Confirmation that a portion does indeed meet one of these prongs does not create a presumption, prejudgment, or other determination as to whether the species is an endangered species or threatened species. Rather, we must then undertake a more detailed analysis of the other prong to make that determination. Only if the portion does indeed meet both SPR prongs would the species warrant listing because of its status in a significant portion of its range.

At both stages in this process—the stage of screening potential portions to identify any portions that warrant further consideration and the stage of undertaking the more detailed analysis of any portions that do warrant further consideration—it might be more efficient for us to address the "significance" question or the "status" question first. Our selection of which question to address first for a particular portion depends on the biology of the species, its range, and the threats it faces. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range.

For *Hexastylis naniflora*, we chose to evaluate the status question (i.e., identifying portions where the *Hexastylis naniflora*, may be in danger of extinction or likely to become so in the foreseeable future) first. To conduct this screening, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. We examined the following threats: development projects, trash disposal, expansion of residential lawns, cattle, or invasive exotics. We found no concentration of threats in any portion of the *Hexastylis naniflora*, range at a biologically meaningful scale.

If both (1) a species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range and (2) the threats to the species are essentially uniform throughout its range, then the species could not be in danger of extinction or likely to become so in the foreseeable future in any biologically meaningful portion of its range. For the *Hexastylis naniflora*, we found both: the species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, and there is no geographical concentration of threats so the threats to the species are essentially uniform throughout its range.or likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Therefore, we find that the species does not meet the definition of an endangered species or a threatened species under the Act.

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove *Hexastylis naniflora*, from the Federal List of Endangered and Threatened Wildlife. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under Section 7 of the Act in the event that activities they authorize, fund, or carry out

Deleted: dwarf-flowered heartleaf

Deleted: dwarf-flowered heartleaf

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: drarf-flowered heartleaf

Deleted: ¶

Deleted: dwarf-flowered heartleaf

may affect *Hexastylis naniflora*. There is no critical habitat designated for this species.

Deleted: dwarf-flowered heartleaf

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than five years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as a threatened or endangered species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2018-XXXX. Copies can also be obtained from the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT** section). We seek information, data, and comments from the public regarding the dwarf-flowered heartleaf and the PDM plan. We are also seeking peer review of this draft plan

concurrently with this comment period. We anticipate finalizing this plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(a) Be logically organized;

(b) Use the active voice to address readers directly;

(c) Use clear language rather than jargon;

(d) Be divided into short sections and sentences; and

(e) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc. Send a copy of any comments on how we can make this rule easier to understand to: Office of Regulatory Affairs, Department of the Interior, room 7229, 1849 C Street NW., Washington, DC 20240. You may also email the comments to this address: Exsec@ios.doi.gov.

National Environmental Policy Act

We have determined that we do not need to prepare an Environmental Assessment or Environmental Impact Statement, as defined in the National Environmental Policy Act (42 USC

4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act. We published a notice outlining our reasons for this determination in the Federal Register October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands associated with this proposed regulation.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket Number FWS-R4-ES-2018-XXXX and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

2. Amend § 17.11(h), by removing the entries for "Heartleaf, Dwarf-flowered" under "PLANTS" from the List of Endangered and Threatened Wildlife.

§ 17.11 Endangered and threatened wildlife.

Dated: _____

_____

Margret E. Everson
Principal Deputy Director
U.S. Fish and Wildlife Service,
Exercising the Authority of the Director,
U.S. fish and Wildlife Service.

~~**Endangered and Threatened Wildlife and Plants; Removal of the Nashville Crayfish from the Federal List of Endangered and Threatened Wildlife**~~

Information Memorandum for the Secretary/Director

Date: May 18, 2020

From: Gary Frazer, Assistant Director, Ecological Services

Telephone #: 202-208-4646

Subject: Dwarf-flowered heartleaf Proposed Delisting

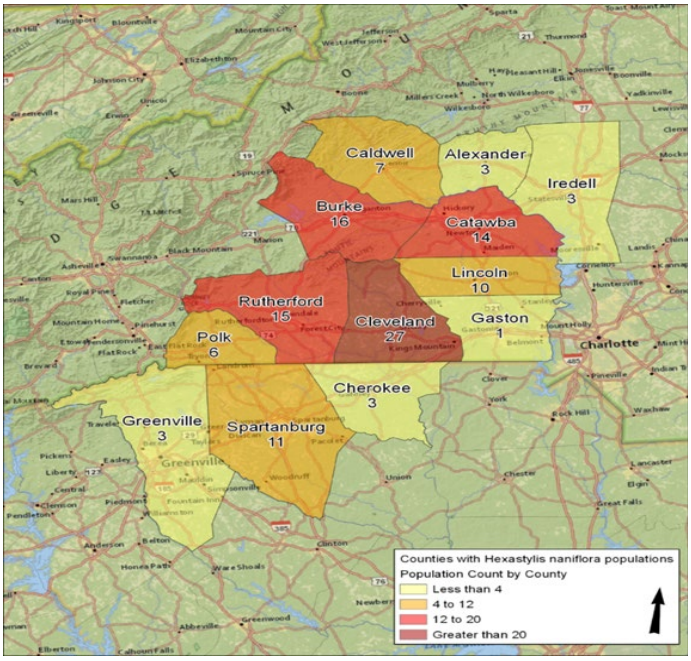
I. Introduction

We are proposing to delist the dwarf-flowered heartleaf (*Hexastylis naniflora*). This proposal is based on a thorough review of the best available scientific and commercial information, which indicates that this species does not meet the definition of an endangered species or threatened species.

II. Background

On April 14, 1989, we listed the dwarf-flowered heartleaf as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing (FR 54 14964). A recovery plan for the species was never completed. Over the last 29 years, the Service has worked closely with partners to recover this species. The Service initiated a Species Status Assessment (SSA) to aid in determining the appropriateness of reclassifying the species in 2018.

Photos and Range Maps



Key Drivers of Species Status

The dwarf-flowered heartleaf is a low growing herbaceous plant in the birthwort family. At the time of listing, 24 extant populations (and one extirpated population) were distributed across eight counties in the upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include five additional counties in North Carolina. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two states.

At the time of listing, the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. In addition, other documented threats include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of ponds, impacts from grazing cattle, off road vehicle damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or siltation. In the SSA, we assessed these same factors as well as climate change to determine the viability of the dwarf-flowered heartleaf currently and in the future. Climate change through changes in temperature and precipitation may exacerbate these risk factors to the species.

To determine current resiliency for populations, we used Element Occurrence viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. Of the 78 populations assessed, 28 currently have very high resiliency, five have high, 26 have moderate, while 19 have low resiliency. We also assessed the future condition of the dwarf-flowered heartleaf under three scenarios projected out to the year 2040. Under all scenarios, viability remains very similar to current conditions. Thus, after considering the best available scientific and commercial information, we determine the dwarf-flowered heartleaf is not likely to become in danger of extinction in the foreseeable future.

Foreseeable Future

Threats to the dwarf-flowered heartleaf are primarily related to invasive species, climate change, and habitat changes from development. When determining foreseeable future, we selected a time frame for which we have reasonable confidence regarding the likelihood of occurrence of both the level of threats and the species' responses to those threats. We consider 20 years to be a reasonable period of time within which reliable predictions can be made for dwarf-flowered heartleaf. This period of time aligns with the timeframes for predictions regarding development growth and climate change.

Climate Change

Using the NCCV and considering the more extreme "representative concentration pathways" (RCP) greenhouse gas emission scenario (RCP 8.5), along with the more conservative RCP 4.5 scenario, we calculated projected annual mean changes from 1981–2010 to those projected for 2025–2049 for maximum temperature, precipitation, soil storage, and evaporative deficit in all counties where dwarf-flowered heartleaf occurs. Based on these results, all 13 counties within the range of dwarf-flowered heartleaf will be subjected to higher temperatures (annual mean increase of 2.6 °F (RCP 4.5) or 2.9 °F (RCP 8.5)) and slightly higher precipitation (annual mean increase of 0.1 inch per month (RCP 4.5) or 0.2 inch per month (RCP 8.5)) relative to the period of 1981–2010. Because the average annual increase in precipitation is predicted to be only

slight, the loss in soil storage is likely primarily the result of higher predicted temperatures. While the predictions of a changing climate could negatively impact dwarf-flowered heartleaf, the species possesses other biological traits to provide resiliency against this threat.

Data Sources

The data set available for determining species abundance, distribution, and factors influencing the species viability predominantly relies on existing information from unpublished field survey results (1990-2015), research project reports, peer reviewed scientific publications, unpublished field observations by experienced biologists, personal communications, the latest 5-year review, and the species status assessment report.

Recovery Criteria

No Recovery Plan has been completed for this species.

Conservation Efforts

The North Carolina Plant Conservation and Protection Act (NC State Code Article 19B, § 106-202.12) provides limited protection from unauthorized collection and trade of plants listed under that statute. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. In South Carolina, plants are protected only from disturbance where they occur on those properties owned by the state and specifically managed as South Carolina Heritage Preserves (SC State Code of Regulations Part 123 § 200-204). There are no other federal or state statutes that afford significant protections to dwarf-flowered heartleaf.

The majority of sites that have the potential to afford long-term protection to the species have been protected as a direct result of the provisions of Section 7 of the ESA. Through Section 7 and other voluntary conservation actions, approximately 24 of the 78 populations are permanently protected, and another 18 populations are partially protected, greatly minimizing the likelihood of impacts due to development.

Additionally, tens of thousands of dwarf-flowered heartleaf plants are conserved by Duke Energy along the Broad River. Another population is conserved at Cowpens National Battlefield, in upstate South Carolina. A third population is part of the Broad River Greenway, a local park in North Carolina's Cleveland County. Furthermore, Foothills Conservancy, Catawba Lands Conservancy, and The Nature Conservancy all protect sites. The North Carolina Department of Transportation is one of the greatest contributors to conservation of the species, acquiring land and conserving multiple populations over the years, including land that became part of Cleveland County's Broad River Greenway.

****

The information below this line is for informational and outreach purposes only and has not been used as the basis for any potential Agency decision.

III. Positions of Interested Parties

The dwarf-flowered heartleaf occurs on public and private land, based on a long history of outreach and conservation projects, landowners would likely be neutral or favorable regarding a proposed delisting.

IV. Potential Issues/Conflicts

Potential issues and conflicts with this proposed delisting are not anticipated.

V. Communications and Outreach

Outreach Lead:	Gary Peeples
Affected States:	North/South Carolina
Media POC:	Gary Peeples, Ashville Ecological Services Field Office, 828–216–4970
Congressional:	Kristen Peters (EA) will send advance notification emails to Congressionals via email two days before the rule publication.
State Contacts:	Ashville Ecological Services Office Field Supervisor (Janet Mizzi) will ensure email notification sent to the following offices: North/South Carolina Governor's Office, Deputy Chief of Staff; NC Botanical Garden, Director of Conservation Programs; NC Forest Service, Regional Forester; NC Division of Parks and Recreation – State Parks, Director; NC Natural Heritage Program, Director; NC Plant Conservation Program, Administrator; NC Clean Water Management Trust Fund, Acquisition Program Manager.
Other Outreach:	Interior Region 2/4 Facebook and Twitter Accounts – Katherine Taylor.

Name	Affiliation	Address 1	Address 2	Address 3	City, State Zip
Dave Willoughby	RK&K Consulting Engineers	125 Floyd Smith Drive, Suite 140			Charlotte, NC 28262
James Padgett	New Home United Methodist Church	544 Moriah School Road			Casar, NC 28150
	US Army Corps of Engineers - Columbia Regulatory Field Office	Charleston District	Strom Thurmond Federal Building	1835 Assembly Street, Room 865 B-1	Columbia, SC 29201
	Catawba County Wildlife Club	PO Box 544			Hickory, NC 28603
	Girl Scouts of America - Camp Mary Elizabeth	330 Scout Drive			Spartanburg, SC 29301
Robert and Carolyn Tate		4411 US 221 South			Forest City, NC 28043

SECTION I: GENERAL INFORMATION

1. **Plan title** Proposed delisting of the dwarf-flowered heartleaf (*Hexastylis naniflora*)

2. **DTS number** *TBD*

3. **What is the action triggering this communications plan?** *(Please explain in no more than three sentences)*

Proposed delisting the dwarf-flowered heartleaf

4. **What is the proposed date for this action? Why has it been selected? Is it flexible?**

Depends on Federal Register publication date.

5. **Which office is leading this communications effort and which other programs, regions or groups are involved?**

Asheville ES Field Office

SECTION II: GOALS AND MESSAGES

6. **What story do we want to tell?**

Partnership was the key to the proposed delisting for this plant.

7. **What are our key messages?** *(These should be top concepts that readers should take away, including an understanding of why this action matters and why they should care, not a list of facts, which should be placed in the appendix. List no more than four!)*

• This proposed delisting resulted from the contribution of a broad range of partners.

SECTION III: IMPLEMENTATION

8. Implementation timeline *(If not known, put TBD or the number of days/hours before/after the announcement*

Target Date	Tactic	Responsible
All times are in the Eastern time zone		
One day before FR reading room	Inform Congressional staff	ASFO
One day before FR reading room	Inform state agency	ASFO
Day proposal displayed in FR reading room	Inform other stakeholders	ASFO
Day proposal displayed in FR reading room	Post to digital media	ASFO/R4EA
Day proposal displayed in FR reading room	Distribute media release	ASFO

9. Which communications tools are needed to support these strategies and tactics? *(Be as specific as possible about the products identified and who will produce them)*

Tool	Responsible	Due Date
Media release	ASFO	6/1/2018
Digital photo album	ASFO	6/1/2018
Facebook post	ASFO	6/1/2018
Twitter post	ASFO	6/1/2018
FAQs	ASFO	6/1/2018

10. Social media plan *(Provide a list of accounts to be used as well as sample hashtags, messages, multimedia and other links, etc. as appropriate)*

R4 twitter account

- Tweet = Thanks to a host of partners, NC plant proposed for endangered species list removal.
- Hastag = #NCplantrecovered
- Link to announcement on R4 website

R4 Flickr account

- Hosting digital photo album

R4 Facebook account

- Post = Dwarf-flowered heartleaf recommended for removal from the endangered species list - conserved thanks to a network of conservation partnerships.
- Link to announcement on R4 website

11. Stakeholder contact grids *(For each, paste in a table that provides organization name, contact person, how the person will be contacted, phone or email address as appropriate and a name of the person who will be making contact)*

Internal

External

FHWA - NC	John Sullivan, division administrator	john.sullivan@dot.gov
FHWA - SC	Emily Lawton, division administrator	emily.lawton@dot.gov
HUD - NC	Christopher Taylor, acting field office director	NC_Webmanager@hud.gov
HUD - SC	Michael German, acting field office director	SC_Webmanager@hud.gov
NRCS - NC	Tim Beard, state conservationist	timothy.beard@nc.usda.gov
NRCS - SC	Ann English, state conservationist	ann.english@sc.usda.gov
USACOE - Wilmington	(b)(6) PII, division chief	(b)(6) PII(b)(6) PII(b)(6) PII
USFS-Pisgah National Forest	Allen Nicholas, forest supervisor	anicholas@fs.fed.us

USFS-Pisgah National Forest	Gary Kauffman	gkauffman@fs.fed.us
US Army Corps of Engineers - Asheville Regulatory Field Office	(b)(6) PII, Asheville office supervisor	(b)(6) PII(b)(6) PII
US Fish and Wildlife Service - Charleston	April Punsalan, SC FWS botanist	april_punsalan@fws.gov
US Fish and Wildlife Service - Raleigh	Dale Suiter	dale_suiter@fws.gov
National Park Service - Cowpens National Battlefield	John Slaughter	John_Slaughter@nps.gov
NC State Parks - West	Sean McElhone,	Sean.mcelhone@ncparks.gov
NC State Parks	Ed Corey, inventory biologist	ed.corey@ncparks.gov
NCDOT	Phil Harris, head, environmental analysis unit	pharris@ncdot.gov
NCDOT	Heath Slaughter, division environmental officer - Division 11	hslaughter@ncdot.gov
NCDOT	Trish Beam, environmental supervisor - Division 12	pdbeam@ncdot.gov
NCDOT	Roger Bryan, environmental supervisor - Division 13	rbrahn@ncdot.gov
NCDOT	Dave McHenry, environmental supervisor - Division14	dgmchenry@ncdot.gov
NCPCP	Cheryl Gregory, administrator	cheryl.gregory@ncagr.gov
NCNHP	Misty Buchanan, director	misty.buchanan@ncdenr.gov
NCNHP	Laura Robinson, botanist	Laura.Robinson@ncdenr.gov
NCWRC	Gordon Myers, executive director	gordon.myers@ncwildlife.org
NC Botanical Garden	Johnny Randall, director of conservation programs	jrandall@email.unc.edu
NC Forest Service	Greg Yates, Regional forester	greg.yates@ncagr.gov
NC Department of Transportation	Tim Bassette, environmental program consultant	tpbassette@ncdot.gov
NC Department of	Jared Gray, environmental	jgray@ncdot.gov

Transportation	program supervisor II	
NC Division of Parks and Recreation - State Parks	Mike Murphy	michael.murphy@ncparks.gov
NC Natural Heritage Program	Laura Robinson, botanist	laura.robinson@ncdcr.gov
NC Natural Heritage Program	Jame Amoroso, conservation information specialist	jame.amoroso@ncdcr.gov
NC Natural Heritage Program	Misty Buchanan, director	misty.buchanan@ncdcr.gov
NC Natural Heritage Program	Wesley Knapp, western regional ecologist/botanist	wesley.knapp@ncdcr.gov
NC Natural Heritage Program	Suzanne Mason, conservation data manager & NCDOT project specialist	suzanne.mason@ncdcr.gov
NC Natural Heritage Program	Mike Shafale, terrestrial biologist	michael.schafale@ncdcr.gov
NC Natural Heritage Program	Harry LeGrand, retired	hlegrandjr@gmail.com
NC Natural Heritage Program	Bruce Sorrie, retired	basorrie@gmail.com
NC Plant Conservation Program	Cheryl Gregory, administrator	cheryl.gregory@ncagr.gov
NC Plant Conservation Program	Lesley Starke	lesley.starke@ncagr.gov
NC Plant Conservation Program	Jenny Stanley	jennifer.stanley@ncagr.gov
SC Department of Natural Resources - Heritage Trust Program	Herrick Brown, assistant Botanist	brownh@dnr.sc.gov
SC Department of Natural Resources - Heritage Trust Program	Bert Pittman, botanist	pittmanb@dnr.sc.gov
SC Department of Natural Resources - Heritage Trust Program	Kathy Boyle	boylek@dnr.sc.gov
SC Department of Natural Resources - Heritage Trust Program	Pat Cloninger, preserve manager	cloningerp@dnr.sc.gov
SC Department of Transportation	Chad Long	longcc@scdot.org

Clean Water Management Trust Fund	Nancy Gutherie, acquisition program manager	nancy.gutherie@ncdcr.gov
Wilkes	John Yates	jyates@wilkescounty.net
Caldwell	Stan Kiser	skiser@caldwellcountync.org
Alexander	Don Adams	manageralc@skybest.com
Iredell	Ron Smith	rsmith@co.iredell.nc.us
Catawba	Mark Berry	MBerry@CatawbaCountyNC.gov
Burke	Bryan Steen	Bryan.Steen@burkenc.org
Lincoln	Kelly Atkins	katkins@lincolncounty.org
Gaston	Earl Mathers	earl.mathers@gastongov.com
Cleveland	Jeff Richardson	April.Crotts@clevelandcounty.com
Rutherford	Steve Garrison	steve.garrison@rutherfordcountync.gov
Polk	D. Marche Pittman	mpittman@polknc.org
Cherokee	Bill Blanton	bill.blanton@cherokeecountysc.com
Spartanburg	Katherin O'Neil	koneill@spartanburgCounty.org
Greenville	Jospeh Kernell	countyadministrator@greenvillecounty.org
Burke County School System	Larry Putnam	lputnam@burke.k12.nc.us
City of Landrum	Rich Caplan	rich.caplan@cityoflandrumsc.com
City of Shelby	Rick Howell	rick.howell@cityofshelby.com
Cleveland County	Jeff Richardson	Jeff.Richardson@clevelandcounty.com
Foothills Environmental Landfill	Barry Calloway	bcalloway@caldwellcountync.org
Hickory Parks and Recreation	Mack McLeod	mmcleod@hickorync.gov
Rutherford County	Steve Garrison	steve.garrison@rutherfordcountync.gov

Self McNeilly Landfill - Cleveland County	Nathan McNeilly	Nathan.McNeilly@clevelandcounty.com
Town of Boiling Springs	Tom Hart	tom.hart@boilingspringsnc.net
NC Forestry Association	Chris Brown, Sr director of communications	cbrown@ncforestry.org
NC Farm Bureau	Larry Wooten, President and CEO	larry.wooten@ncfb.org
Forestry Association of South Carolina	Cam Crawford, President and CEO	ccrawford@scforestry.org
SC Farm Bureau	Harry Ott, President and CEO	harryott@scfb.org
NC Wildlife Federation	Tim Gestwicki, Chief Executive officer	tim@ncwf.org
Defenders of Wildlife	Ben Prater, SE coordinator	BPrater@defenders.org
TNC - NC	Katherine Skinner, state director	kskinner@tnc.org
TNC - SC	Mark Robertson, executive director	kskinner@tnc.org
NC Native Plant Society	Jean Woods, president	jean@ncwildflower.org
Foothills Conservancy	Andrew Kota, executive director	akota@foothillsconservancy.org
Catawba Lands Conservancy	Tom Okel, executive director	tom@catawbalands.org
Catawba Lands Conservancy	Sean Bloom, Rhyne Preserve	sean@catawbalands.org
Conestee Foundation - Lake Conestee Nature Park	Mary Walter, director of development and communication	mary@lakeconesteenaturepark.com
Conserving Carolina	Pam Torlina, Southeast stewardship manager, Conserving Carolina	pam@conservingcarolina.org
Foothills Conservancy NC	Andrew Kota, executive director	akota@foothillsconservancy.org
Foothills Conservancy of NC	Ryan Sparks, Conservation Associate	rsparks@foothillsconservancy.com
Friends of Plant Conservation	Alvin Braswell, Friends group to PCP	alvin.braswell@naturalsciences.org
Naturaland Trust	Frank Hollemon, president	frankholleman@naturalandtrus

		t.org
Spartanburg Area Conservancy (SPACE)	Frederick Parrish	fmpiii@bellsouth.net
Spartanburg Area Conservancy (SPACE)	Andrew Waters	andrew@spartanburgconservation.org
The Nature Conservancy - NC	Brenda Wichmann, conservation coordinator	brenda.wichmann@tnc.org
The Nature Conservancy - SC	Kristen Austin, upstate conservation director	kaustin@tnc.org
Upstate Forever	Andrea Cooper, executive director	acooper@upstateforever.org
Appalachian State University	Mike Estep, assistant professor, evolutionary genetics and genomics	estepmc@appstate.edu
Appalachian State University	Zack Murrell, professor and chair	murrellze@appstate.edu
Gardner-Webb University	Thomas Jones, professor of biology	tjones@gardner-webb.edu
NC Botanical Gardens	Johnny Randall, director of conservation programs	jrandall@email.unc.edu
NC Botanical Gardens	Michael Kunz, conservation ecologist	mkunz@email.unc.edu
NCSU Herbarium	Alexander Krings, director	Alexander_Krings@ncsu.edu
SC Botanical Gardens	Patrick McMillan, director	pmcmill@clemson.edu
UNC Herbarium	Alan Weakly, director	weakley@unc.edu
USC Upstate	Gill Newberry, retired	gnewberry@charter.net, gnewberry@uscupstate.edu
USC Upstate Herbarium	Benjamin Montgomery, director	BMONTGOMERY@uscupstate.edu
Wofford College	Doug Rayner, professor of biology	raynerda@wofford.edu
Atlas Environmental	Jennifer Robertson	jrobertson@atlasenvi.com
Axiom Environmental	Grant Lewis	glewis@axiomenvironmental.org

Carolina Ecosystems, Inc.	Brian Smith	info@carolinaeco.com
Carolina Wetland Services	Greg Antemann	gregg@cws-inc.net
ClearWater Environmental Consultants	Clement Riddle	clement@cwenv.com
ECS Carolinas, LLP	Cory Darnell	cdarnell@ecslimited.com
Environmental Services Inc.	Kevin Markham	kmarkham@esinc.cc
Habitat Assessment and Restoration Professionals	Karri Cecil Blackmon	info@habitatassessment.com
Hazen and Sawyer	Jarrod Karl	jkarl@hazenandsawyer.com
HDR	Kevin Mosteller	kevin.mosteller@hdrinc.com
HW Lochner	Kenneth Smith	ksmith@hwlochner.com
Kimley-Horn and Associates, Inc.	Chris Tinklenberg	chris.tinklenberg@kimley-horn.com
Kleinfelder	Kevin Thomas	kthomas@kleinfelder.com
Maser Consulting	Seth Ryan	sryan@maserconsulting.com
Michael Baker International	Frank Curti	fcurti@mbakerintl.com
Michael Baker International	Jake Byers	jbyers@mbakerintl.com
S&EC	Bob Zarzecki	bzarzecki@sandec.com
Three Oaks Engineering	Mary Frazer	mary.frazer@threeoaksengineering.com
Wetlands & Waters, Inc.	Tamp Bandy	jtampbandy@gmail.com
Wetlands and Environmental Planning Group	Len Rindner	len.rindner@wetlands-epg.com

12. Congressional member email list

NC-10th-Patrick McHenry	David McCrary	David.McCrary@mail.house.gov
NC-11th-Mark Meadows	Beverly Elliott	Beverly.Elliott@mail.house.gov
NC-5th-Virginia Foxx	Dawn Boyer	dawn.boyer@mail.house.gov
NC-13th-Ted Budd	Todd Poole	todd.poole@mail.house.gov
NC-N/A-Richard Burr	Mike Fenley	mike_fenley@burr.senate.gov

NC-N/A-Thom Tillis	Jordan Barnes	Jordan_Barnes@tillis.senate.gov
SC-4th-William Timmons	Hope Blackley	hope.blackley@mail.house.gov
SC-5th-Ralph Norman	Jeffrey Sligh	jeffrey.sligh@mail.house.gov
SC-N/A-Lindsay Graham	Laura Bauld	laura_bauld@lgraham.senate.gov
SC-N/A-Tim Scott	Danielle Gibbs	danielle_gibbs@scott.senate.gov

13. Congressional committee email list

SECTION IV: PRIMARY POINTS OF CONTACT

14. Media coordinators *(For national-level plans, list at least one person from HQ Public Affairs and others from region/program if appropriate. For regional-level plans, only regional coordinators are required. Enter name, email and phone)*

Gary Peeples, ASFO, gary_peeples@fws.gov, 828/258-3939, ext. 234

15. Congressional coordinators *(For national-level plans, list at least one person from HQ Public Affairs and others from region/program if appropriate. For regional-level plans, only regional coordinators are required. Enter name, email and phone)*

Gary Peeples, ASFO, gary_peeples@fws.gov, 828/258-3939, ext. 234

16. Subject matter experts available for interview *(Must be approved by HQ Public Affairs for an HQ-led announcement or by Regional Public Affairs for region-led announcement. Enter name, email and phone)*

Rebekah Reid, ASFO, rebekah_reid@fws.gov, 828/258-3939, ext. 238

17. Additional technical experts for reference *(Enter name, email and phone)*

N/A

18. Are there any non-FWS points of contact for this action? *(Enter name, organization, role, email and phone)*

No

SECTION V: DOCUMENT INFO

19. Date Created **Created By**

Jun 13, 2018	Gary Peeples

20. Date last edited **Edited By**

APPENDIX: ADDITIONAL BACKROUND INFORMATION AND MATERIALS

DO NOT PUT OTHER MATERIALS SUCH AS FAQs, NEWS RELEASE OR TALKING POINTS IN THIS SECTION. KEEP THOSE AS SEPARATE DOCUMENTS.

(Consider the following: What is the historical context? Does this relate to other issues that may not immediately be apparent (consider other programs and regions)? Is there a scientific basis to this issue? If so what is it?)

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.784884989	1292490.002	1511130.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.786536992	1292520.002	1511130.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.781584978	1292460.002	1511100.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.779954016	1292490.002	1511100.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.778320014	1292520.002	1511100.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.789830983	1292550.002	1511100.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.782473981	1292610.002	1511100.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.790894985	1292640.002	1511100.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.790894985	1292670.002	1511100.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.792630017	1292700.002	1511100.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.776681006	1292400.002	1511070.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.775038004	1292430.002	1511070.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.74159801	1292460.002	1511070.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.684307992	1292490.002	1511070.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.683315992	1292550.002	1511070.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.782473981	1292580.002	1511070.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.785838008	1292610.002	1511070.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.785838008	1292640.002	1511070.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.790894985	1292670.002	1511070.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.801297009	1292700.002	1511070.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.799574971	1292730.002	1511070.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.770087004	1292400.002	1511040.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.661945999	1292460.002	1511040.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.726343989	1292580.002	1511040.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.728079021	1292610.002	1511040.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.672703981	1292640.002	1511040.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.67583102	1292670.002	1511040.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.790894985	1292700.002	1511040.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.797846973	1292730.002	1511040.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.80301398	1292760.002	1511040.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.796113014	1292790.002	1511040.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.792630017	1292730.002	1511010.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.820810974	1292760.002	1511010.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.808129013	1292790.002	1511010.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.799574971	1292820.002	1511010.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.763490975	1292760.002	1510980.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.818392992	1292790.002	1510980.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.816536009	1292820.002	1510980.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.811510026	1292850.002	1510980.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.828041971	1293000.002	1510980.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.807623029	1293030.002	1510980.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.241733	1293060.002	1510980.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.792630017	1292790.002	1510950.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.804724991	1292820.002	1510950.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.81486702	1292850.002	1510950.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.821506023	1292880.002	1510950.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.823149025	1292910.002	1510950.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.826417983	1292940.002	1510950.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.832017004	1292970.002	1510950.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.81486702	1293000.002	1510950.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.724786997	1293030.002	1510950.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.732369006	1293060.002	1510950.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.850243986	1293090.002	1510950.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.720170975	1292850.002	1510920.005	29	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.809822023	1292880.002	1510920.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.742851019	1292910.002	1510920.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.733457029	1292940.002	1510920.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.735342979	1292970.002	1510920.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.660423994	1293000.002	1510920.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.660875976	1293030.002	1510920.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.668271005	1293060.002	1510920.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.817951977	1293090.002	1510920.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.69085598	1292880.002	1510890.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.704990029	1292910.002	1510890.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.659672022	1292940.002	1510890.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.703706026	1293060.002	1510890.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.807623029	1293090.002	1510890.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.726687014	1293090.002	1510860.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.842589021	1293120.002	1510860.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.824787021	1293120.002	1510830.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.839457989	1293150.002	1510830.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.703706026	1293120.002	1510800.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.79035902	1293150.002	1510800.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.831510007	1293180.002	1510800.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.689423978	1293150.002	1510770.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.699568987	1293180.002	1510770.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.730477989	1293210.002	1510770.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.833617985	1293240.002	1510710.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.706032991	1292970.002	1510650.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.804925025	1292490.002	1510620.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.828041971	1292910.002	1510620.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.829659998	1292940.002	1510620.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.792110026	1293060.002	1510620.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.752797008	1292490.002	1510590.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.794373989	1292520.002	1510590.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.811510026	1292700.002	1510590.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.808129013	1292730.002	1510590.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.818198979	1292760.002	1510590.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.819854975	1292790.002	1510590.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.816536009	1292820.002	1510590.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.792110026	1292850.002	1510590.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.786840975	1292880.002	1510590.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.83040899	1292910.002	1510590.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.810020983	1292550.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.774366975	1292700.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.667439997	1292730.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.725883007	1292760.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.660875976	1292790.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.706080019	1292820.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.705635011	1292850.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.82823199	1292880.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.840184987	1293060.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.834710002	1293090.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.829659998	1293120.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.828041971	1293150.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.735342979	1293180.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.806125998	1293210.002	1510560.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.637865007	1292790.002	1510530.005	29	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.65694797	1292820.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.779742002	1292850.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.83040899	1292910.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.83040899	1292940.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.740980029	1292970.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.744719982	1293000.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.816536009	1293030.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.720978022	1293060.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.711408019	1293090.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.727780998	1293120.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.703706026	1293150.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.707561016	1293180.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.776163995	1293210.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.826609015	1293240.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.809822023	1293270.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.804724991	1293300.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.804724991	1293360.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.801297009	1293390.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.796113014	1293420.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.792630017	1293450.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.790894985	1293480.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.782473981	1293510.002	1510530.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.701775014	1292820.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.816536009	1292850.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.829900026	1292880.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.821506023	1292910.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.816536009	1292940.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.618224978	1292970.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.668850005	1293000.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.664928019	1293030.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.662966013	1293060.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.694557011	1293090.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.589488983	1293120.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.585776985	1293150.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.585776985	1293180.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.611488998	1293210.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.813190997	1293240.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.824979007	1293270.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.81486702	1293300.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.813970029	1293330.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.804724991	1293360.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.797846973	1293390.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.792630017	1293420.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.785838008	1293450.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.784151971	1293480.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.747573018	1293510.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.797448993	1293540.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.787865996	1293570.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.724165976	1293600.002	1510500.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.794373989	1292490.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.797846973	1292520.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.809822023	1292820.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.833113015	1292850.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.828794003	1292880.002	1510470.005	29	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.696168005	1292910.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.692287982	1292940.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.674724996	1292970.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.668850005	1293000.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.659039021	1293030.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.655125022	1293060.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.714523971	1293090.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.585776985	1293210.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.714433014	1293240.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.804724991	1293270.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.806429982	1293300.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.722078025	1293330.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.773166001	1293360.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.764173985	1293390.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.813528001	1293420.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.776857018	1293450.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.709806025	1293480.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.714106977	1293510.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.745173991	1293540.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.724165976	1293570.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.72112298	1293600.002	1510470.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.760242999	1292370.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.785838008	1292400.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.794373989	1292490.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.785838008	1292790.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.77256602	1292820.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.813970029	1292850.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.83385402	1292880.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.727442026	1292970.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.687110007	1293000.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.756316006	1293270.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.759846985	1293300.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.764173985	1293330.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.748555005	1293360.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.745020986	1293390.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.74327302	1293420.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.766053975	1293450.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.757453978	1293480.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.741756022	1293510.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.738325	1293540.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.71894598	1293570.002	1510440.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.787519991	1292460.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.744090021	1292790.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.767134011	1292820.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.779742002	1292850.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.720170975	1292880.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.68255502	1292910.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.794120014	1292940.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.733120024	1293000.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.719829023	1293030.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.683212996	1293060.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.74327302	1293300.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.74327302	1293330.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.753755987	1293360.002	1510410.005	29	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.738020003	1293390.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.748579979	1293420.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.829539001	1293450.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.799046993	1293480.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.679651976	1293510.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.684156001	1293540.002	1510410.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.742361009	1292790.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.758069992	1292820.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.77076	1292850.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.710595012	1292880.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.669399977	1292910.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.720170975	1292940.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.741262972	1292970.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.752435029	1293000.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.728322983	1293060.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.772660017	1293090.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.72972399	1293120.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.767738998	1293150.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.734559	1293420.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.792677999	1293450.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.797448993	1293480.002	1510380.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.748579979	1292790.002	1510350.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.755481005	1292820.002	1510350.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.741524994	1292850.002	1510350.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.746782005	1292880.002	1510350.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.690407991	1292910.002	1510350.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.694109023	1292940.002	1510350.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.705635011	1292970.002	1510350.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.727780998	1293000.002	1510350.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.804472983	1293030.002	1510350.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.721737027	1293090.002	1510350.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.777956009	1293120.002	1510350.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.613456011	1293150.002	1510350.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.733269989	1292850.002	1510320.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.738453984	1292880.002	1510320.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.740207016	1292910.002	1510320.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.747211993	1292940.002	1510320.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.696433008	1292970.002	1510320.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.706080019	1293000.002	1510320.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.720978022	1293030.002	1510320.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.831510007	1293060.002	1510320.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.823149025	1293120.002	1510320.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.678650975	1293150.002	1510320.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.611488998	1293180.002	1510320.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.741524994	1292940.002	1510290.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.692707002	1292970.002	1510290.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.697906017	1293000.002	1510290.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.713326991	1293030.002	1510290.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.750522971	1293060.002	1510290.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.725543022	1293150.002	1510290.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.617392004	1293180.002	1510290.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.700761974	1293330.002	1510290.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.736715972	1293360.002	1510290.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.374882013	1293390.002	1510290.005	29	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.415977001	1293030.002	1510260.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.526426971	1293060.002	1510260.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.819854975	1293150.002	1510260.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.783302009	1293180.002	1510260.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.723981977	1293210.002	1510260.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.722078025	1293240.002	1510260.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.701775014	1293270.002	1510260.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.752089977	1293300.002	1510260.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.728583992	1293030.002	1510230.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.825545013	1293060.002	1510230.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.819854975	1293150.002	1510230.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.779742002	1293180.002	1510230.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.725883007	1293210.002	1510230.005	29	2000	very high
NC	14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	0.373106003	1293676.469	1510541.206	29	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.856280982	1287000.002	1449600.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.847010016	1287000.002	1449570.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.771614015	1287510.002	1449570.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.848545015	1287000.002	1449540.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.777010977	1287480.002	1449540.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.82593298	1287000.002	1449510.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.778800011	1287450.002	1449510.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.853103995	1287000.002	1449480.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.780584991	1287450.002	1449480.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.689669013	1287450.002	1449450.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.864750028	1287000.002	1449420.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.850072026	1287030.002	1449420.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.782365024	1287420.002	1449420.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.642987013	1287450.002	1449420.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.571560025	1287480.002	1449420.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.85789001	1287000.002	1449390.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.850072026	1287030.002	1449390.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.855467975	1287390.002	1449390.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.81101501	1287420.002	1449390.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.778800011	1287450.002	1449390.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.859019995	1287000.002	1449360.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.850072026	1287030.002	1449360.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.851768017	1287390.002	1449360.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.848722994	1287420.002	1449360.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.859019995	1287000.002	1449330.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.78818202	1287030.002	1449330.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.812698007	1287390.002	1449330.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.827468991	1287000.002	1449300.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.762144983	1287030.002	1449300.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.816044986	1287390.002	1449300.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.85789001	1286970.002	1449270.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.827468991	1287000.002	1449270.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.82593298	1287030.002	1449270.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.855744004	1287000.002	1449240.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.824304998	1287030.002	1449240.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.871715009	1287360.002	1449240.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.862764001	1286940.002	1449210.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.677972019	1287840.002	1449210.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.863699019	1286940.002	1449180.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.773418009	1287810.002	1449180.005	100	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.681877971	1287840.002	1449180.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.864602029	1286940.002	1449150.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.683827996	1287780.002	1449150.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.681877971	1287810.002	1449150.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.679925978	1287840.002	1449150.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.864602029	1286940.002	1449120.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.869526982	1287690.002	1449120.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.794885993	1287720.002	1449120.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.778800011	1287750.002	1449120.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.687723994	1287780.002	1449120.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.825245023	1286910.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.723380029	1286940.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.772136986	1286970.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.741284013	1287510.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.771288991	1287540.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.86294198	1287570.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.864395976	1287600.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.867447019	1287630.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.83020103	1287660.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.749074996	1287690.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.749074996	1287720.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.74535203	1287750.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.687723994	1287780.002	1449090.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.865502	1286910.002	1449060.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.723380029	1286940.002	1449060.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.829989016	1286970.002	1449060.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.867199004	1287480.002	1449060.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.726167023	1286940.002	1449030.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.741641998	1287360.002	1449030.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.874321997	1287390.002	1449030.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.86836803	1287420.002	1449030.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.869287014	1287450.002	1449030.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.72734803	1286910.002	1449000.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.722154021	1286940.002	1449000.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.796947002	1287300.002	1449000.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.724026978	1287330.002	1449000.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.708307981	1287360.002	1449000.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.70638299	1287390.002	1449000.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.836596012	1287420.002	1449000.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.865842998	1287450.002	1449000.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.722572982	1286910.002	1448970.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.83783102	1287270.002	1448970.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.728914976	1287300.002	1448970.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.704455018	1287330.002	1448970.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.69865799	1287360.002	1448970.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.719781995	1286910.002	1448940.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.731987	1287240.002	1448940.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.724026978	1287270.002	1448940.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.699105024	1287300.002	1448940.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.691493988	1286910.002	1448910.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.866711974	1286940.002	1448910.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.880111992	1287210.002	1448910.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.782307029	1287240.002	1448910.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.752882004	1287390.002	1448910.005	100	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.772213995	1287420.002	1448910.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.691493988	1286910.002	1448880.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.868728995	1286940.002	1448880.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.876293004	1287180.002	1448880.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.795614004	1287210.002	1448880.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.581533015	1287390.002	1448880.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.678608	1287420.002	1448880.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.861710012	1286940.002	1448850.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.915365994	1287150.002	1448850.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.875371993	1287180.002	1448850.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.647028983	1286910.002	1448820.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.861710012	1286940.002	1448820.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.829937994	1286970.002	1448820.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.694622993	1287000.002	1448820.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.743212998	1287030.002	1448820.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.914669991	1287060.002	1448820.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.914669991	1287090.002	1448820.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.852380991	1287120.002	1448820.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.885003984	1287150.002	1448820.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.83869499	1287180.002	1448820.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.829937994	1286940.002	1448790.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.694622993	1286970.002	1448790.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.746756971	1287000.002	1448790.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.841244996	1287030.002	1448790.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.834089994	1287060.002	1448790.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.806276023	1287090.002	1448790.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.854180992	1287120.002	1448790.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.837850988	1287150.002	1448790.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.649567008	1286910.002	1448760.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.687092006	1286940.002	1448760.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.71685499	1286970.002	1448760.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.798434973	1287000.002	1448760.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.834089994	1287030.002	1448760.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.824774027	1287060.002	1448760.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.909430027	1287120.002	1448760.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.666768014	1286910.002	1448730.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.697598994	1286940.002	1448730.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.744029999	1286970.002	1448730.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.720138013	1287000.002	1448730.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.726517975	1286970.002	1448700.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.721252978	1287000.002	1448700.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.787263989	1286970.002	1448670.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.618583024	1286790.002	1448640.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.632565022	1286820.002	1448640.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.788430989	1286970.002	1448640.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.839374006	1286850.002	1448610.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.840349019	1286880.002	1448610.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.795204997	1286910.002	1448610.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.794417977	1286940.002	1448610.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.777384996	1286820.002	1448580.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.728214979	1286850.002	1448580.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.73893702	1286880.002	1448580.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.741424024	1286910.002	1448580.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.41424799	1286940.002	1448580.005	100	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.756990016	1286820.002	1448550.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.751085997	1286850.002	1448550.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.752399027	1286880.002	1448550.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.768579006	1286940.002	1448550.005	100	2000	very high
NC	12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	0.804343998	1286820.002	1448520.005	100	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.506470978	1282350.002	1528530.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.770762026	1282710.002	1528530.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.752002001	1282740.002	1528530.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.540371001	1282320.002	1528500.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.51284498	1282350.002	1528500.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.717253983	1282650.002	1528500.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.785417974	1282680.002	1528500.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.770762026	1282710.002	1528500.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.754528999	1282740.002	1528500.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.706766009	1282230.002	1528470.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.589410007	1282260.002	1528470.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.529573977	1282290.002	1528470.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.515403986	1282320.002	1528470.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.51029098	1282350.002	1528470.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.731539011	1282650.002	1528470.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.634546995	1282680.002	1528470.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.722790003	1282710.002	1528470.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.705772996	1282740.002	1528470.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.679252028	1282800.002	1528470.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.705449998	1282230.002	1528440.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.586740017	1282260.002	1528440.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.525694013	1282290.002	1528440.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.641272008	1282680.002	1528440.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.726684988	1282710.002	1528440.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.718882024	1282740.002	1528440.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.763312995	1282770.002	1528440.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.692556024	1282800.002	1528440.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.675247014	1282830.002	1528440.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.713329971	1282230.002	1528410.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.539532006	1282260.002	1528410.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.533024013	1282290.002	1528410.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.691807985	1282680.002	1528410.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.691807985	1282710.002	1528410.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.718882024	1282740.002	1528410.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.714962006	1282770.002	1528410.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.688573003	1282800.002	1528410.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.677917004	1282830.002	1528410.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.652469993	1282860.002	1528410.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.719864011	1282230.002	1528380.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.547378004	1282260.002	1528380.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.675835013	1282410.002	1528380.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.537366986	1282440.002	1528380.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.556104004	1282470.002	1528380.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.70370698	1282680.002	1528380.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.68383503	1282710.002	1528380.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.718882024	1282740.002	1528380.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.705772996	1282770.002	1528380.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.693881989	1282800.002	1528380.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.684581995	1282830.002	1528380.005	227	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.608613014	1282110.002	1528350.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.734243989	1282230.002	1528350.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.618408978	1282260.002	1528350.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.60681802	1282410.002	1528350.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.543449998	1282440.002	1528350.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.604587018	1282470.002	1528350.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.726364017	1282710.002	1528350.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.807134986	1282740.002	1528350.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.70709002	1282800.002	1528350.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.679747999	1282830.002	1528350.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.532167017	1282110.002	1528320.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.603245974	1282140.002	1528320.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.71201998	1282260.002	1528320.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.685166001	1282380.002	1528320.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.605476022	1282410.002	1528320.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.621097028	1282440.002	1528320.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.710708022	1282470.002	1528320.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.609955013	1282500.002	1528320.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.543893993	1282530.002	1528320.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.740851998	1282740.002	1528320.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.722790003	1282770.002	1528320.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.693048	1282800.002	1528320.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.635891974	1282380.002	1528290.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.555261016	1282410.002	1528290.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.617561996	1282440.002	1528290.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.72766	1282470.002	1528290.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.614874005	1282500.002	1528290.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.609955013	1282530.002	1528290.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.551760972	1282560.002	1528290.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.737972021	1282710.002	1528290.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.685166001	1282740.002	1528290.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.708890021	1282770.002	1528290.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.691721976	1282800.002	1528290.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.647993982	1282380.002	1528260.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.557896972	1282410.002	1528260.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.621595025	1282500.002	1528260.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.611298025	1282530.002	1528260.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.740532994	1282710.002	1528260.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.689154029	1282740.002	1528260.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.616217971	1282770.002	1528260.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.741811991	1282350.002	1528230.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.625629008	1282380.002	1528230.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.563180029	1282410.002	1528230.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.612640977	1282530.002	1528230.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.737972021	1282710.002	1528230.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.638583004	1282740.002	1528230.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.573302984	1282770.002	1528230.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.607270002	1282230.002	1528200.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.694459021	1282260.002	1528200.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.74436301	1282350.002	1528200.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.654708982	1282380.002	1528200.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.570252001	1282410.002	1528200.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.736688018	1282710.002	1528200.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.568476021	1282740.002	1528200.005	227	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.550446987	1282200.002	1528170.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.558344007	1282260.002	1528170.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.750892997	1282380.002	1528170.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.579106987	1282410.002	1528170.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.559664011	1282230.002	1528140.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.567600012	1282290.002	1528140.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.705024004	1282380.002	1528140.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.624737978	1282410.002	1528140.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.63280803	1282380.002	1528110.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.626083016	1282410.002	1528110.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.639078975	1282380.002	1528080.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.589293003	1282740.002	1528080.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.587957025	1282230.002	1527990.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.712902009	1282290.002	1527990.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.571578979	1282290.002	1527960.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.579558015	1282320.002	1527960.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.636389017	1282350.002	1527960.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.566275001	1282320.002	1527930.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.564951003	1282350.002	1527930.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.571578979	1282320.002	1527810.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.649420023	1282350.002	1527810.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.711592019	1282380.002	1527810.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.714209974	1282410.002	1527810.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.714209974	1282440.002	1527810.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.672124028	1282470.002	1527810.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.576894999	1282380.002	1527780.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.579558015	1282410.002	1527780.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.58089	1282440.002	1527780.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.584891021	1282470.002	1527780.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.592455983	1282500.002	1527780.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.668112993	1282530.002	1527780.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.672124028	1282560.002	1527780.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.537720978	1282410.002	1527750.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.571578979	1282440.002	1527750.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.571578979	1282470.002	1527750.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.574235976	1282500.002	1527750.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.58089	1282530.002	1527750.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.639532983	1282560.002	1527750.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.599604011	1282590.002	1527720.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.655656993	1282620.002	1527720.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.658339977	1282650.002	1527720.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.663700998	1282680.002	1527720.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.67433399	1282710.002	1527720.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.58089	1282590.002	1527690.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.58355701	1282620.002	1527690.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.58355701	1282650.002	1527690.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.644910991	1282680.002	1527690.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.484167993	1282650.002	1527660.005	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.555140972	1282650.592	1527514.316	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.626083016	1282542.034	1528156.343	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.547821999	1282118.265	1528152.725	227	2000	very high
NC	22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	0.556078017	1282736.134	1527882.367	227	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.739553988	1281270.002	1448580.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.830594003	1281270.002	1448550.005	276	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.541881979	1281210.002	1448520.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.830594003	1281240.002	1448520.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.543796003	1281180.002	1448490.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.833801985	1281210.002	1448490.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.84325999	1281180.002	1448460.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.745810986	1281210.002	1448460.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.846266985	1281150.002	1448430.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.805208981	1281180.002	1448430.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.851258993	1281120.002	1448400.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.846266985	1281150.002	1448400.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.857080996	1281090.002	1448370.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.858262002	1281120.002	1448370.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.806912005	1281150.002	1448370.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.859054983	1281060.002	1448340.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.859247983	1281090.002	1448340.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.840134978	1281120.002	1448340.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.800064027	1281150.002	1448340.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.796606004	1281180.002	1448340.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.385612011	1281210.002	1448340.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.861011982	1281030.002	1448310.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.856088996	1281060.002	1448310.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.848913014	1281090.002	1448310.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.825733006	1281120.002	1448310.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.715701997	1281150.002	1448310.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.851954997	1281030.002	1448280.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.814016998	1281060.002	1448280.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.709948003	1281090.002	1448280.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.823952973	1281000.002	1448250.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.76098299	1281030.002	1448250.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.823952973	1280970.002	1448220.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.654065013	1280820.002	1448040.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.748553991	1280700.002	1448010.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.80289799	1280970.002	1448010.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.772422016	1280760.002	1447980.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.864998996	1280880.002	1447980.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.864998996	1280910.002	1447980.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.683625996	1280640.002	1447920.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.686623991	1280730.002	1447920.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.709586978	1280550.002	1447890.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.748529017	1280580.002	1447890.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.646248996	1280610.002	1447890.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.677851975	1280700.002	1447890.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.528882027	1280520.002	1447860.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.647818983	1280550.002	1447860.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.806931019	1279590.002	1447560.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.811181009	1279620.002	1447560.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.758296013	1279590.002	1447530.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.366338015	1281660.002	1447500.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.780237019	1281690.002	1447500.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.621433973	1281450.002	1447470.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.528882027	1281360.002	1447440.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.734095991	1281390.002	1447440.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.791382015	1281420.002	1447440.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.528882027	1281300.002	1447410.005	276	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.58911401	1281330.002	1447410.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.793277979	1281360.002	1447410.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.228506997	1281150.002	1447380.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.574141979	1281180.002	1447380.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.569118977	1281210.002	1447380.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.58911401	1281240.002	1447380.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.72033298	1281270.002	1447380.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.339134991	1281840.002	1447170.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.348013014	1281810.002	1447140.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.764247	1281840.002	1447140.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.771723986	1281870.002	1447140.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.771723986	1281780.002	1447110.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.756917	1281810.002	1447110.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.484795004	1281690.002	1446960.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.594008029	1281720.002	1446960.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.73021102	1281750.002	1446960.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.801784992	1281780.002	1446960.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.579521	1281810.002	1446960.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.899636984	1280820.002	1446930.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.89587301	1280850.002	1446930.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.891079009	1280880.002	1446930.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.659092009	1281690.002	1446930.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.89587301	1280820.002	1446900.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.897705972	1280850.002	1446900.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.893786013	1280880.002	1446900.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.891079009	1280850.002	1446870.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.31725201	1281720.002	1446840.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.801784992	1281750.002	1446840.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.122672997	1281690.002	1446810.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.753238022	1281720.002	1446810.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.715278983	1280880.002	1446750.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.715278983	1280910.002	1446750.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.710278988	1280910.002	1446720.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.767920017	1280940.002	1446720.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.787325025	1280970.002	1446720.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.863660991	1281000.002	1446720.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.825492978	1281000.002	1446690.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.861720026	1281030.002	1446690.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.833200991	1281090.002	1446690.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.775493026	1281090.002	1446660.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.858612001	1281120.002	1446660.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.861208975	1281150.002	1446660.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.858612001	1281150.002	1446630.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.855039001	1281180.002	1446630.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.86185497	1281180.002	1446600.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.417144001	1281690.002	1446600.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.849600017	1281720.002	1446600.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.853920996	1281210.002	1446570.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.661845982	1281630.002	1446570.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.346536994	1281660.002	1446570.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.741423011	1281690.002	1446570.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.737236977	1281720.002	1446570.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.836982012	1281750.002	1446570.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.709501982	1281180.002	1446540.005	276	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.73535502	1281660.002	1446540.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.733469009	1281690.002	1446540.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.73012501	1281720.002	1446540.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.733469009	1281750.002	1446540.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.838562012	1281780.002	1446540.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.838562012	1281810.002	1446540.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.803499997	1281840.002	1446540.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.837164998	1281870.002	1446540.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.825733006	1281900.002	1446540.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.822458982	1281930.002	1446540.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.817499995	1281960.002	1446540.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.708225012	1281150.002	1446510.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.698563993	1281750.002	1446510.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.846534014	1281780.002	1446510.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.830594003	1281810.002	1446510.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.820811987	1281900.002	1446510.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.744634986	1281930.002	1446510.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.714268982	1281090.002	1446480.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.704056025	1281120.002	1446480.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.633669019	1281480.002	1446450.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.699226022	1281060.002	1446420.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.633669019	1281480.002	1446420.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.639962018	1281480.002	1446390.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.674692988	1281510.002	1446390.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.726390004	1281480.002	1446360.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.763103008	1281510.002	1446360.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.726390004	1281450.002	1446330.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.642677009	1281480.002	1446330.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.763103008	1281510.002	1446330.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.499848008	1281480.002	1446300.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.727137983	1281510.002	1446300.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.381779999	1281510.002	1446270.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.739695013	1281510.002	1446210.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.64071703	1281510.002	1446180.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.597362995	1281510.002	1446150.005	276	2000	very high
NC	26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	0.666849017	1281540.002	1446120.005	276	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.804561019	1289970.002	1510230.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.804561019	1290000.002	1510230.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.881107986	1289790.002	1510200.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.885755002	1289820.002	1510200.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.88380301	1289850.002	1510200.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.883083999	1289880.002	1510200.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.80193001	1289910.002	1510200.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.790713012	1289940.002	1510200.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.790713012	1289970.002	1510200.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.698839009	1290000.002	1510200.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.834834993	1290030.002	1510200.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.880617976	1289580.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.884657979	1289610.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.885986984	1289640.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.888621986	1289670.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.889231026	1289700.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.887920976	1289730.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.898299992	1289760.002	1510170.005	178	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.885986984	1289790.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.870003998	1289820.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.847374022	1289850.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium		1289880.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.69690299	1289910.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.74109	1289940.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.739215016	1289970.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.828410029	1290000.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.73733598	1290030.002	1510170.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.682187021	1289430.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.68186301	1289460.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.786216021	1289490.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.880617976	1289520.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.883943021	1289550.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.882601023	1289580.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.885277987	1289610.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.852912009	1289640.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.80252701	1289670.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.80252701	1289700.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.792870998	1289730.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.881973028	1289760.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.879254997	1289790.002	1510140.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.351823002	1289370.002	1510110.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.682187021	1289400.002	1510110.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.872318983	1289430.002	1510110.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.873722017	1289460.002	1510110.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.879254997	1289490.002	1510110.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.877147973	1289520.002	1510110.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.879415989	1289550.002	1510110.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.797048986	1289580.002	1510110.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.879254997	1289610.002	1510110.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.789774001	1289640.002	1510110.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.784074008	1289670.002	1510110.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.426358998	1289310.002	1510080.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.812727988	1289340.002	1510080.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.837817013	1289370.002	1510080.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.842522979	1289400.002	1510080.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.874373019	1289430.002	1510080.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.786552012	1289460.002	1510080.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.677631021	1289490.002	1510080.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.675768018	1289520.002	1510080.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.797048986	1289580.002	1510080.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.698132992	1289610.002	1510080.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.777374029	1289640.002	1510080.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.74793601	1289280.002	1510050.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.751648009	1289310.002	1510050.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.872556984	1289340.002	1510050.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.838551998	1289370.002	1510050.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.875533998	1289400.002	1510050.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.82814002	1289430.002	1510050.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.799085021	1289550.002	1510050.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.75898701	1289580.002	1510050.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.679521024	1289610.002	1510050.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.728806019	1290000.002	1510050.005	178	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.679494977	1290030.002	1510050.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.696186006	1290060.002	1510050.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.747013986	1289250.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.744284987	1289280.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.744284987	1289310.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.865487993	1289340.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.874373019	1289550.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.873722017	1289580.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.681905985	1289610.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.845772982	1289730.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.847312987	1289760.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.800808012	1289790.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.709712029	1289820.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.793572009	1289850.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.798780024	1289880.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.803937972	1289910.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.805646002	1289940.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.807348013	1289970.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.809044003	1290000.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.765623987	1290030.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.749742985	1290060.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.843711972	1290090.002	1510020.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.634518027	1289280.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.906675994	1289520.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.875764012	1289550.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.868061006	1289580.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.839273989	1289730.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.793572009	1289760.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.795313001	1289790.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.797048986	1289820.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.800504982	1289850.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.805646002	1289880.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.887309015	1289910.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.812418997	1289940.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.815769017	1289970.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.801132977	1290000.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.784771979	1290030.002	1509990.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.824783027	1289460.002	1509960.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.886213005	1289490.002	1509960.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.874373019	1289520.002	1509960.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.862273991	1289550.002	1509960.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.775884986	1289580.002	1509960.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.788314998	1289760.002	1509960.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.853003025	1289790.002	1509960.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.803021014	1289820.002	1509960.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.800504982	1289850.002	1509960.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.797048986	1289880.002	1509960.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.900694013	1289430.002	1509930.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.865182996	1289460.002	1509930.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.870908022	1289490.002	1509930.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.877304971	1289520.002	1509930.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.802461982	1289550.002	1509930.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.878709972	1289370.002	1509900.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.871806026	1289400.002	1509900.005	178	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.871806026	1289430.002	1509900.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.863732994	1289460.002	1509900.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.863732994	1289490.002	1509900.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.842418015	1289520.002	1509900.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.858551979	1289340.002	1509870.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.868982971	1289370.002	1509870.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.865487993	1289400.002	1509870.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.833334029	1289430.002	1509870.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.731867015	1289310.002	1509840.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.862720013	1289340.002	1509840.005	178	2000	very high
NC	28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.862720013	1289370.002	1509840.005	178	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.785251975	1322460.002	1479270.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.769132972	1322490.002	1479270.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.792285979	1322430.002	1479240.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.748389006	1322460.002	1479240.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.578077972	1322490.002	1479240.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.797505021	1322400.002	1479210.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.750245988	1322430.002	1479210.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.797505021	1322370.002	1479180.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.753948987	1322400.002	1479180.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.806092978	1322340.002	1479150.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.790534973	1322370.002	1479150.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.826309025	1322310.002	1479120.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.824678004	1322340.002	1479120.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.781704009	1322550.002	1479120.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.835955977	1322280.002	1479090.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.786728978	1322310.002	1479090.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.735237002	1322340.002	1479090.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.717886984	1322370.002	1479090.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.719797015	1322400.002	1479090.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.766779006	1322430.002	1479090.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.794031024	1322460.002	1479090.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.750245988	1322490.002	1479090.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.69283098	1322520.002	1479090.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.837540984	1322250.002	1479060.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.725120008	1322280.002	1479060.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.697974026	1322310.002	1479060.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.690213025	1322340.002	1479060.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.682424009	1322400.002	1479060.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.678520024	1322430.002	1479060.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.678520024	1322460.002	1479060.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.831162989	1322250.002	1479030.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.71103102	1322280.002	1479030.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.802390993	1322250.002	1479000.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.78877902	1322700.002	1478850.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.454362005	1322730.002	1478850.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.449090004	1322760.002	1478850.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.247751996	1322790.002	1478850.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.800957024	1322640.002	1478820.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.795771003	1322670.002	1478820.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.541176021	1322700.002	1478820.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.529793024	1322730.002	1478820.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.803466976	1322640.002	1478790.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.546898007	1322670.002	1478790.005	302	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.624294996	1322010.002	1478760.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.628234029	1322040.002	1478760.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.745405018	1322070.002	1478760.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.745405018	1322100.002	1478760.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.743538022	1322130.002	1478760.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.628234029	1322160.002	1478760.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.611348987	1322220.002	1478760.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.615284026	1322250.002	1478760.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.795771003	1322640.002	1478760.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.734584987	1322100.002	1478730.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.732698023	1322130.002	1478730.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.742098987	1322220.002	1478730.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.745833993	1322250.002	1478730.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.679633975	1322430.002	1478700.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.681885004	1322610.002	1478700.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.800957024	1322700.002	1478700.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.545544028	1322760.002	1478700.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.539828002	1322790.002	1478700.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.816973984	1322610.002	1478670.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.807793021	1322640.002	1478670.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.76859498	1322670.002	1478670.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.753948987	1322700.002	1478670.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.683835983	1322610.002	1478640.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.800957024	1322640.002	1478640.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.766377985	1322280.002	1478400.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.745045006	1322310.002	1478400.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.737986028	1322340.002	1478400.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.736105025	1322370.002	1478400.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.745045006	1322400.002	1478400.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.817282975	1322430.002	1478400.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.835663974	1322610.002	1478400.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.835663974	1322640.002	1478400.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.834071994	1322670.002	1478400.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.717396021	1322280.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.702754974	1322310.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.730443001	1322340.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.512998998	1322370.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.722410977	1322400.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.796898007	1322430.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.826762974	1322460.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.847510993	1322490.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.845972002	1322520.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.844425976	1322550.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.83247298	1322580.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.827636003	1322610.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.83247298	1322640.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.830866992	1322670.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.834071994	1322700.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.84215802	1322730.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.830866992	1322760.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.829254985	1322790.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.754061997	1322820.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.746643007	1322850.002	1478370.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.712852001	1322430.002	1478340.005	302	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.714769006	1322460.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.73675698	1322490.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.788163006	1322520.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.791673005	1322550.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.835861027	1322580.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.832670987	1322610.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.732988	1322640.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.732988	1322670.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.779298007	1322700.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.816120028	1322730.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.815223992	1322760.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.818552017	1322790.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.738156974	1322820.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.737285018	1322850.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.653253973	1322880.002	1478340.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.723510027	1322520.002	1478310.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.74634701	1322580.002	1478310.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.80400002	1322610.002	1478310.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.69225198	1322640.002	1478310.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.694639027	1322850.002	1478310.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.64735198	1322880.002	1478310.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.789920986	1322610.002	1478280.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.782859027	1322640.002	1478280.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.77392	1322610.002	1478250.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.807707012	1322640.002	1478250.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.721605003	1322670.002	1478250.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.792196989	1322640.002	1478220.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.79914701	1322670.002	1478220.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.713958025	1322700.002	1478220.005	302	2000	very high
NC	24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	0.788689971	1322700.002	1478190.005	302	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.82287699	1286190.002	1450080.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.80913502	1286220.002	1450080.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.854628026	1286190.002	1450050.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.769210994	1286220.002	1450050.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.822223008	1286190.002	1450020.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.774520993	1286220.002	1450020.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.855503023	1286160.002	1449990.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.788591981	1286190.002	1449990.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.851598978	1286220.002	1449990.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.809834003	1286250.002	1449990.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.83484602	1286160.002	1449960.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.820439994	1286190.002	1449960.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.801451027	1286220.002	1449960.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.787527025	1286250.002	1449960.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.827763021	1286160.002	1449930.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.813678026	1286190.002	1449930.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.783378005	1286220.002	1449930.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.685283005	1286250.002	1449930.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.848537982	1286130.002	1449900.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.808363974	1286160.002	1449900.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.792182982	1286190.002	1449900.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.691120982	1286220.002	1449900.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.839815974	1286070.002	1449870.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.790750027	1286100.002	1449870.005	100	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.808018982	1286130.002	1449870.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.793928981	1286160.002	1449870.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.779438972	1286190.002	1449870.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.846704006	1286010.002	1449840.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.853305995	1286040.002	1449840.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.787030995	1286070.002	1449840.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.769491017	1286100.002	1449840.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.863964021	1286280.002	1449840.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.862506986	1286310.002	1449840.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.864058018	1286010.002	1449810.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.83424902	1286040.002	1449810.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.787838995	1286070.002	1449810.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.768287003	1286100.002	1449810.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.878687978	1286250.002	1449810.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.876259029	1286280.002	1449810.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.870658994	1286310.002	1449810.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.861042023	1286340.002	1449810.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.839815974	1285980.002	1449780.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.85946101	1286010.002	1449780.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.86077702	1286040.002	1449780.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.761350989	1286070.002	1449780.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.772091985	1286100.002	1449780.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.815694988	1286130.002	1449780.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.892076015	1286160.002	1449780.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.891245008	1286190.002	1449780.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.881394029	1286220.002	1449780.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.87867099	1286250.002	1449780.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.859915972	1286010.002	1449750.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.807309985	1286040.002	1449750.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.767255008	1286070.002	1449750.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.771785975	1286100.002	1449750.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.86243999	1286130.002	1449750.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.884886026	1286160.002	1449750.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.891245008	1286190.002	1449750.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.836951971	1286220.002	1449750.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.78816998	1286250.002	1449750.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.84166801	1286040.002	1449720.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.752456009	1286070.002	1449720.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.729169011	1286100.002	1449720.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.772890985	1286130.002	1449720.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.791577995	1286160.002	1449720.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.784640014	1286190.002	1449720.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.739495993	1286040.002	1449690.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.785157025	1286070.002	1449690.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.772890985	1286100.002	1449690.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.722121	1286040.002	1449660.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.797828972	1286070.002	1449660.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.785166979	1286010.002	1449630.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.803445995	1286040.002	1449630.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.769698024	1286070.002	1449630.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.804513991	1286010.002	1449600.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.797828972	1286040.002	1449600.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.767080009	1286070.002	1449600.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.756241024	1285950.002	1449570.005	100	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.863566995	1285980.002	1449570.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.842595994	1286010.002	1449570.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.73674798	1285830.002	1449540.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.813983023	1285860.002	1449540.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.758394003	1285890.002	1449540.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.793502986	1285920.002	1449540.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.847893	1285950.002	1449540.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.84859103	1285980.002	1449540.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.798660994	1285770.002	1449510.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.878602028	1285800.002	1449510.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.887538016	1285830.002	1449510.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.890035987	1285860.002	1449510.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.819019973	1285890.002	1449510.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.822308004	1285920.002	1449510.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.784752011	1285710.002	1449480.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.848686993	1285740.002	1449480.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.867341995	1285770.002	1449480.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.891650021	1285800.002	1449480.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.823397994	1285830.002	1449480.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.814146996	1285860.002	1449480.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.708324015	1285890.002	1449480.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.802986026	1285650.002	1449450.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.85946101	1285680.002	1449450.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.894500017	1285710.002	1449450.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.866075993	1285740.002	1449450.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.735099018	1285770.002	1449450.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.727750003	1285800.002	1449450.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.722483993	1285830.002	1449450.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.600648999	1285560.002	1449420.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.638953984	1285590.002	1449420.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.652927995	1285620.002	1449420.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.799290001	1285650.002	1449420.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.839567006	1285680.002	1449420.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.752399027	1285710.002	1449420.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.748920977	1285740.002	1449420.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.727750003	1285770.002	1449420.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.600648999	1285530.002	1449390.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.659123003	1285560.002	1449390.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.789946973	1285590.002	1449390.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.638953984	1285500.002	1449360.005	100	2000	very high
NC	13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	0.839815974	1285530.002	1449360.005	100	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.769155025	1332120.002	1507650.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.77304399	1332150.002	1507650.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.77304399	1332180.002	1507650.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.77304399	1332210.002	1507650.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.767341018	1332030.002	1507620.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.777469993	1332060.002	1507620.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.77304399	1332090.002	1507620.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.771239996	1332120.002	1507620.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.765522003	1332150.002	1507620.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.765522003	1331970.002	1507590.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.771239996	1332000.002	1507590.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.771239996	1332030.002	1507590.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.763698995	1332060.002	1507590.005	96	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.734363973	1332090.002	1507590.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.678138971	1332120.002	1507590.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.663296998	1332150.002	1507590.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.768184006	1331910.002	1507560.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.769430995	1331940.002	1507560.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.718389988	1331970.002	1507560.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.721153975	1332000.002	1507560.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.728691995	1332030.002	1507560.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.638383985	1332060.002	1507560.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.659823	1332090.002	1507560.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.655439019	1332120.002	1507560.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.768145025	1331880.002	1507530.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.718389988	1331910.002	1507530.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.687811017	1331940.002	1507530.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.697440982	1331970.002	1507530.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.691622019	1332000.002	1507530.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.62391299	1332030.002	1507530.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.653927028	1332060.002	1507530.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.655893028	1332090.002	1507530.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.734363973	1331880.002	1507500.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.772046983	1331910.002	1507500.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.642323017	1331940.002	1507500.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.62588203	1331970.002	1507500.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.619974017	1332000.002	1507500.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.618005991	1332030.002	1507500.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.616037011	1332060.002	1507500.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.739001989	1331880.002	1507470.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.776480019	1331910.002	1507470.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.760039985	1331940.002	1507470.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.642323017	1331970.002	1507470.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.642323017	1332000.002	1507470.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.640353978	1332030.002	1507470.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.641463995	1332060.002	1507470.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.727853	1332090.002	1507470.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.734816015	1332360.002	1507470.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.770172	1331850.002	1507440.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.682044029	1331880.002	1507440.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.730585992	1331910.002	1507440.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.770271003	1331940.002	1507440.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.727853	1331970.002	1507440.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.769430995	1332000.002	1507440.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.770271003	1332030.002	1507440.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.72873503	1332060.002	1507440.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.763698995	1332090.002	1507440.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.751637995	1332120.002	1507440.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.64605701	1332150.002	1507440.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.634240985	1332300.002	1507440.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.740454972	1331760.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.740454972	1331790.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.766543984	1331820.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.672271013	1331850.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.64605701	1331880.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.615583003	1331910.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.76187098	1331940.002	1507410.005	96	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.76187098	1331970.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.727853	1332000.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.76187098	1332030.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.770271003	1332060.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.76454699	1332090.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.749783993	1332120.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.640150011	1332150.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.65854001	1332240.002	1507410.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.186132997	1332295.953	1507578.747	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.650665998	1331730.002	1507380.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.654609025	1331850.002	1507380.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.602275014	1331880.002	1507380.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.643634021	1331910.002	1507380.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.672271013	1331940.002	1507380.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.732367992	1331970.002	1507380.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.728583992	1332000.002	1507380.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.671413004	1332030.002	1507380.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.767616987	1332060.002	1507380.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.771178007	1332090.002	1507380.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.65854001	1332120.002	1507380.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.668353021	1331970.002	1507350.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.684229016	1332000.002	1507350.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.72775197	1332030.002	1507350.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.765798986	1332060.002	1507350.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.762679994	1332090.002	1507350.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.662468016	1332120.002	1507350.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.140498996	1331970.002	1507320.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.676183999	1332000.002	1507320.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.770271003	1332030.002	1507320.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.725955009	1332060.002	1507320.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.670313001	1332090.002	1507320.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.174783006	1331970.002	1507290.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.764505982	1332000.002	1507290.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.771079004	1332030.002	1507290.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.720978975	1332060.002	1507290.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.343769014	1331970.002	1507260.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.772046983	1332000.002	1507260.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.771979988	1332030.002	1507260.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.719070017	1332060.002	1507260.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.345250994	1332000.002	1507230.005	96	2000	very high
NC	21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	0.753489017	1332030.002	1507230.005	96	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.752397001	1289850.002	1511520.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.735601008	1289880.002	1511520.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.743102014	1289730.002	1511490.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.74496901	1289760.002	1511490.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.744539022	1289790.002	1511490.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.703984022	1289820.002	1511490.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.720795989	1289730.002	1511460.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.731387019	1289760.002	1511460.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.750617027	1289100.002	1511400.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.823327005	1289520.002	1511400.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.724249005	1289550.002	1511400.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.736455023	1289070.002	1511370.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.836610973	1289100.002	1511370.005	178	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.823327005	1289490.002	1511370.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.727599025	1289520.002	1511370.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.904148996	1289610.002	1511370.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.889210999	1289040.002	1511340.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.72933799	1289070.002	1511340.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.725106001	1289100.002	1511340.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.829503	1289460.002	1511340.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.729494989	1289490.002	1511340.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.91051501	1289010.002	1511310.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.74316901	1289040.002	1511310.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.721297979	1289070.002	1511310.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.848546028	1289310.002	1511310.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.758686006	1289430.002	1511310.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.73327601	1289460.002	1511310.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.762878001	1289490.002	1511310.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.84463799	1288980.002	1511280.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.797622979	1289010.002	1511280.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.74129802	1289040.002	1511280.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.78135699	1289460.002	1511280.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.819471002	1288980.002	1511250.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.868532002	1289010.002	1511250.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.871372998	1288980.002	1511220.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.896773994	1289610.002	1511220.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.785372019	1288980.002	1511190.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.883755982	1288860.002	1511130.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.826687992	1288890.002	1511130.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.700873971	1288920.002	1511130.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.807967007	1289550.002	1511130.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.812345028	1288830.002	1511100.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.900834024	1288860.002	1511100.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.788899004	1288890.002	1511100.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.705850005	1288920.002	1511100.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.773102999	1288950.002	1511100.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.802850008	1289550.002	1511100.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.915349007	1288830.002	1511070.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.86421299	1288860.002	1511070.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.720495999	1288890.002	1511070.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.677541971	1288920.002	1511070.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.758540988	1288950.002	1511070.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.914225996	1288590.002	1511040.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.881651998	1288830.002	1511040.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.803300977	1288860.002	1511040.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.694804013	1288890.002	1511040.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.855895996	1288590.002	1511010.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.828642011	1288620.002	1511010.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.880294979	1288830.002	1511010.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.819094002	1288860.002	1511010.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.690473974	1288890.002	1511010.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.922064006	1288560.002	1510980.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.846563995	1288590.002	1510980.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.795243025	1288620.002	1510980.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.825668991	1288860.002	1510980.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.709001005	1288890.002	1510980.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.805646002	1289430.002	1510980.005	178	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.922555983	1288530.002	1510950.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.916463971	1288560.002	1510950.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.849628985	1288590.002	1510950.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.906114995	1288620.002	1510950.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.903719008	1288860.002	1510950.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.765623987	1288890.002	1510950.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.920257986	1288500.002	1510920.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.884338975	1288530.002	1510920.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.85115099	1288560.002	1510920.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.849628985	1288590.002	1510920.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.880207002	1288620.002	1510920.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.898159027	1288890.002	1510920.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.766299009	1289460.002	1510920.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.917734981	1288500.002	1510890.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.854079008	1288530.002	1510890.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.805572987	1288560.002	1510890.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.845404983	1288590.002	1510890.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.878841996	1288620.002	1510890.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.918667018	1288470.002	1510860.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.918829978	1288500.002	1510860.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.808970988	1288530.002	1510860.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.785476983	1288560.002	1510860.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.822555006	1288590.002	1510860.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.922064006	1288470.002	1510830.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.913092971	1288500.002	1510830.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.803866029	1288530.002	1510830.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.876505017	1289340.002	1510830.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.917734981	1288500.002	1510800.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.881973028	1289310.002	1510800.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.855895996	1288500.002	1510770.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.158366993	1290780.002	1509180.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.814292014	1290810.002	1509180.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.753942013	1290840.002	1509180.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.691192985	1290870.002	1509180.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.668308973	1290900.002	1509180.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.768419981	1290930.002	1509180.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.167010993	1290780.002	1509150.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.46094799	1290810.002	1509150.005	178	2000	very high
NC	36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	0.44937399	1290840.002	1509150.005	178	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.778342009	1265490.002	1445670.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.809352994	1265520.002	1445670.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.728855014	1265310.002	1445640.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.81723398	1265340.002	1445640.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.776763976	1265370.002	1445640.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.864109993	1265400.002	1445640.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.860399008	1265430.002	1445640.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.850642025	1265460.002	1445640.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.812725008	1265490.002	1445640.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.799493015	1265520.002	1445640.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.813894987	1265340.002	1445610.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.767741978	1265370.002	1445610.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.864109993	1265400.002	1445610.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.866361976	1265430.002	1445610.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.889388025	1265460.002	1445610.005	99	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.799094975	1265490.002	1445610.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.737522006	1265520.002	1445610.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.743117988	1265340.002	1445580.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.820547998	1265370.002	1445580.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.852334976	1265400.002	1445580.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.86273998	1265430.002	1445580.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.882763028	1265460.002	1445580.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.661702991	1265490.002	1445580.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.728083014	1265520.002	1445580.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.711941004	1265340.002	1445550.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.735004008	1265370.002	1445550.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.779253006	1265400.002	1445550.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.789876997	1265430.002	1445550.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.816031992	1265460.002	1445550.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.657774985	1265490.002	1445550.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.674786985	1265520.002	1445550.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.706170976	1265340.002	1445520.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.72744	1265370.002	1445520.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.795283973	1265400.002	1445520.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.837354004	1265430.002	1445520.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.814360976	1265460.002	1445520.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.614400029	1265490.002	1445520.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.670871973	1265520.002	1445520.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.717917979	1265370.002	1445490.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.736886024	1265400.002	1445490.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.829361022	1265430.002	1445490.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.760529995	1265460.002	1445490.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.595584989	1265490.002	1445490.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.71408999	1265370.002	1445460.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.729336023	1265400.002	1445460.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.827741981	1265430.002	1445460.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.75869602	1265460.002	1445460.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.591665983	1265490.002	1445460.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.580386996	1265520.002	1445460.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.71408999	1265370.002	1445430.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.731227994	1265400.002	1445430.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.821201026	1265430.002	1445430.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.75869602	1265460.002	1445430.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.659982026	1265490.002	1445430.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.578436971	1265520.002	1445430.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.576973021	1265370.002	1445400.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.779421985	1265400.002	1445400.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.819549978	1265430.002	1445400.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.75869602	1265460.002	1445400.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.751314998	1265490.002	1445400.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.577987015	1265520.002	1445400.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.555419981	1265370.002	1445370.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.707526982	1265400.002	1445370.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.751600027	1265430.002	1445370.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.685359001	1265460.002	1445370.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.689252019	1265490.002	1445370.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.574407995	1265520.002	1445370.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.56169498	1265370.002	1445340.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.70174098	1265400.002	1445340.005	99	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.74602598	1265430.002	1445340.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.740417004	1265460.002	1445340.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.685359001	1265490.002	1445340.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.612187982	1265520.002	1445340.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.587859988	1265550.002	1445340.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.559759974	1265370.002	1445310.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.684032977	1265400.002	1445310.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.734777987	1265430.002	1445310.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.734777987	1265460.002	1445310.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.738541007	1265490.002	1445310.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.616123021	1265520.002	1445310.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.589816988	1265550.002	1445310.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.620689988	1265400.002	1445280.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.70786202	1265430.002	1445280.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.711706996	1265460.002	1445280.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.729107976	1265490.002	1445280.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.656701028	1265520.002	1445280.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.612819016	1265550.002	1445280.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.608887017	1265430.002	1445250.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.668392003	1265460.002	1445250.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.65080303	1265490.002	1445250.005	99	2000	very high
NC	21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	0.644900024	1265520.002	1445250.005	99	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.780788004	1302540.002	1495590.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.644644022	1302570.002	1495590.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.77362299	1302510.002	1495560.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.660848022	1302540.002	1495560.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.684328973	1302570.002	1495560.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.671688974	1302600.002	1495560.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.77680099	1302480.002	1495530.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.668241978	1302510.002	1495530.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.651032984	1302540.002	1495530.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.737559021	1302570.002	1495530.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.763808012	1302450.002	1495500.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.712859988	1302480.002	1495500.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.687263012	1302510.002	1495500.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.728120029	1302540.002	1495500.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.746914029	1302570.002	1495500.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.839749992	1302420.002	1495470.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.85659802	1302450.002	1495470.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.762216985	1302480.002	1495470.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.730014026	1302510.002	1495470.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.72241801	1302540.002	1495470.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.626186013	1302570.002	1495470.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.844431996	1302390.002	1495440.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.860248983	1302420.002	1495440.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.861037016	1302450.002	1495440.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.828095973	1302480.002	1495440.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.70974201	1302510.002	1495440.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.587737978	1302540.002	1495440.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.630033016	1302570.002	1495440.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.655623972	1302600.002	1495440.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.845149994	1302360.002	1495410.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.852091014	1302390.002	1495410.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.85659802	1302420.002	1495410.005	243	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.760922015	1302450.002	1495410.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.710183978	1302480.002	1495410.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.700546026	1302510.002	1495410.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.607248008	1302570.002	1495410.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.65169102	1302600.002	1495410.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.802707016	1302270.002	1495380.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.833410025	1302300.002	1495380.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.839749992	1302330.002	1495380.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.850573003	1302360.002	1495380.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.855103016	1302390.002	1495380.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.771072984	1302420.002	1495380.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.708185971	1302450.002	1495380.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.669408023	1302180.002	1495350.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.796176016	1302210.002	1495350.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.801357985	1302240.002	1495350.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.836593986	1302270.002	1495350.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.809976995	1302300.002	1495350.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.821654975	1302330.002	1495350.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.849048972	1302360.002	1495350.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.814924002	1302390.002	1495350.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.707741976	1302420.002	1495350.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.821654975	1302330.002	1495320.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.847517014	1302360.002	1495320.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.760149002	1302390.002	1495320.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.833410025	1302300.002	1495290.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.850754976	1302330.002	1495290.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.838174999	1302360.002	1495290.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.750928998	1302390.002	1495290.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.844617009	1302300.002	1495260.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.803171992	1302330.002	1495260.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.811773002	1302360.002	1495260.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.833410025	1302390.002	1495260.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.841503978	1302300.002	1495230.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.831807971	1302330.002	1495230.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.797909021	1302360.002	1495230.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.841503978	1302390.002	1495230.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.838364005	1302300.002	1495200.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.825331986	1302330.002	1495200.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.841503978	1302300.002	1495170.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.831999004	1302270.002	1495140.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.838364005	1302300.002	1495140.005	243	2000	very high
NC	10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	0.837512016	1302270.002	1495110.005	243	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.851296008	1288860.002	1510200.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.852810025	1288800.002	1510170.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.811833024	1288830.002	1510170.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.858790994	1288770.002	1510140.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.852810025	1288800.002	1510140.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.789737999	1288740.002	1510110.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.861737013	1288770.002	1510110.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.864651024	1288710.002	1510080.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.867533982	1288740.002	1510080.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.855816007	1288770.002	1510080.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.825618029	1288860.002	1510080.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.851296008	1288890.002	1510080.005	178	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.590713024	1288680.002	1510050.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.871800005	1288710.002	1510050.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.868202984	1288740.002	1510050.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.863197982	1288770.002	1510050.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.860267997	1288800.002	1510050.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.860267997	1288830.002	1510050.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.854317009	1288860.002	1510050.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.848245978	1288890.002	1510050.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.845166981	1288920.002	1510050.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.887309015	1288650.002	1510020.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.884657979	1288680.002	1510020.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.864651024	1288710.002	1510020.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.855816007	1288740.002	1510020.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.855816007	1288770.002	1510020.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.852810025	1288800.002	1510020.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.852810025	1288830.002	1510020.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.851296008	1288860.002	1510020.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.775426984	1288890.002	1510020.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.722729981	1288920.002	1510020.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.89251101	1288620.002	1509990.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.864748001	1288650.002	1509990.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.792870998	1288680.002	1509990.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.767255008	1288710.002	1509990.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.754507005	1288740.002	1509990.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.706966996	1288770.002	1509990.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.70373702	1288800.002	1509990.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.763091981	1288830.002	1509990.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.885986984	1288620.002	1509960.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.796352983	1288650.002	1509960.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.767255008	1288680.002	1509960.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.752745986	1288710.002	1509960.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.812713981	1288620.002	1509930.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.770879984	1288650.002	1509930.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.682107985	1289070.002	1509780.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.68395102	1289100.002	1509780.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.721009016	1289040.002	1509750.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.721009016	1289070.002	1509750.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.713766992	1289100.002	1509750.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.674803972	1289130.002	1509750.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.711974978	1289160.002	1509750.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.711974978	1289190.002	1509750.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.746089995	1289040.002	1509720.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.742504001	1289070.002	1509720.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.836356997	1289100.002	1509720.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.653006971	1289130.002	1509720.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.621401012	1289160.002	1509720.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.869728982	1289040.002	1509690.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.777574003	1289070.002	1509690.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.755586028	1289100.002	1509690.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.605301976	1289130.002	1509690.005	178	2000	very high
NC	28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.601710975	1289160.002	1509690.005	178	2000	very high
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.74289602	1308180.002	1455270.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.768748999	1308210.002	1455270.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.628372014	1308240.002	1455270.005	208	99	low

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.732724011	1308270.002	1455270.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.327607989	1308240.002	1455240.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.329665989	1308270.002	1455240.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.816127002	1308300.002	1455240.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.723523974	1308330.002	1455240.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.723523974	1308360.002	1455240.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.818331003	1308330.002	1455210.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.84899801	1308360.002	1455210.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.836447001	1308390.002	1455210.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.808045983	1308420.002	1455210.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.806921005	1308450.002	1455210.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.816127002	1308480.002	1455210.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.851230025	1308510.002	1455210.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.725135028	1308540.002	1455210.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.721386015	1308570.002	1455210.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.318378001	1308240.002	1455180.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.322593987	1308270.002	1455180.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.325428009	1308300.002	1455180.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.756340981	1308390.002	1455180.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.766337991	1308420.002	1455180.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.802332997	1308450.002	1455180.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.813910007	1308480.002	1455180.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.841916978	1308510.002	1455180.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.721109986	1308540.002	1455180.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.713437021	1308570.002	1455180.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.315589994	1308210.002	1455150.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.318378001	1308240.002	1455150.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.319777995	1308270.002	1455150.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.325103998	1308300.002	1455150.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.725135028	1308330.002	1455150.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.326444	1308420.002	1455150.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.736899018	1308450.002	1455150.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.318378001	1308240.002	1455120.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.729349017	1308270.002	1455120.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.375634015	1308300.002	1455120.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.334547013	1308420.002	1455120.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.721749008	1308510.002	1455060.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.705137014	1308540.002	1455060.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.629781008	1308570.002	1455060.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.723712027	1308600.002	1455060.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.708638012	1308630.002	1455060.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.325922996	1308450.002	1455030.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.724089026	1308480.002	1455030.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.717931986	1308510.002	1455030.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.719842017	1308540.002	1455030.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.725555003	1308570.002	1455030.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.710264981	1308540.002	1455000.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.703001976	1308510.002	1454970.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.699136019	1308540.002	1454970.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.706857979	1308570.002	1454970.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.697201014	1308510.002	1454940.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.224649996	1308540.002	1454940.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.228909001	1308570.002	1454940.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.558036029	1308510.002	1454910.005	208	99	low

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.204905003	1308540.002	1454910.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.204905003	1308570.002	1454910.005	208	99	low
NC	22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	0.563840985	1308540.002	1454880.005	208	99	low
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.826209009	1287750.002	1448310.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.83069098	1287750.002	1448280.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.890917003	1287750.002	1448250.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.840413988	1287780.002	1448250.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.827414989	1287870.002	1448250.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.823334992	1287900.002	1448250.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.889856994	1287750.002	1448220.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.88815099	1287780.002	1448220.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.876327991	1287810.002	1448220.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.877246022	1287840.002	1448220.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.876327991	1287870.002	1448220.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.82169199	1287900.002	1448220.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.879068971	1287720.002	1448190.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.846306026	1287750.002	1448190.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.795123994	1287780.002	1448190.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.793700993	1287810.002	1448190.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.791148007	1287840.002	1448190.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.727657974	1287870.002	1448190.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.701541007	1287900.002	1448190.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.886497974	1287690.002	1448160.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.869018018	1287720.002	1448160.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.693629026	1287750.002	1448160.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.689742982	1287780.002	1448160.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.631407022	1287810.002	1448160.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.608501971	1287840.002	1448160.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.881744981	1287690.002	1448130.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.789812982	1287720.002	1448130.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.671046972	1287750.002	1448130.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.606653988	1287780.002	1448130.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.685180008	1287810.002	1448130.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.874692976	1287660.002	1448100.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.76612401	1287690.002	1448100.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.875865996	1288290.002	1448010.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.72082001	1288260.002	1447980.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.864877999	1288410.002	1447980.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.863915026	1288440.002	1447980.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.843666971	1288350.002	1447950.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.778822005	1288380.002	1447950.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.770069003	1288410.002	1447950.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.699437976	1288440.002	1447950.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.784280002	1288320.002	1447920.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.780008018	1288350.002	1447920.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.820042014	1288560.002	1447890.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.815056026	1288590.002	1447890.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.83069098	1288500.002	1447860.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.739322007	1288530.002	1447860.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.733676016	1288560.002	1447860.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.625496984	1288590.002	1447860.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.692960024	1288620.002	1447860.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.661315024	1288380.002	1447740.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.809544027	1288410.002	1447740.005	100	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.712988019	1288380.002	1447650.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.739655972	1288380.002	1447530.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.660540998	1288380.002	1447440.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.761777997	1288410.002	1447440.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.749238014	1288440.002	1447440.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.772023022	1288470.002	1447440.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.718904972	1288500.002	1447440.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.824322999	1288530.002	1447440.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.781584978	1288650.002	1447440.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.638025999	1288410.002	1447410.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.663133979	1288440.002	1447410.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.813157976	1288620.002	1447410.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.780496001	1288650.002	1447410.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.755091012	1288590.002	1447380.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.733421028	1288620.002	1447380.005	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.708190978	1288316.727	1447836.831	100	2000	very high
NC	22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	0.743613005	1288320.584	1447847.387	100	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.782306015	1264830.002	1445700.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.816459	1264860.002	1445700.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.773289025	1264890.002	1445700.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.78490901	1264860.002	1445670.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.838177025	1264890.002	1445670.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.782306015	1264860.002	1445640.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.818661988	1264890.002	1445640.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.780085027	1264860.002	1445610.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.818661988	1264890.002	1445610.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.780085027	1264860.002	1445580.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.822170019	1264890.002	1445580.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.85926801	1264920.002	1445580.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.872972012	1264860.002	1445550.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.822170019	1264890.002	1445550.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.827782989	1264920.002	1445550.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.819968998	1264860.002	1445520.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.818661988	1264890.002	1445520.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.800884008	1264920.002	1445520.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.818906009	1264860.002	1445490.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.742222011	1264890.002	1445490.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.731877029	1264920.002	1445490.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.750769019	1264950.002	1445490.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.75120002	1264890.002	1445460.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.733765006	1264920.002	1445460.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.754469991	1264950.002	1445460.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.748480022	1264890.002	1445430.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.743570983	1264920.002	1445430.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.783976972	1264950.002	1445430.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.689490974	1264980.002	1445430.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.795117974	1264890.002	1445400.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.74495697	1264920.002	1445400.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.731877029	1264950.002	1445400.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.747053027	1264980.002	1445400.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.701210976	1264920.002	1445370.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.747498989	1264950.002	1445370.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.726193011	1264980.002	1445370.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.629882991	1265010.002	1445370.005	99	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.69709003	1264950.002	1445340.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.729984999	1264980.002	1445340.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.68712002	1265010.002	1445340.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.744771004	1264980.002	1445310.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.707952023	1265010.002	1445310.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.629882991	1265040.002	1445310.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.736522019	1264980.002	1445280.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.801177025	1265010.002	1445280.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.707952023	1265040.002	1445280.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.742222011	1265040.002	1445250.005	99	2000	very high
NC	17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	0.631852984	1265070.002	1445250.005	99	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.060871199	1313220.002	1508070.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.406040013	1313220.002	1508040.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.665190995	1313250.002	1508040.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.587451994	1313100.002	1507920.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.655324996	1313130.002	1507920.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.453453004	1313160.002	1507920.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.426167011	1313070.002	1507890.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.444671005	1313100.002	1507890.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.597941995	1313130.002	1507890.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.438450992	1313160.002	1507890.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.637611985	1313100.002	1507860.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.645488024	1313130.002	1507860.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.740687013	1314810.002	1507860.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.814885974	1314780.002	1507830.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.733162999	1314810.002	1507830.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.406203985	1313790.002	1507650.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.701680005	1313820.002	1507650.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.407862991	1313850.002	1507650.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.189186007	1313760.002	1507620.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.645588994	1313790.002	1507620.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.603830993	1313820.002	1507620.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.607761025	1313850.002	1507620.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.404547989	1313880.002	1507620.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.166943997	1313760.002	1507590.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.57920301	1313790.002	1507590.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.595981002	1313820.002	1507590.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.597941995	1313850.002	1507590.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.696559012	1313880.002	1507590.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.698494017	1313910.002	1507590.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.193252996	1313730.002	1507560.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.590103984	1313760.002	1507560.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.592061996	1313790.002	1507560.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.690741003	1313820.002	1507560.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.690741003	1313850.002	1507560.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.744503975	1313880.002	1507560.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.744503975	1313910.002	1507560.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.737013996	1313760.002	1507530.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.686852992	1313790.002	1507530.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.772575974	1313820.002	1507530.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.774375021	1313850.002	1507530.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.742636979	1313880.002	1507530.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.68879801	1313910.002	1507530.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.733247995	1313760.002	1507500.005	31	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.682958007	1313790.002	1507500.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.735131979	1313820.002	1507500.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.737013996	1313850.002	1507500.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.738892019	1313880.002	1507500.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.733247995	1313790.002	1507470.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.735131979	1313820.002	1507470.005	31	2000	very high
NC	20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	0.682958007	1313850.002	1507470.005	31	2000	very high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.192938	1311930.002	1516770.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.682869971	1311780.002	1516740.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.682869971	1311810.002	1516740.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.671370029	1311840.002	1516740.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.387598991	1311870.002	1516740.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.373957008	1311900.002	1516740.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.202722996	1311930.002	1516740.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.690638006	1311780.002	1516710.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.679192007	1311810.002	1516710.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.675284028	1311840.002	1516710.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.370539993	1311870.002	1516710.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.378681988	1311900.002	1516710.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.394057989	1311930.002	1516710.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.761690021	1311960.002	1516710.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.683094978	1311780.002	1516680.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.685045004	1311810.002	1516680.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.388889998	1311840.002	1516680.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.395684004	1311870.002	1516680.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.388889998	1311900.002	1516680.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.654009998	1311930.002	1516680.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.667670012	1311960.002	1516680.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.897176981	1311660.002	1516650.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.77452898	1311780.002	1516650.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.772728026	1311810.002	1516650.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.739027023	1311840.002	1516650.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.473641008	1311870.002	1516650.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.823683023	1311900.002	1516650.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.714652002	1311930.002	1516650.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.758377016	1311960.002	1516650.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.782513022	1311690.002	1516620.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.897773981	1311720.002	1516620.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.789578021	1311750.002	1516620.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.783459008	1311780.002	1516620.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.893382013	1311810.002	1516620.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.858493984	1311840.002	1516620.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.858493984	1311870.002	1516620.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.857008994	1311900.002	1516620.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.799844027	1311930.002	1516620.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.818888009	1311720.002	1516590.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.899819016	1311750.002	1516590.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.896521986	1311780.002	1516590.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.89526099	1311810.002	1516590.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.893990993	1311840.002	1516590.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.893990993	1311870.002	1516590.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.892099977	1311900.002	1516590.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.798117995	1311930.002	1516590.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.308672994	1311750.002	1516560.005	316	1000	high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.314162999	1311780.002	1516560.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.862828016	1311810.002	1516560.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.868780971	1311840.002	1516560.005	316	1000	high
NC	25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	0.300574988	1311780.002	1516530.005	316	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.717794001	1303080.002	1466220.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.791863024	1303110.002	1466220.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.786590993	1303140.002	1466220.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.788353026	1303170.002	1466220.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.678716004	1303200.002	1466220.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.759554029	1303230.002	1466220.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.827216983	1303050.002	1466190.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.787424028	1303080.002	1466190.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.841926992	1303110.002	1466190.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.841926992	1303140.002	1466190.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.841926992	1303170.002	1466190.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.859102011	1303200.002	1466190.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.857618988	1303230.002	1466190.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.798184991	1303050.002	1466160.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.789183974	1303080.002	1466160.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.848116994	1303110.002	1466160.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.84503597	1303140.002	1466160.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.837211013	1303170.002	1466160.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.830825984	1303200.002	1466160.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.799911022	1303050.002	1466130.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.792971015	1303080.002	1466130.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.843484998	1303110.002	1466130.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.749357998	1303050.002	1466100.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.848116994	1303080.002	1466100.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.843484998	1303110.002	1466100.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.832431972	1303140.002	1466100.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.659741998	1303050.002	1466070.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.710559011	1303080.002	1466070.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.793609977	1303110.002	1466070.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.784823	1303140.002	1466070.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.712585986	1303020.002	1466040.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.718225002	1303050.002	1466040.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.697498024	1303080.002	1466040.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.687789023	1303110.002	1466040.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.667894006	1303020.002	1466010.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.730732977	1303050.002	1466010.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.704783022	1303080.002	1466010.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.689734995	1303110.002	1466010.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.667894006	1303020.002	1465980.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.647938013	1303050.002	1465980.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.708635986	1303080.002	1465980.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.698987007	1303110.002	1465980.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.259851009	1303050.002	1465950.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.780736983	1303080.002	1465950.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.723142028	1303110.002	1465950.005	232	1000	high
NC	16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	0.713586986	1303140.002	1465950.005	232	1000	high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.744305015	1285530.002	1449180.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.775135994	1285560.002	1449180.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.790983975	1285590.002	1449180.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.787301004	1285620.002	1449180.005	100	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.790983975	1285650.002	1449180.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.789502025	1285680.002	1449180.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.784004986	1285710.002	1449180.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.786967993	1285740.002	1449180.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.765749991	1285770.002	1449180.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.722073972	1285800.002	1449180.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.597774029	1285470.002	1449150.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.66999799	1285500.002	1449150.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.800153971	1285530.002	1449150.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.799851	1285560.002	1449150.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.794191003	1285590.002	1449150.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.762484014	1285770.002	1449150.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.781705022	1285800.002	1449150.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.777493	1285830.002	1449150.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.731326997	1285860.002	1449150.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.715946019	1285890.002	1449150.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.76838702	1285920.002	1449150.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.564037979	1285440.002	1449120.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.693428993	1285470.002	1449120.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.769499004	1285500.002	1449120.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.800927997	1285530.002	1449120.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.888337016	1285800.002	1449120.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.782274008	1285830.002	1449120.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.729906976	1285440.002	1449090.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.788402975	1285470.002	1449090.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.780259013	1285500.002	1449090.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.823225975	1285290.002	1449060.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.768508017	1285320.002	1449060.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.799736023	1285440.002	1449060.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.744750977	1285470.002	1449060.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.748462021	1285290.002	1449030.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.800813019	1285320.002	1449030.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.855279982	1285350.002	1449030.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.836088002	1285410.002	1449030.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.763002992	1285440.002	1449030.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.739280999	1285470.002	1449030.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.80973202	1285350.002	1449000.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.836088002	1285380.002	1449000.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.840030015	1285410.002	1449000.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.758171976	1285440.002	1449000.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.859597981	1285350.002	1448970.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.836983979	1285380.002	1448970.005	100	2000	very high
NC	18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	0.755725026	1285410.002	1448970.005	100	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.641695023	1294020.002	1460490.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.506281018	1294050.002	1460490.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.796772003	1293990.002	1460460.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.400456011	1294020.002	1460460.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.535145998	1294050.002	1460460.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.784291029	1293990.002	1460430.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.730153024	1294020.002	1460430.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.535145998	1294050.002	1460430.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.496989012	1294080.002	1460430.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.714397013	1293990.002	1460400.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.724476993	1294020.002	1460400.005	217	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.726607978	1294050.002	1460400.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.720901012	1294080.002	1460400.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.708635986	1293990.002	1460370.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.382652014	1294020.002	1460370.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.639724016	1294050.002	1460370.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.718774021	1294080.002	1460370.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.602820992	1294020.002	1460340.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.64558202	1294050.002	1460340.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.71686703	1294080.002	1460340.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.669193029	1294020.002	1460310.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.703419983	1294050.002	1460310.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.704439998	1294080.002	1460310.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.663417995	1294020.002	1460280.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.682837009	1294050.002	1460280.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.692008972	1294080.002	1460280.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.659491003	1294020.002	1460250.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.677128017	1294050.002	1460250.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.607607007	1294080.002	1460250.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.663326979	1294020.002	1460220.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.676998019	1294050.002	1460220.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.667340994	1294080.002	1460220.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.568452001	1293990.002	1460190.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.341793001	1294020.002	1460190.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.673216999	1294050.002	1460190.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.277545005	1294080.002	1460190.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.277036995	1293990.002	1460160.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.465427995	1294020.002	1460160.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.671258986	1294050.002	1460160.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.565813005	1294080.002	1460160.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.668251991	1294020.002	1460130.005	217	2000	very high
NC	22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	0.665380001	1294050.002	1460130.005	217	2000	very high
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.740840018	1309530.002	1505130.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.235293001	1309530.002	1505100.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.240832001	1309560.002	1505100.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.745456994	1309590.002	1505100.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.235293001	1309560.002	1505070.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.768094003	1309590.002	1505070.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.680028975	1309590.002	1505040.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.768094003	1309590.002	1505010.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.762629986	1309590.002	1504890.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.766277015	1309560.002	1504860.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.760798991	1309590.002	1504860.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.766277015	1309560.002	1504830.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.757125974	1309590.002	1504830.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.765300989	1309530.002	1504800.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.719115973	1309560.002	1504800.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.483061999	1309470.002	1504770.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.481238991	1309500.002	1504770.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.606769979	1309530.002	1504770.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.611971974	1309440.002	1504740.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.499552995	1309470.002	1504740.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.497700006	1309500.002	1504740.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.726994991	1309830.002	1504650.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.491522998	1309860.002	1504650.005	252	500	moderate

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.78866303	1309890.002	1504650.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.245994002	1309770.002	1504620.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.728891015	1309800.002	1504620.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.48785001	1309830.002	1504620.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.690419018	1310100.002	1504440.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.797388971	1310010.002	1504410.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.789478004	1310040.002	1504410.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.660349011	1310070.002	1504410.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.595224977	1310100.002	1504410.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.543281019	1309950.002	1504380.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.644491017	1309980.002	1504380.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.746568024	1310010.002	1504380.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.678727984	1310040.002	1504380.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.597182989	1310070.002	1504380.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.515478015	1309920.002	1504350.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.59542799	1309950.002	1504350.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.524232984	1309980.002	1504350.005	252	500	moderate
NC	13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	0.53363198	1310010.002	1504350.005	252	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.237736002	1287180.002	1499340.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.265246004	1287150.002	1499310.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.316204995	1287180.002	1499310.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.456375986	1287120.002	1499280.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.378024995	1287150.002	1499280.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.656584024	1287540.002	1499280.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.359845996	1287090.002	1499250.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.367514998	1287120.002	1499250.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.724731982	1287390.002	1499250.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.803231001	1287420.002	1499250.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.810033977	1287510.002	1499250.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.646309018	1287060.002	1499220.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.806644022	1287360.002	1499220.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.743865013	1287390.002	1499220.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.714717984	1287420.002	1499220.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.513374984	1287540.002	1499220.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.175267994	1287060.002	1499190.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.341915995	1287300.002	1499190.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.083415397	1287330.002	1499190.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.747591972	1287360.002	1499190.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.745730996	1287390.002	1499190.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.637879014	1287420.002	1499190.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.635927975	1287450.002	1499190.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.632757008	1287540.002	1499190.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.391454995	1287300.002	1499160.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.511501014	1287390.002	1499160.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.412263006	1287420.002	1499160.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.636686027	1287570.002	1499160.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.184028	1287600.002	1499160.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.672048986	1287630.002	1499160.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.622933984	1287330.002	1499130.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.804940999	1287360.002	1499130.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.633669972	1287390.002	1499130.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.815833986	1287420.002	1499130.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.632757008	1287570.002	1499130.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.727292001	1287630.002	1499130.005	303	500	moderate

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.628827989	1287420.002	1499100.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.544448972	1287600.002	1499100.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.435396999	1287630.002	1499070.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.817498028	1287660.002	1499070.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.547250986	1287630.002	1499040.005	303	500	moderate
NC	35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	0.73209101	1287491.3	1499319.491	303	500	moderate
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.646669984	1306440.002	1495530.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.654538989	1306470.002	1495500.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.603049994	1306500.002	1495500.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.914227009	1306560.002	1495500.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.913093984	1306590.002	1495500.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.698095024	1306530.002	1495470.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.919884026	1306560.002	1495470.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.890919983	1306590.002	1495470.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.678644001	1306350.002	1495440.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.919884026	1306560.002	1495440.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.890919983	1306590.002	1495440.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.686444998	1306380.002	1495410.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.684496999	1306410.002	1495410.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.64863801	1306440.002	1495410.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.890919983	1306560.002	1495410.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.82229501	1306590.002	1495410.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.840357006	1306620.002	1495410.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.256090999	1306650.002	1495410.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.219403997	1306680.002	1495410.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.217341006	1306710.002	1495410.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.888315022	1306530.002	1495380.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.889621973	1306560.002	1495380.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.601086974	1306590.002	1495350.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.660534978	1306530.002	1495320.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.262394011	1306740.002	1495230.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.658571005	1306530.002	1495200.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.561600983	1306560.002	1495200.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.622560024	1306560.002	1495170.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.618623018	1306590.002	1495170.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.612720013	1306620.002	1495170.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.692278981	1306560.002	1495140.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.652674019	1306590.002	1495140.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.690335989	1306560.002	1495110.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.595202029	1306590.002	1495110.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.693183005	1306560.002	1495080.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.582332015	1306590.002	1495080.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.652674019	1306560.002	1495050.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.559666991	1306590.002	1495050.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.652674019	1306560.002	1495020.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.652674019	1306590.002	1495020.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.585416019	1306620.002	1495020.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.65070802	1306590.002	1494990.005	271	99	low
NC	24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	0.591283977	1306620.002	1494990.005	271	99	low
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.80528599	1265040.002	1446750.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.811159015	1265040.002	1446720.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.754956007	1265040.002	1446690.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.86690098	1265010.002	1446660.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.811797023	1265040.002	1446660.005	99	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.818843007	1265010.002	1446630.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.815684974	1265040.002	1446630.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.81764698	1265010.002	1446600.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.865110993	1264980.002	1446570.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.81764698	1265010.002	1446570.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.866183996	1264980.002	1446540.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.818805993	1265010.002	1446540.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.818458021	1264980.002	1446510.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.862471998	1265010.002	1446510.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.819557011	1264980.002	1446480.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.816413999	1265010.002	1446480.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.819557011	1264980.002	1446450.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.791218996	1265010.002	1446450.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.820653021	1264980.002	1446420.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.821744978	1265010.002	1446420.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.776347995	1265040.002	1446420.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.870037019	1264980.002	1446390.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.821744978	1265010.002	1446390.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.859242022	1265040.002	1446390.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.820653021	1264980.002	1446360.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.82280302	1265010.002	1446360.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.823175013	1265040.002	1446360.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.762041986	1265070.002	1446360.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.871914029	1264980.002	1446330.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.823826015	1265010.002	1446330.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.825572014	1265040.002	1446330.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.709075987	1265070.002	1446330.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.873694003	1264980.002	1446300.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.823826015	1265010.002	1446300.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.859242022	1265040.002	1446300.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.824846029	1265010.002	1446270.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.859242022	1265040.002	1446270.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.865877986	1265010.002	1446240.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.739435017	1265040.002	1446240.005	99	2000	very high
NC	2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	0.790057003	1265040.002	1446210.005	99	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.714241028	1273830.002	1457490.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.736519992	1273770.002	1457460.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.634875	1273800.002	1457460.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.814363003	1273470.002	1457430.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.867965996	1273500.002	1457430.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.685953021	1273650.002	1457430.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.738400996	1273680.002	1457430.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.778622985	1273470.002	1457400.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.767814994	1273500.002	1457400.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.728492022	1273530.002	1457400.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.769631982	1273560.002	1457400.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.745096028	1273590.002	1457400.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.731293976	1273620.002	1457400.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.716069996	1273650.002	1457400.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.829365015	1273470.002	1457370.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.709396005	1273500.002	1457370.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.710214019	1273530.002	1457370.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.701021016	1273560.002	1457370.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.710658014	1273590.002	1457370.005	154	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.719920993	1273680.002	1457340.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.746892989	1273710.002	1457340.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.739188015	1273740.002	1457340.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.752462029	1273680.002	1457310.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.741931975	1273650.002	1457280.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.747753978	1273680.002	1457280.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.860710979	1273620.002	1457250.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.746892989	1273650.002	1457250.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.857755005	1273590.002	1457220.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.861377001	1273620.002	1457220.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.393359005	1273650.002	1457220.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.844617009	1273140.002	1457190.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.836054981	1273200.002	1457190.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.853264987	1273560.002	1457190.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.848707974	1273110.002	1457160.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.84306401	1273140.002	1457160.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.819845021	1273200.002	1456950.005	154	2000	very high
NC	21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	0.819845021	1273170.002	1456860.005	154	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.816416979	1273110.002	1444200.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.782683015	1273080.002	1444170.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.871890008	1273110.002	1444170.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.85582	1273140.002	1444170.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.752587974	1273050.002	1444140.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.857312024	1273140.002	1444140.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.851301014	1273170.002	1444080.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.855014026	1273170.002	1444050.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.828081012	1272630.002	1443990.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.827498972	1272660.002	1443990.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.771845996	1272660.002	1443960.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.817722023	1272360.002	1443930.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.779538989	1272690.002	1443930.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.827147007	1272390.002	1443900.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.745820999	1272420.002	1443900.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.782150984	1272690.002	1443900.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.825389028	1272420.002	1443870.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.831911027	1272720.002	1443870.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.771313012	1272750.002	1443870.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.836966991	1272420.002	1443840.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.819109023	1272750.002	1443840.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.768706977	1272780.002	1443840.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.793744028	1272450.002	1443810.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.86027199	1272810.002	1443810.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.873934984	1272840.002	1443810.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.865238011	1272870.002	1443810.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.857312024	1272900.002	1443810.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.865489006	1272870.002	1443780.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.869789004	1272900.002	1443780.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.860951006	1272930.002	1443780.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.814689994	1272480.002	1443720.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.810549021	1272480.002	1443690.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.758194983	1272510.002	1443630.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.778937995	1272510.002	1443600.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.840498984	1272600.002	1443510.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.837348998	1272630.002	1443480.005	99	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.837536991	1272720.002	1443420.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.818651021	1272750.002	1443390.005	99	2000	very high
NC	14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	0.821954012	1272810.002	1443360.005	99	2000	very high
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.740785003	1305360.002	1506330.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.792001009	1305390.002	1506330.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.768296003	1305420.002	1506330.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.654964983	1305330.002	1506300.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.792001009	1305360.002	1506300.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.802395999	1305390.002	1506300.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.822753012	1305420.002	1506300.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.814261973	1305450.002	1506300.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.221302003	1305300.002	1506270.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.508917987	1305330.002	1506270.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.564954996	1305360.002	1506270.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.715662003	1305390.002	1506270.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.807516992	1305420.002	1506270.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.829268992	1305450.002	1506270.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.242219001	1305300.002	1506240.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.532079995	1305330.002	1506240.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.530179977	1305360.002	1506240.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.685558021	1305390.002	1506240.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.71182698	1305420.002	1506240.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.305023998	1305450.002	1506240.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.827650011	1305480.002	1506240.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.202867001	1305300.002	1506210.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.198078007	1305330.002	1506210.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.515079021	1305360.002	1506210.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.526390016	1305390.002	1506210.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.702198029	1305420.002	1506210.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.807516992	1305450.002	1506210.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.200939	1305330.002	1506180.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.200939	1305360.002	1506180.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.526390016	1305390.002	1506180.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.535884976	1305420.002	1506180.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.719485998	1305450.002	1506180.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.526390016	1305360.002	1506150.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.528284013	1305390.002	1506150.005	32	500	moderate
NC	14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	0.532079995	1305420.002	1506150.005	32	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.175008997	1304670.002	1487280.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.159364998	1304700.002	1487280.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.400243998	1304730.002	1487280.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.180684999	1304640.002	1487250.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.180684999	1304670.002	1487250.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.398604989	1304700.002	1487250.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.401888013	1304730.002	1487250.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.398604989	1304760.002	1487250.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.359142005	1304610.002	1487220.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.081872202	1304640.002	1487220.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.179812998	1304670.002	1487220.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.156265005	1304700.002	1487220.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.396970004	1304730.002	1487220.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.366270006	1304760.002	1487220.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.315286994	1304790.002	1487220.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.357971013	1304610.002	1487190.005	98	500	moderate

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.357618004	1304640.002	1487190.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.178945005	1304670.002	1487190.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.206856996	1304700.002	1487190.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.390473008	1304730.002	1487190.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.443906993	1304760.002	1487190.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.443906993	1304790.002	1487190.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.170996994	1304610.002	1487160.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.356451005	1304640.002	1487160.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.367747992	1304670.002	1487160.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.204898	1304700.002	1487160.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.492713004	1304730.002	1487160.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.427354008	1304760.002	1487160.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.172478005	1304790.002	1487160.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.353424013	1304640.002	1487130.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.35609901	1304670.002	1487130.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.409260988	1304700.002	1487130.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.203924	1304730.002	1487130.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.171641007	1304760.002	1487130.005	98	500	moderate
NC	7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	0.176393002	1304700.002	1487100.005	98	500	moderate
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.378374994	1330650.002	1506840.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.379956007	1330680.002	1506840.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.306923002	1330710.002	1506840.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.379956007	1330620.002	1506810.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.379956007	1330650.002	1506810.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.381541997	1330680.002	1506810.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.346996993	1330710.002	1506810.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.306923002	1330740.002	1506810.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.689146996	1330620.002	1506780.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.744839013	1330650.002	1506780.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.346996993	1330680.002	1506780.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.375007987	1330710.002	1506780.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.37658	1330740.002	1506780.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.375007987	1330770.002	1506780.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.569585979	1330590.002	1506750.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.571528971	1330620.002	1506750.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.501627982	1330650.002	1506750.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.678725004	1330680.002	1506750.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.780065	1330710.002	1506750.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.748650014	1330740.002	1506750.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.35009101	1330770.002	1506750.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.084824897	1330590.002	1506720.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.410600007	1330620.002	1506720.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.412658989	1330650.002	1506720.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.567252994	1330680.002	1506720.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.608829975	1330710.002	1506720.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.610794008	1330740.002	1506720.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.379738003	1330770.002	1506720.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.565315008	1330620.002	1506690.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.567252994	1330650.002	1506690.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.606868029	1330680.002	1506690.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.622823	1330710.002	1506690.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.612757981	1330740.002	1506690.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.569191992	1330650.002	1506660.005	96	2000	very high
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.616926014	1330680.002	1506660.005	96	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	0.699169993	1330710.002	1506660.005	96	2000	very high
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.261943012	1303500.002	1485810.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.263143986	1303530.002	1485810.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.173575997	1303560.002	1485810.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.590785027	1303470.002	1485780.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.503687024	1303500.002	1485780.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.261943012	1303530.002	1485780.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.501829028	1303560.002	1485780.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.505549014	1303590.002	1485780.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.651238978	1303440.002	1485750.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.653203011	1303470.002	1485750.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.653203011	1303500.002	1485750.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.507413983	1303530.002	1485750.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.507413983	1303560.002	1485750.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.653203011	1303590.002	1485750.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.653203011	1303620.002	1485750.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.722370982	1303440.002	1485720.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.71945399	1303470.002	1485720.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.510092974	1303500.002	1485720.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.508222997	1303530.002	1485720.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.715631008	1303560.002	1485720.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.752008021	1303590.002	1485720.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.47439	1303620.002	1485720.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.713715017	1303470.002	1485690.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.501199007	1303500.002	1485690.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.634644985	1303530.002	1485690.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.424214005	1303560.002	1485690.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.656974971	1303590.002	1485690.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.666790009	1303620.002	1485690.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.654121995	1303470.002	1485660.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.495213002	1303500.002	1485660.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.419515997	1303530.002	1485660.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.41782701	1303560.002	1485660.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.421207994	1303590.002	1485660.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.414463997	1303530.002	1485630.005	98	500	moderate
NC	4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	0.412788004	1303560.002	1485630.005	98	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.759643972	1291020.002	1447410.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.754719973	1291020.002	1447380.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.74250102	1291050.002	1447350.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.747915983	1291050.002	1447320.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.749927998	1291080.002	1447320.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.806560993	1291050.002	1447290.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.735688984	1291170.002	1447290.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.79450798	1291050.002	1447260.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.75790298	1291170.002	1447260.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.79450798	1291050.002	1447230.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.849892974	1291170.002	1447230.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.79283601	1291050.002	1447200.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.836687982	1291170.002	1447200.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.755204976	1291080.002	1447170.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.675246	1291140.002	1447170.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.675246	1291080.002	1447140.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.715807974	1291110.002	1447140.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.695635021	1291140.002	1447140.005	274	500	moderate

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.613492012	1291110.002	1447110.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.675246	1291140.002	1447110.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.675246	1291140.002	1447080.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.592934012	1291140.002	1447050.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.592934012	1291140.002	1447020.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.738444984	1291170.002	1446990.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.69847399	1291170.002	1446960.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.742518008	1291200.002	1446960.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.795832992	1291230.002	1446960.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.678111017	1291170.002	1446930.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.572493017	1291140.002	1446900.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.552222013	1291140.002	1446870.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.512391984	1291140.002	1446840.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.512391984	1291140.002	1446810.005	274	500	moderate
NC	25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	0.661208987	1291170.002	1446810.005	274	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.676720977	1305420.002	1487760.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.610476971	1305450.002	1487760.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.586576998	1305360.002	1487730.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.56794101	1305390.002	1487730.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.598704994	1305420.002	1487730.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.599156022	1305450.002	1487730.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.679717004	1305300.002	1487700.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.784111023	1305330.002	1487700.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.747189999	1305360.002	1487700.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.673354983	1305390.002	1487700.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.491025001	1305420.002	1487700.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.490601987	1305450.002	1487700.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.783159971	1305210.002	1487670.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.675813973	1305240.002	1487670.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.675813973	1305270.002	1487670.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.745325983	1305300.002	1487670.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.780556977	1305330.002	1487670.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.689639986	1305360.002	1487670.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.460649014	1305390.002	1487670.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.485520005	1305420.002	1487670.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.73971498	1305150.002	1487640.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.74158901	1305180.002	1487640.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.685747981	1305210.002	1487640.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.775188029	1305240.002	1487640.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.687695026	1305270.002	1487640.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.752985001	1305300.002	1487640.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.743458986	1305330.002	1487640.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.74158901	1305360.002	1487640.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.771586001	1305060.002	1487610.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.771586001	1305090.002	1487610.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.677944005	1305120.002	1487610.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.466643006	1305150.002	1487610.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.679898024	1305030.002	1487580.005	98	500	moderate
NC	109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	0.777203023	1305090.002	1487580.005	98	500	moderate
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.789947987	1290570.002	1510350.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.826784015	1290600.002	1510350.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.766336977	1290630.002	1510350.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.740539014	1290540.002	1510320.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.831632018	1290570.002	1510320.005	178	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.769966006	1290600.002	1510320.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.67227602	1290630.002	1510320.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.857308984	1290480.002	1510290.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.72814697	1290510.002	1510290.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.826030016	1290540.002	1510290.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.777997017	1290570.002	1510290.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.769966006	1290600.002	1510290.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.857652009	1290450.002	1510260.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.764349997	1290480.002	1510260.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.857308984	1290510.002	1510260.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.835684001	1290540.002	1510260.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.738035023	1290570.002	1510260.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.772027016	1290420.002	1510230.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.768408	1290450.002	1510230.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.85581702	1290480.002	1510230.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.867534995	1290510.002	1510230.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.782521009	1290540.002	1510230.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.762629986	1290420.002	1510200.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.852539003	1290450.002	1510200.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.819383979	1290480.002	1510200.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.827579975	1290510.002	1510200.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.825953007	1290450.002	1510170.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.896324992	1290480.002	1510170.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.764200985	1290510.002	1510170.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.897579014	1290450.002	1510140.005	178	2000	very high
NC	21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	0.861835003	1290480.002	1510140.005	178	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.698571026	1286640.002	1449690.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.700505018	1286610.002	1449660.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.758975983	1286640.002	1449660.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.766287029	1286550.002	1449630.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.630074024	1286580.002	1449630.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.753350019	1286610.002	1449630.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.796948016	1286520.002	1449600.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.693020999	1286550.002	1449600.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.685240984	1286580.002	1449600.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.777121007	1286460.002	1449570.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.780263007	1286430.002	1449540.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.802124023	1286460.002	1449540.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.775327027	1286430.002	1449510.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.722389996	1286400.002	1449480.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.671769023	1286430.002	1449480.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.787518978	1286370.002	1449450.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.665889025	1286430.002	1449450.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.788685977	1286340.002	1449420.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.814329028	1286370.002	1449420.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.790910006	1286310.002	1449390.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.824334979	1286280.002	1449360.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.818975985	1286310.002	1449360.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.81605202	1286190.002	1449330.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.798623025	1286220.002	1449330.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.821928978	1286250.002	1449330.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.785948992	1286190.002	1449300.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.694966972	1286220.002	1449300.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.69164598	1286250.002	1449300.005	100	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.810374022	1286070.002	1449120.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.796900988	1286070.002	1449090.005	100	2000	very high
NC	21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	0.831176996	1286070.002	1449060.005	100	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.760839999	1305210.002	1457520.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.273332	1305240.002	1457520.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.366324991	1305270.002	1457520.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.765680015	1305300.002	1457520.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.33743301	1305150.002	1457490.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.657289028	1305180.002	1457490.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.798784971	1305210.002	1457490.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.802228987	1305240.002	1457490.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.879269004	1305270.002	1457490.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.861862004	1305300.002	1457490.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.454948008	1305420.002	1457490.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.697930992	1305450.002	1457490.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.522854984	1305150.002	1457460.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.713247001	1305180.002	1457460.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.802228987	1305210.002	1457460.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.815797985	1305240.002	1457460.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.819122016	1305270.002	1457460.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.820774972	1305300.002	1457460.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.825695992	1305330.002	1457460.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.609632015	1305420.002	1457460.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.615375996	1305450.002	1457460.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.705058992	1305480.002	1457460.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.528843999	1305180.002	1457430.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.715164006	1305210.002	1457430.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.789793015	1305270.002	1457430.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.782517016	1305300.002	1457430.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.69986099	1305420.002	1457430.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.706339002	1305450.002	1457430.005	214	2000	very high
NC	22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	0.712459981	1305480.002	1457430.005	214	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.804561019	1289880.002	1510530.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.856691003	1289910.002	1510530.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.813030005	1289940.002	1510530.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.814706028	1289970.002	1510530.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.899416983	1290000.002	1510530.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.786427021	1289610.002	1510500.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.821114004	1289640.002	1510500.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.735369027	1289670.002	1510500.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.719325006	1289790.002	1510500.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.837503016	1289820.002	1510500.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.808753014	1289850.002	1510500.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.854260027	1289880.002	1510500.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.803644001	1289910.002	1510500.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.799409986	1289940.002	1510500.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.706562996	1289970.002	1510500.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.699657023	1290000.002	1510500.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.716376007	1289580.002	1510470.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.747232974	1289610.002	1510470.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.750948012	1289640.002	1510470.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.745369971	1289670.002	1510470.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.354912996	1289820.002	1510470.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.755980015	1289850.002	1510470.005	178	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.718078017	1289880.002	1510470.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.704635978	1289910.002	1510470.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.827584982	1289550.002	1510440.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.730355978	1289580.002	1510440.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.745369971	1289610.002	1510440.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.647985995	1289640.002	1510440.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.82269001	1289550.002	1510410.005	178	2000	very high
NC	28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.648679972	1289580.002	1510410.005	178	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.788552999	1271040.002	1444890.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.685491025	1271010.002	1444860.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.756639004	1271040.002	1444860.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.693270028	1271010.002	1444830.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.69520998	1271040.002	1444830.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.784197986	1271070.002	1444830.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.691327989	1270980.002	1444800.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.697148025	1271010.002	1444800.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.791244984	1271040.002	1444800.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.763971984	1270980.002	1444770.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.787732005	1271010.002	1444770.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.765794992	1270920.002	1444740.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.801554024	1270950.002	1444740.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.756861985	1270890.002	1444710.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.79993403	1270920.002	1444710.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.755496025	1270890.002	1444680.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.762570024	1270860.002	1444650.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.712310016	1270860.002	1444620.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.774591029	1270860.002	1444590.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.810159028	1270860.002	1444560.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.806545973	1270860.002	1444530.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.717393994	1270830.002	1444500.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.804224014	1270860.002	1444500.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.718625009	1270830.002	1444470.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.718625009	1270830.002	1444440.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.719816983	1270800.002	1444410.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.81103301	1270830.002	1444410.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.721009016	1270800.002	1444380.005	99	2000	very high
NC	16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	0.814203978	1270800.002	1444350.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.766234994	1265430.002	1446870.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.758921981	1265430.002	1446840.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.768051982	1265430.002	1446810.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.78876102	1265400.002	1446780.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.773477018	1265430.002	1446780.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.758921981	1265460.002	1446780.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.760757029	1265490.002	1446780.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.790516973	1265400.002	1446750.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.780644	1265430.002	1446750.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.769864976	1265460.002	1446750.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.777069986	1265430.002	1446720.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.786791027	1265430.002	1446690.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.790309012	1265430.002	1446660.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.771673024	1265460.002	1446660.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.77611202	1265460.002	1446630.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.672991991	1265490.002	1446630.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.786791027	1265460.002	1446600.005	99	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.777069986	1265490.002	1446600.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.691673994	1265520.002	1446600.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.801862001	1265460.002	1446570.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.801862001	1265490.002	1446570.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.787944019	1265520.002	1446570.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.756639004	1265460.002	1446540.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.804369986	1265490.002	1446540.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.782423973	1265520.002	1446540.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.807775974	1265490.002	1446510.005	99	2000	very high
NC	22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.791244984	1265520.002	1446510.005	99	2000	very high
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.301411003	1285020.002	1496040.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.361490995	1285050.002	1496040.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.273790002	1284990.002	1496010.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.178194001	1285020.002	1496010.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.274417996	1285050.002	1496010.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.485321999	1284960.002	1495980.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.371609986	1284990.002	1495980.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.460509986	1285020.002	1495980.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.608668983	1285530.002	1495800.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.746801972	1285500.002	1495770.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.714568973	1285530.002	1495770.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.674337029	1285560.002	1495770.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.68195498	1285590.002	1495770.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.725888014	1285500.002	1495740.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.674148977	1285530.002	1495740.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.520281971	1285560.002	1495740.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.560666978	1285590.002	1495740.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.626205981	1285560.002	1495710.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.570807993	1285590.002	1495710.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.56022501	1285620.002	1495710.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.684219003	1285590.002	1495680.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.565509975	1285620.002	1495680.005	304	500	moderate
NC	35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	0.670050979	1285620.002	1495650.005	304	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.458916008	1267830.002	1442550.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.621025026	1267800.002	1442520.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.62737298	1267830.002	1442520.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.610832989	1267860.002	1442520.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.565407991	1267770.002	1442490.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.610832989	1267800.002	1442490.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.621025026	1267830.002	1442490.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.510793984	1267860.002	1442490.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.662678003	1267740.002	1442460.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.706092	1267770.002	1442460.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.698367	1267800.002	1442460.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.609229982	1267740.002	1442430.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.704164028	1267770.002	1442430.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.694491982	1267740.002	1442400.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.705063999	1267770.002	1442400.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.698367	1267740.002	1442370.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.703135014	1267770.002	1442370.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.701204002	1267740.002	1442340.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.698367	1267770.002	1442340.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.703135014	1267740.002	1442310.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.650646985	1267710.002	1442280.005	248	500	moderate

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.698367	1267740.002	1442280.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.686478972	1267710.002	1442250.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.701204002	1267740.002	1442250.005	248	500	moderate
NC	8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	0.696430027	1267710.002	1442220.005	248	500	moderate
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.701654971	1269570.002	1449720.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.837619007	1269600.002	1449720.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.701654971	1269600.002	1449690.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.795005023	1269630.002	1449690.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.798473001	1269660.002	1449690.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.837858975	1269690.002	1449690.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.756112993	1269690.002	1449660.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.839434981	1269720.002	1449660.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.84482801	1269750.002	1449660.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.841718018	1269780.002	1449660.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.841004014	1269780.002	1449630.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.847908974	1269810.002	1449630.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.856972992	1269780.002	1449600.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.80786097	1269810.002	1449600.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.844120979	1269840.002	1449600.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.848742008	1269870.002	1449600.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.897771001	1269900.002	1449600.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.819540024	1269750.002	1449570.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.761622012	1269870.002	1449570.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.768908024	1269900.002	1449570.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.892127991	1269930.002	1449570.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.897206008	1269960.002	1449570.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.889388025	1269990.002	1449570.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.610587001	1269750.002	1449540.005	247	2000	very high
NC	20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	0.828720987	1269990.002	1449540.005	247	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.344195008	1302750.002	1462410.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.345678985	1302780.002	1462410.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.766870975	1302720.002	1462380.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.777908981	1302750.002	1462380.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.779695988	1302780.002	1462380.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.781477988	1302810.002	1462380.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.772305012	1302840.002	1462380.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.666971028	1302720.002	1462350.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.770712972	1302750.002	1462350.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.654053986	1302780.002	1462350.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.656020999	1302810.002	1462350.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.674805999	1302840.002	1462350.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.729151011	1302870.002	1462350.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.672849	1302900.002	1462350.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.483182013	1302780.002	1462320.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.661083996	1302810.002	1462320.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.666971028	1302840.002	1462320.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.668932021	1302870.002	1462320.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.469208986	1302900.002	1462320.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.666971028	1302840.002	1462290.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.465618014	1302870.002	1462290.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.465618014	1302900.002	1462290.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.169421002	1302930.002	1462290.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.460256994	1302870.002	1462260.005	216	2000	very high
NC	22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	0.460671008	1302900.002	1462260.005	216	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.660573006	1261260.002	1443840.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.734852016	1261050.002	1443810.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.727055013	1261080.002	1443810.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.742359996	1261110.002	1443810.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.742359996	1261140.002	1443810.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.658609986	1261170.002	1443810.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.658609986	1261200.002	1443810.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.648543	1261230.002	1443810.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.650509	1261260.002	1443810.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.662536025	1261290.002	1443810.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.662536025	1261320.002	1443810.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.664497018	1261350.002	1443810.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.664497018	1261380.002	1443810.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.725157022	1261050.002	1443780.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.652474999	1261320.002	1443780.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.652474999	1261350.002	1443780.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.263042986	1261380.002	1443780.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.256927013	1261410.002	1443780.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.648792028	1261050.002	1443750.005	125	2000	very high
NC	21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	0.322490007	1261470.002	1443750.005	125	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.845171988	1273260.002	1446360.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.703252017	1273290.002	1446360.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.854321003	1273230.002	1446330.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.840498984	1273260.002	1446330.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.610248029	1273290.002	1446330.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.786215007	1273200.002	1446300.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.840498984	1273230.002	1446300.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.744373977	1273260.002	1446300.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.625737011	1273290.002	1446300.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.794556975	1273140.002	1446270.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.780893981	1273170.002	1446270.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.795846999	1273110.002	1446240.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.786215007	1273110.002	1446210.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.798205972	1273080.002	1446180.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.801633	1273050.002	1446150.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.702211976	1273020.002	1446120.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.799350977	1273050.002	1446120.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.681608021	1273050.002	1446090.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.674772024	1273080.002	1446090.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.759528995	1273110.002	1446090.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.754005015	1273140.002	1446090.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.752155006	1273170.002	1446090.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.752155006	1273200.002	1446090.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.750302017	1273200.002	1446060.005	245	2000	very high
NC	20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	0.788336992	1273230.002	1446030.005	245	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.569417	1303770.002	1460610.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.632901013	1303800.002	1460610.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.636838019	1303830.002	1460610.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.485772997	1303740.002	1460580.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.557120979	1303770.002	1460580.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.569859982	1303800.002	1460580.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.628964007	1303830.002	1460580.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.400243014	1303740.002	1460550.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.567919016	1303770.002	1460550.005	216	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.49395901	1303800.002	1460550.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.67692399	1303830.002	1460550.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.398604006	1303740.002	1460520.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.488440007	1303770.002	1460520.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.558799982	1303800.002	1460520.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.561752975	1303830.002	1460520.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.588539004	1303800.002	1460490.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.659052014	1303830.002	1460490.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.550173998	1303860.002	1460490.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.657087982	1303800.002	1460460.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.657087982	1303830.002	1460460.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.473571986	1303860.002	1460460.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.550173998	1303830.002	1460430.005	216	2000	very high
NC	22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	0.651480019	1303856.114	1460748.968	216	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.662784994	1261230.002	1457970.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.660821974	1261260.002	1457940.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.667756975	1261170.002	1457910.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.659907997	1261230.002	1457910.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.655978978	1261290.002	1457910.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.670015991	1261170.002	1457880.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.679732978	1261200.002	1457880.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.654012978	1261320.002	1457880.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.520439029	1261440.002	1457880.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.518553019	1261470.002	1457880.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.551515996	1261500.002	1457880.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.553443015	1261530.002	1457880.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.507297993	1261560.002	1457880.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.662109971	1261200.002	1457850.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.524218023	1261440.002	1457850.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.648111999	1261380.002	1457820.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.558205009	1261440.002	1457820.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.661059976	1261380.002	1457760.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.650996029	1261410.002	1457760.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.661059976	1261410.002	1457730.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.564010024	1261440.002	1457730.005	176	2000	very high
NC	21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	0.516671002	1261500.002	1457700.005	176	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.679765999	1304010.002	1459680.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.785733998	1304040.002	1459680.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.685841024	1303980.002	1459650.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.689724028	1304010.002	1459650.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.598683	1304040.002	1459650.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.317081988	1304070.002	1459650.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.543666005	1303950.002	1459620.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.534251988	1303980.002	1459620.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.636072993	1304010.002	1459620.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.355033994	1304040.002	1459620.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.580852985	1304070.002	1459620.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.300108999	1303920.002	1459590.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.528554976	1303950.002	1459590.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.530451	1303980.002	1459590.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.632139981	1304010.002	1459590.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.311545998	1304040.002	1459590.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.236814007	1303920.002	1459560.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.298774004	1303950.002	1459560.005	216	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.112733997	1303980.002	1459560.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.161310002	1304010.002	1459560.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.111040004	1303950.002	1459530.005	216	2000	very high
NC	22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	0.111602001	1303980.002	1459530.005	216	2000	very high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.315762997	1303260.002	1465590.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.742619991	1303290.002	1465590.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.409711987	1303260.002	1465560.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.686828017	1303290.002	1465560.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.73408699	1303290.002	1465380.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.735107005	1303320.002	1465380.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.743770003	1303350.002	1465380.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.751213014	1303380.002	1465380.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.803348005	1303410.002	1465380.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.677178025	1303440.002	1465380.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.792595983	1303380.002	1465350.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.749064028	1303410.002	1465350.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.740818977	1303440.002	1465350.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.792999983	1303380.002	1465320.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.814131975	1303410.002	1465320.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.740818977	1303440.002	1465320.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.785565019	1303380.002	1465290.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.814131975	1303410.002	1465290.005	232	1000	high
NC	22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	0.814131975	1303440.002	1465290.005	232	1000	high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.798762977	1286160.002	1450500.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.767087996	1286190.002	1450500.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.752328992	1286130.002	1450470.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.775391996	1286490.002	1450290.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.772795975	1286520.002	1450290.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.77413398	1286490.002	1450260.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.771320999	1286520.002	1450260.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.769617975	1286550.002	1450260.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.772261024	1286580.002	1450260.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.673864007	1286520.002	1450230.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.780934989	1286610.002	1450230.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.858816028	1286640.002	1450230.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.747578025	1286850.002	1450170.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.740652978	1286880.002	1450170.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.626114011	1286880.002	1450140.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.65099299	1286910.002	1450140.005	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.778963029	1286415.371	1450350.021	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.865464985	1286385.19	1450405.727	100	2000	very high
NC	22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	0.875974	1286280.616	1450427.99	100	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.634660006	1268460.002	1446900.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.622844994	1268490.002	1446900.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.636629999	1268460.002	1446870.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.640568018	1268430.002	1446840.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.642536998	1268400.002	1446810.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.590838015	1268430.002	1446810.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.642536998	1268370.002	1446780.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.638598979	1268400.002	1446780.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.588257015	1268310.002	1446750.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.592171013	1268340.002	1446750.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.641485989	1268370.002	1446750.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.667271972	1268280.002	1446720.005	99	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.586301982	1268310.002	1446720.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.640568018	1268280.002	1446690.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.652374983	1268250.002	1446660.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.654341996	1268220.002	1446630.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.608781993	1268190.002	1446570.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.663114011	1268190.002	1446540.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.66496098	1268160.002	1446360.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.618344009	1268130.002	1446300.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.611320972	1268160.002	1446300.005	99	2000	very high
NC	21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	0.675673008	1268133.035	1446419.698	99	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.814126015	1303620.002	1463640.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.777163982	1303650.002	1463640.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.816568017	1303590.002	1463610.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.812448025	1303620.002	1463610.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.709079981	1303650.002	1463610.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.756752014	1303530.002	1463580.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.818229973	1303560.002	1463580.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.815797985	1303590.002	1463580.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.706710994	1303620.002	1463580.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.434978008	1303650.002	1463580.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.735970974	1303500.002	1463550.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.749064982	1303530.002	1463550.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.728839993	1303560.002	1463550.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.712480009	1303590.002	1463550.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.559742987	1303620.002	1463550.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.756752014	1303500.002	1463520.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.712585986	1303530.002	1463520.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.773572028	1303560.002	1463520.005	216	2000	very high
NC	643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	0.770309985	1303500.002	1463490.005	216	2000	very high
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.796464026	1306020.002	1455690.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.438304991	1306050.002	1455690.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.432260007	1305990.002	1455660.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.794164002	1306020.002	1455660.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.794164002	1306050.002	1455660.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.437020004	1306080.002	1455660.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.385434985	1305990.002	1455630.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.78857398	1306020.002	1455630.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.800997019	1306050.002	1455630.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.471329987	1306080.002	1455630.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.702310979	1306020.002	1455600.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.792948008	1306050.002	1455600.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.806713998	1306080.002	1455600.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.797610998	1306110.002	1455600.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.710973978	1306050.002	1455570.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.800997019	1306080.002	1455570.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.806713998	1306110.002	1455570.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.792948008	1306080.002	1455540.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.632084012	1306140.002	1455450.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.639889002	1306140.002	1455420.005	206	99	low
NC	22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	0.703247011	1306170.002	1455420.005	206	99	low
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.189429	1269720.002	1445820.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.192179993	1269750.002	1445820.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.416785985	1269780.002	1445820.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.741611004	1269750.002	1445700.005	99	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.212220997	1269750.002	1445670.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.746631026	1269780.002	1445670.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.171439007	1269780.002	1445640.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.756742001	1269810.002	1445640.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.759181023	1269840.002	1445610.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.712638974	1269810.002	1445580.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.700971007	1269840.002	1445580.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.741611004	1269660.002	1445550.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.745395005	1269690.002	1445550.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.746631026	1269720.002	1445550.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.712638974	1269750.002	1445550.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.750141025	1269780.002	1445550.005	99	2000	very high
NC	10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	0.582899988	1269810.002	1445550.005	99	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.595830977	1306530.002	1456410.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.497135013	1306560.002	1456410.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.298593014	1306440.002	1456380.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.621999979	1306470.002	1456380.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.62450099	1306500.002	1456380.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.607522011	1306530.002	1456380.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.586775005	1306560.002	1456380.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.616771996	1306470.002	1456350.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.619386017	1306500.002	1456350.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.625733018	1306530.002	1456350.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.532405972	1306560.002	1456350.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.708577991	1306380.002	1456290.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.79776299	1306410.002	1456290.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.78362298	1306440.002	1456290.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.709812999	1306350.002	1456260.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.800997019	1306380.002	1456260.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.783636987	1306410.002	1456260.005	214	2000	very high
NC	22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	0.433562011	1306380.002	1456230.005	214	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.845734	1266270.002	1445370.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.793591976	1266240.002	1445340.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.838469982	1266270.002	1445340.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.799983025	1266300.002	1445340.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.703971028	1266180.002	1445310.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.769954979	1266210.002	1445310.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.850246012	1266240.002	1445310.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.822854996	1266270.002	1445310.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.789714992	1266300.002	1445310.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.784807026	1266150.002	1445280.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.800522029	1266180.002	1445280.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.841072977	1266210.002	1445280.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.797671974	1266240.002	1445280.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.657163978	1266060.002	1445250.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.732136011	1266090.002	1445250.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.823637009	1266120.002	1445250.005	99	2000	very high
NC	22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	0.788336992	1266150.002	1445250.005	99	2000	very high
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.306903005	1265370.002	1458600.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.445921004	1265400.002	1458600.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.414627999	1265430.002	1458600.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.456707001	1265370.002	1458570.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.458483011	1265400.002	1458570.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.458483011	1265430.002	1458570.005	292	500	moderate

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.45323801	1265370.002	1458540.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.45323801	1265400.002	1458540.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.449712008	1265370.002	1458510.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.451472998	1265400.002	1458510.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.372355998	1265340.002	1458480.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.418172985	1265370.002	1458480.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.406468987	1265400.002	1458480.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.385304987	1265430.002	1458480.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.411193013	1265370.002	1458450.005	292	500	moderate
NC	29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	0.386536002	1265400.002	1458450.005	292	500	moderate
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.780879021	1295580.002	1460640.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.636515975	1295610.002	1460640.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.774697006	1295550.002	1460610.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.772592008	1295580.002	1460610.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.630611002	1295610.002	1460610.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.618800998	1295640.002	1460610.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.775887012	1295520.002	1460580.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.772592008	1295550.002	1460580.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.733066022	1295580.002	1460580.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.624705017	1295610.002	1460580.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.771396995	1295520.002	1460550.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.731525004	1295550.002	1460550.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.633449972	1295580.002	1460550.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.768998981	1295520.002	1460520.005	217	2000	very high
NC	22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	0.698175013	1295550.002	1460520.005	217	2000	very high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.127513006	1298910.002	1518240.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.096638799	1298850.002	1518210.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.167145997	1298880.002	1518210.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.127009004	1298910.002	1518210.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.12387	1298940.002	1518210.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.096638799	1298820.002	1518180.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.265195012	1298850.002	1518180.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.603654027	1298880.002	1518180.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.119800001	1298910.002	1518180.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.102169	1298940.002	1518180.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.286839992	1298820.002	1518150.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.260414988	1298850.002	1518150.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.582931995	1298880.002	1518150.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.696721971	1298790.002	1518120.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.285562009	1298820.002	1518120.005	44	1000	high
NC	12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	0.696721971	1298700.002	1518030.005	44	1000	high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.547384977	1315590.002	1509420.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.549305022	1315560.002	1509390.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.551227987	1315590.002	1509390.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.554037988	1315530.002	1509360.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.557896018	1315560.002	1509360.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.557896018	1315530.002	1509330.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.374229997	1315440.002	1509270.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.384665012	1315470.002	1509270.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.389483005	1315500.002	1509270.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.457497001	1315440.002	1509240.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.470669001	1315470.002	1509240.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.506030023	1315500.002	1509240.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.61086899	1315440.002	1509210.005	179	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.606940985	1315470.002	1509210.005	179	2000	very high
NC	14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	0.603015006	1315500.002	1509210.005	179	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.589092016	1270320.002	1445460.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.741057992	1270380.002	1445430.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.820147991	1270410.002	1445430.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.807672024	1270470.002	1445430.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.819283009	1270500.002	1445430.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.709693015	1270530.002	1445430.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.79993403	1270560.002	1445430.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.806989014	1270650.002	1445430.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.80528599	1270680.002	1445430.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.81685102	1270470.002	1445400.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.717794001	1270590.002	1445400.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.709075987	1270620.002	1445400.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.815744996	1270470.002	1445370.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.805415988	1270500.002	1445340.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.798206985	1270530.002	1445280.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.802954972	1270530.002	1445250.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.792994022	1270590.002	1445220.005	99	2000	very high
NC	20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	0.787732005	1270620.002	1445190.005	99	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.791863024	1304730.002	1457970.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.647489011	1304760.002	1457970.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.647489011	1304730.002	1457940.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.641587973	1304760.002	1457940.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.791863024	1304700.002	1457910.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.643555999	1304730.002	1457910.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.635684013	1304760.002	1457910.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.643555999	1304730.002	1457880.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.622740984	1304760.002	1457880.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.649455011	1304730.002	1457850.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.690842986	1304760.002	1457850.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.733552992	1304730.002	1457820.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.690842986	1304760.002	1457820.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.42080301	1304730.002	1457790.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.417423993	1304760.002	1457790.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.133673996	1304790.002	1457790.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.116099998	1304760.002	1457760.005	214	2000	very high
NC	22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	0.111872002	1304790.002	1457760.005	214	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.765137017	1290840.002	1510380.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.707005024	1290810.002	1510350.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.70520401	1290840.002	1510350.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.754799008	1290870.002	1510350.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.756522	1290900.002	1510350.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.687089026	1290930.002	1510350.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.692480981	1290810.002	1510320.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.68530798	1290840.002	1510320.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.683975995	1290870.002	1510320.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.680406988	1290900.002	1510320.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.340454012	1290930.002	1510320.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.341789991	1290960.002	1510320.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.340454012	1290990.002	1510320.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.69066602	1290810.002	1510290.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.683975995	1290840.002	1510290.005	178	2000	very high
NC	21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	0.343129992	1290810.002	1510260.005	178	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.885986984	1288620.002	1510620.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.880617976	1288650.002	1510620.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.881973028	1288680.002	1510620.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.841652989	1288710.002	1510620.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.691192985	1288620.002	1510590.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.685355008	1288650.002	1510590.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.865182996	1288680.002	1510590.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.876505017	1288710.002	1510590.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.876505017	1288740.002	1510590.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.772208989	1288680.002	1510560.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.775638998	1288710.002	1510560.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.870908022	1288740.002	1510560.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.873722017	1288770.002	1510560.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.463512987	1288710.002	1510530.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.772208989	1288740.002	1510530.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.837453008	1288770.002	1510530.005	178	2000	very high
NC	28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	0.87528199	1288800.002	1510530.005	178	2000	very high
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.646143973	1283580.002	1479900.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.652047992	1283550.002	1479870.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.646143973	1283580.002	1479870.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.650080025	1283580.002	1479840.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.646143973	1283820.002	1479750.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.654013991	1283790.002	1479720.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.646143973	1283820.002	1479720.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.608152986	1283850.002	1479720.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.659910023	1283760.002	1479690.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.619958997	1283790.002	1479690.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.448749006	1283820.002	1479690.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.43207401	1283850.002	1479690.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.425621986	1283880.002	1479690.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.544439971	1283790.002	1479660.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.430754989	1283820.002	1479660.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.427329004	1283850.002	1479660.005	272	500	moderate
NC	24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	0.632358015	1283800.859	1479875.481	272	500	moderate
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.480073005	1304580.002	1458390.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.675410986	1304550.002	1458360.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.481893986	1304580.002	1458360.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.602837026	1304490.002	1458330.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.724521995	1304520.002	1458330.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.716657996	1304550.002	1458330.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.675410986	1304580.002	1458330.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.596957028	1304490.002	1458300.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.678873003	1304520.002	1458300.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.716657996	1304550.002	1458300.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.718569994	1304580.002	1458300.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.613788009	1304520.002	1458270.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.714743018	1304550.002	1458270.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.733992994	1304580.002	1458270.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.619683981	1304550.002	1458240.005	214	2000	very high
NC	22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	0.722386003	1304580.002	1458240.005	214	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.590077996	1292550.002	1461000.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.741905987	1292550.002	1460970.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.697251976	1292580.002	1460970.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.743776023	1292550.002	1460940.005	217	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.703052998	1292580.002	1460940.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.692627013	1292610.002	1460940.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.294566989	1293360.002	1460850.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.682264984	1293390.002	1460850.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.299876988	1293360.002	1460820.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.383949995	1292670.002	1460670.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.382355005	1292700.002	1460670.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.722482026	1293960.002	1460460.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.663123012	1293930.002	1460430.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.718666017	1293960.002	1460430.005	217	2000	very high
NC	35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	0.749929011	1293577.694	1460949.527	217	2000	very high
NC	21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	0.460608989	1263510.002	1454460.005	177	2000	very high
NC	21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	0.465974003	1263510.002	1454430.005	177	2000	very high
NC	21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	0.465974003	1263540.002	1454430.005	177	2000	very high
NC	21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	0.473396987	1263480.002	1454400.005	177	2000	very high
NC	21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	0.464183003	1263510.002	1454400.005	177	2000	very high
NC	21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	0.478837013	1263540.002	1454400.005	177	2000	very high
NC	21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	0.385264009	1263540.002	1454370.005	177	2000	very high
NC	21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	0.33127901	1263570.002	1454370.005	177	2000	very high
NC	21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	0.216549993	1263630.002	1454370.005	177	2000	very high
NC	21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	0.218605995	1263660.002	1454340.005	177	2000	very high
NC	21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	0.260105014	1263720.002	1454310.005	177	2000	very high
NC	21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	0.269955993	1263750.002	1454280.005	177	2000	very high
NC	22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	0.798326015	1285200.002	1448610.005	100	2000	very high
NC	22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	0.870290995	1285230.002	1448610.005	100	2000	very high
NC	22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	0.885115027	1285260.002	1448610.005	100	2000	very high
NC	22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	0.806289017	1285290.002	1448610.005	100	2000	very high
NC	22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	0.861528993	1285320.002	1448610.005	100	2000	very high
NC	22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	0.806289017	1285350.002	1448610.005	100	2000	very high
NC	22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	0.85026598	1285380.002	1448610.005	100	2000	very high
NC	22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	0.685491025	1285410.002	1448610.005	100	2000	very high
NC	22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	0.877083004	1285200.002	1448580.005	100	2000	very high
NC	22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	0.881004989	1285230.002	1448580.005	100	2000	very high
NC	22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	0.805894017	1285380.002	1448580.005	100	2000	very high
NC	22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	0.777327001	1285410.002	1448580.005	100	2000	very high
NC	28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	0.835260987	1293150.002	1521600.005	291	99	low
NC	28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	0.828507006	1293180.002	1521600.005	291	99	low
NC	28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	0.829985976	1293120.002	1521570.005	291	99	low
NC	28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	0.824038982	1293150.002	1521570.005	291	99	low
NC	28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	0.81962198	1293120.002	1521540.005	291	99	low
NC	28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	0.616685987	1293390.002	1521510.005	291	99	low
NC	28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	0.652571023	1293420.002	1521510.005	291	99	low
NC	28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	0.605802	1293390.002	1521480.005	291	99	low
NC	28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	0.651648998	1293690.002	1521300.005	291	99	low
NC	28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	0.642652988	1293690.002	1521270.005	291	99	low
NC	28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	0.649851024	1293660.002	1521240.005	291	99	low
NC	28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	0.646251976	1293660.002	1521210.005	291	99	low
NC	22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	0.712217987	1293660.002	1460040.005	217	2000	very high
NC	22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	0.701694012	1293690.002	1460040.005	217	2000	very high
NC	22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	0.702591002	1293660.002	1460010.005	217	2000	very high
NC	22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	0.703625023	1293690.002	1460010.005	217	2000	very high
NC	22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	0.579267979	1293720.002	1460010.005	217	2000	very high
NC	22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	0.583172023	1293660.002	1459980.005	217	2000	very high
NC	22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	0.705554008	1293690.002	1459980.005	217	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	0.581219018	1293720.002	1459980.005	217	2000	very high
NC	22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	0.645725012	1293750.002	1459980.005	217	2000	very high
NC	22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	0.581219018	1293660.002	1459950.005	217	2000	very high
NC	22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	0.585125983	1293690.002	1459950.005	217	2000	very high
NC	22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	0.260280997	1293720.002	1459950.005	217	2000	very high
NC	1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	0.705465019	1286100.002	1448610.005	100	2000	very high
NC	1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	0.789880991	1286100.002	1448580.005	100	2000	very high
NC	1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	0.673542023	1286130.002	1448580.005	100	2000	very high
NC	1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	0.618948996	1286160.002	1448580.005	100	2000	very high
NC	1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	0.789880991	1286130.002	1448550.005	100	2000	very high
NC	1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	0.652493	1286220.002	1448550.005	100	2000	very high
NC	1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	0.696787	1286250.002	1448550.005	100	2000	very high
NC	1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	0.505321026	1286370.002	1448550.005	100	2000	very high
NC	1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	0.792753994	1286250.002	1448520.005	100	2000	very high
NC	1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	0.668474972	1286280.002	1448520.005	100	2000	very high
NC	1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	0.732720017	1286310.002	1448520.005	100	2000	very high
NC	1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	0.745917022	1286340.002	1448520.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.797677994	1285980.002	1449000.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.73328799	1286010.002	1449000.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.758872986	1285950.002	1448970.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.758171976	1285980.002	1448970.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.795422018	1286010.002	1448970.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.759172022	1286040.002	1448970.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.759020984	1285980.002	1448940.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.764144003	1286010.002	1448940.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.759566009	1286040.002	1448940.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.737210989	1286070.002	1448940.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.755725026	1286040.002	1448910.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.812020004	1286070.002	1448910.005	100	2000	very high
NC	22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	0.739970028	1286100.002	1448910.005	100	2000	very high
NC	22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	0.810764015	1305150.002	1457700.005	214	2000	very high
NC	22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	0.666580021	1305060.002	1457670.005	214	2000	very high
NC	22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	0.809073985	1305090.002	1457670.005	214	2000	very high
NC	22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	0.816568017	1305120.002	1457670.005	214	2000	very high
NC	22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	0.615518987	1304970.002	1457640.005	214	2000	very high
NC	22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	0.793604016	1305000.002	1457640.005	214	2000	very high
NC	22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	0.795346022	1305030.002	1457640.005	214	2000	very high
NC	22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	0.80053699	1305060.002	1457640.005	214	2000	very high
NC	22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	0.820969999	1305090.002	1457640.005	214	2000	very high
NC	22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	0.814126015	1305120.002	1457640.005	214	2000	very high
NC	22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	0.571865022	1285500.002	1449240.005	100	2000	very high
NC	22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	0.810890019	1285530.002	1449240.005	100	2000	very high
NC	22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	0.800471008	1285560.002	1449240.005	100	2000	very high
NC	22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	0.782154024	1285590.002	1449240.005	100	2000	very high
NC	22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	0.800471008	1285620.002	1449240.005	100	2000	very high
NC	22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	0.800471008	1285650.002	1449240.005	100	2000	very high
NC	22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	0.800471008	1285680.002	1449240.005	100	2000	very high
NC	22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	0.800471008	1285710.002	1449240.005	100	2000	very high
NC	22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	0.615019023	1285500.002	1449210.005	100	2000	very high
NC	22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	0.774975002	1285800.002	1449210.005	100	2000	very high
NC	22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	0.77234	1285830.002	1449210.005	100	2000	very high
NC	22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	0.790952027	1285860.002	1449210.005	100	2000	very high
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.186012998	1321560.002	1526760.005	308	2000	very high
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.332121015	1321650.002	1526670.005	308	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.302451015	1321680.002	1526670.005	308	2000	very high
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.269627005	1321620.002	1526640.005	308	2000	very high
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.260120004	1321650.002	1526640.005	308	2000	very high
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.263011992	1321680.002	1526640.005	308	2000	very high
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.333819002	1321710.002	1526640.005	308	2000	very high
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.217971995	1321530.002	1526610.005	308	2000	very high
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.220492005	1321560.002	1526610.005	308	2000	very high
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.270853996	1321590.002	1526610.005	308	2000	very high
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.335000992	1321620.002	1526610.005	308	2000	very high
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.333819002	1321740.002	1526610.005	308	2000	very high
NC	36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	0.269627005	1321608.517	1526714.568	308	2000	very high
NC	36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.537361026	1305750.002	1511730.005	295	500	moderate
NC	36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.87035501	1305780.002	1511730.005	295	500	moderate
NC	36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.63836199	1305750.002	1511700.005	295	500	moderate
NC	36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.836875021	1305780.002	1511700.005	295	500	moderate
NC	36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.676259995	1305750.002	1511670.005	295	500	moderate
NC	36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.858767986	1305780.002	1511670.005	295	500	moderate
NC	36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.710713029	1305810.002	1511670.005	295	500	moderate
NC	36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.664507985	1305750.002	1511640.005	295	500	moderate
NC	36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.828876019	1305780.002	1511640.005	295	500	moderate
NC	36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.673443019	1305810.002	1511640.005	295	500	moderate
NC	36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.851278007	1305780.002	1511610.005	295	500	moderate
NC	36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.662160993	1305810.002	1511580.005	295	500	moderate
NC	21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	0.483787	1262910.002	1458060.005	176	2000	very high
NC	21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	0.485082	1262940.002	1458060.005	176	2000	very high
NC	21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	0.485082	1262970.002	1458060.005	176	2000	very high
NC	21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	0.375140011	1263090.002	1458060.005	176	2000	very high
NC	21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	0.48476401	1262820.002	1458030.005	176	2000	very high
NC	21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	0.48842901	1262760.002	1458000.005	176	2000	very high
NC	21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	0.497648001	1262520.002	1457970.005	176	2000	very high
NC	21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	0.49950099	1262550.002	1457970.005	176	2000	very high
NC	21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	0.495797992	1262580.002	1457970.005	176	2000	very high
NC	21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	0.492107004	1262670.002	1457970.005	176	2000	very high
NC	20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	0.74436599	1271400.002	1449000.005	247	2000	very high
NC	20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	0.755725026	1271430.002	1449000.005	247	2000	very high
NC	20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	0.753879011	1271460.002	1449000.005	247	2000	very high
NC	20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	0.703881025	1271490.002	1449000.005	247	2000	very high
NC	20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	0.749951005	1271370.002	1448970.005	247	2000	very high
NC	20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	0.709659994	1271400.002	1448970.005	247	2000	very high
NC	20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	0.584088981	1271430.002	1448970.005	247	2000	very high
NC	20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	0.570446014	1271460.002	1448970.005	247	2000	very high
NC	20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	0.58168602	1271400.002	1448940.005	247	2000	very high
NC	20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	0.520126998	1271430.002	1448940.005	247	2000	very high
NC	20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	0.767463982	1271100.002	1448790.005	247	2000	very high
NC	21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	0.515016973	1261740.002	1457940.005	176	2000	very high
NC	21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	0.488182992	1261740.002	1457910.005	176	2000	very high
NC	21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	0.536180973	1261770.002	1457910.005	176	2000	very high
NC	21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	0.205844998	1261740.002	1457880.005	176	2000	very high
NC	21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	0.524778008	1261770.002	1457880.005	176	2000	very high
NC	21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	0.541914999	1261740.002	1457850.005	176	2000	very high
NC	21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	0.534274995	1261770.002	1457850.005	176	2000	very high
NC	21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	0.547631979	1261740.002	1457820.005	176	2000	very high
NC	21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	0.538052976	1261770.002	1457820.005	176	2000	very high
NC	22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	0.370361	1306260.002	1456590.005	214	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	0.475957006	1306230.002	1456560.005	214	2000	very high
NC	22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	0.494574994	1306260.002	1456560.005	214	2000	very high
NC	22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	0.414294988	1306290.002	1456560.005	214	2000	very high
NC	22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	0.575685978	1306200.002	1456530.005	214	2000	very high
NC	22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	0.526853979	1306230.002	1456530.005	214	2000	very high
NC	22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	0.575685978	1306260.002	1456530.005	214	2000	very high
NC	22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	0.446577996	1306290.002	1456530.005	214	2000	very high
NC	22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	0.445780993	1306200.002	1456500.005	214	2000	very high
NC	22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.719887972	1265760.002	1445790.005	99	2000	very high
NC	22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.71606499	1265790.002	1445790.005	99	2000	very high
NC	22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.78421998	1265820.002	1445790.005	99	2000	very high
NC	22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.814401984	1265910.002	1445790.005	99	2000	very high
NC	22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.77403301	1265940.002	1445790.005	99	2000	very high
NC	22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.777622998	1265970.002	1445790.005	99	2000	very high
NC	22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.770328999	1265820.002	1445760.005	99	2000	very high
NC	22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.777558029	1265910.002	1445760.005	99	2000	very high
NC	22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.766797006	1265940.002	1445760.005	99	2000	very high
NC	22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.768612981	1265970.002	1445760.005	99	2000	very high
NC	22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	0.713829994	1265940.002	1445730.005	99	2000	very high
NC	8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	0.607694983	1269420.002	1451460.005	247	2000	very high
NC	8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	0.881412983	1269450.002	1451430.005	247	2000	very high
NC	8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	0.841530025	1269480.002	1451430.005	247	2000	very high
NC	8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	0.839963973	1269510.002	1451430.005	247	2000	very high
NC	8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	0.850268006	1269510.002	1451400.005	247	2000	very high
NC	8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	0.853298008	1269540.002	1451400.005	247	2000	very high
NC	8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	0.891979992	1269570.002	1451400.005	247	2000	very high
NC	8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	0.818527997	1269600.002	1451400.005	247	2000	very high
NC	17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	0.670906007	1268220.002	1447320.005	99	2000	very high
NC	17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	0.686731994	1268160.002	1447290.005	99	2000	very high
NC	17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	0.500675023	1267890.002	1447260.005	99	2000	very high
NC	17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	0.525722027	1267920.002	1447260.005	99	2000	very high
NC	17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	0.592637002	1267950.002	1447260.005	99	2000	very high
NC	17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	0.635334015	1267980.002	1447260.005	99	2000	very high
NC	17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	0.637299001	1268010.002	1447260.005	99	2000	very high
NC	17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	0.635334015	1268040.002	1447260.005	99	2000	very high
NC	17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	0.690609992	1268130.002	1447260.005	99	2000	very high
NC	17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	0.569305003	1267511.796	1446916.712	99	2000	very high
NC	17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	0.640110016	1267734.371	1446995.529	99	2000	very high
NC	4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	0.32783401	1332510.002	1527990.005	59	500	moderate
NC	4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	0.302451015	1332420.002	1527930.005	59	500	moderate
NC	4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	0.273986995	1332000.002	1527900.005	59	500	moderate
NC	4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	0.305139005	1332030.002	1527900.005	59	500	moderate
NC	4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	0.339356005	1332360.002	1527900.005	59	500	moderate
NC	4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	0.329259008	1332390.002	1527900.005	59	500	moderate
NC	4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	0.255400002	1332420.002	1527900.005	59	500	moderate
NC	21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	0.279439986	1271790.002	1448580.005	247	2000	very high
NC	21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	0.683167994	1271820.002	1448580.005	247	2000	very high
NC	21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	0.673398972	1271850.002	1448580.005	247	2000	very high
NC	21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	0.767699003	1271790.002	1448550.005	247	2000	very high
NC	21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	0.641490996	1271820.002	1448550.005	247	2000	very high
NC	21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	0.773127019	1271760.002	1448520.005	247	2000	very high
NC	21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	0.771322012	1271790.002	1448520.005	247	2000	very high
NC	21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	0.378468007	1271820.002	1448520.005	247	2000	very high
NC	21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	0.739439011	1271790.002	1448490.005	247	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	0.579118013	1305480.002	1487340.005	98	500	moderate
NC	13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	0.584976017	1305510.002	1487340.005	98	500	moderate
NC	13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	0.58693099	1305540.002	1487340.005	98	500	moderate
NC	13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	0.588886976	1305570.002	1487340.005	98	500	moderate
NC	13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	0.592803001	1305600.002	1487340.005	98	500	moderate
NC	13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	0.559122026	1305630.002	1487340.005	98	500	moderate
NC	13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	0.594762981	1305660.002	1487340.005	98	500	moderate
NC	13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	0.600646973	1305690.002	1487340.005	98	500	moderate
NC	28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	0.138410002	1246110.002	1446210.005	287	500	moderate
NC	28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	0.354447991	1246170.002	1446180.005	287	500	moderate
NC	28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	0.362066001	1246230.002	1446150.005	287	500	moderate
NC	28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	0.362066001	1246260.002	1446120.005	287	500	moderate
NC	28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	0.370644003	1246290.002	1446090.005	287	500	moderate
NC	28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	0.366822988	1246320.002	1446060.005	287	500	moderate
NC	28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	0.332004994	1246350.002	1446030.005	287	500	moderate
NC	28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	0.358307987	1246440.002	1445910.005	287	500	moderate
NC	28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	0.347622991	1246470.002	1445880.005	287	500	moderate
NC	35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	0.110303998	1354590.002	1520610.005	306	99	low
NC	35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	0.109748997	1354620.002	1520610.005	306	99	low
NC	35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	0.112241	1354560.002	1520580.005	306	99	low
NC	35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	0.101609997	1354590.002	1520580.005	306	99	low
NC	35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	0.102127001	1354620.002	1520580.005	306	99	low
NC	35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	0.114298999	1354650.002	1520580.005	306	99	low
NC	35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	0.086769603	1354560.002	1520550.005	306	99	low
NC	35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	0.050329801	1354590.002	1520550.005	306	99	low
NC	35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	0.065958902	1354620.002	1520550.005	306	99	low
NC	29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	0.713234007	1335810.002	1494150.005	293	99	unknown
NC	29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	0.749671996	1335780.002	1494120.005	293	99	unknown
NC	29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	0.608030975	1335810.002	1494120.005	293	99	unknown
NC	29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	0.608030975	1335840.002	1494120.005	293	99	unknown
NC	29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	0.751525998	1335780.002	1494090.005	293	99	unknown
NC	29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	0.751525998	1335810.002	1494090.005	293	99	unknown
NC	29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	0.616815984	1335840.002	1494090.005	293	99	unknown
NC	29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	0.137737006	1335810.002	1494060.005	293	99	unknown
NC	3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	0.799605012	1295040.002	1456860.005	93	500	moderate
NC	3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	0.743893981	1295070.002	1456860.005	93	500	moderate
NC	3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	0.733421981	1295100.002	1456860.005	93	500	moderate
NC	3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	0.369576007	1295040.002	1456830.005	93	500	moderate
NC	3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	0.324681997	1295070.002	1456830.005	93	500	moderate
NC	3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	0.224803999	1295100.002	1456830.005	93	500	moderate
NC	3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	0.219571993	1295070.002	1456800.005	93	500	moderate
NC	3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	0.218770996	1295100.002	1456800.005	93	500	moderate
NC	31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	0.00554191	1323900.002	1449690.005	296	500	moderate
NC	31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	0.081489101	1323930.002	1449690.005	296	500	moderate
NC	31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	0.081904002	1323960.002	1449690.005	296	500	moderate
NC	31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	0.019058701	1323900.002	1449660.005	296	500	moderate
NC	31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	0.075052299	1323930.002	1449660.005	296	500	moderate
NC	31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	0.0983482	1323960.002	1449660.005	296	500	moderate
NC	31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	0.019100999	1323900.002	1449630.005	296	500	moderate
NC	31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	0.077639997	1323930.002	1449630.005	296	500	moderate
NC	31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	0.099172004	1323960.002	1449630.005	296	500	moderate
NC	22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	0.514431	1303890.002	1461210.005	216	2000	very high
NC	22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	0.856850982	1303920.002	1461210.005	216	2000	very high
NC	22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	0.859816015	1303890.002	1461180.005	216	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	0.852172971	1303920.002	1461180.005	216	2000	very high
NC	22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	0.865653992	1303950.002	1461180.005	216	2000	very high
NC	22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	0.579267979	1303890.002	1461150.005	216	2000	very high
NC	22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	0.774769008	1303920.002	1461150.005	216	2000	very high
NC	22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	0.865653992	1303950.002	1461150.005	216	2000	very high
NC	22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	0.562609971	1303920.002	1461120.005	216	2000	very high
NC	20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	0.547133982	1269030.002	1447110.005	99	2000	very high
NC	20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	0.550971985	1269060.002	1447110.005	99	2000	very high
NC	20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	0.663922012	1268970.002	1447080.005	99	2000	very high
NC	20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	0.688059986	1269000.002	1447080.005	99	2000	very high
NC	20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	0.761014998	1269030.002	1447080.005	99	2000	very high
NC	20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	0.76284498	1268940.002	1447050.005	99	2000	very high
NC	20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	0.768307984	1268970.002	1447050.005	99	2000	very high
NC	20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	0.757344007	1269000.002	1447050.005	99	2000	very high
NC	18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	0.810980976	1286550.002	1448190.005	100	2000	very high
NC	18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	0.815263987	1286580.002	1448190.005	100	2000	very high
NC	18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	0.808569014	1286610.002	1448190.005	100	2000	very high
NC	18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	0.80744499	1286640.002	1448190.005	100	2000	very high
NC	18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	0.811761975	1286520.002	1448160.005	100	2000	very high
NC	18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	0.808569014	1286550.002	1448160.005	100	2000	very high
NC	18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	0.802917004	1286580.002	1448160.005	100	2000	very high
NC	18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	0.714134991	1286310.002	1448040.005	100	2000	very high
NC	22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	0.85651201	1283880.002	1448100.005	100	2000	very high
NC	22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	0.854331017	1283820.002	1448070.005	100	2000	very high
NC	22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	0.761003017	1283850.002	1448070.005	100	2000	very high
NC	22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	0.774815023	1283880.002	1448070.005	100	2000	very high
NC	22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	0.849188983	1283790.002	1448040.005	100	2000	very high
NC	22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	0.792187989	1283820.002	1448040.005	100	2000	very high
NC	22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	0.85917598	1283790.002	1448010.005	100	2000	very high
NC	21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	0.844604015	1273410.002	1446450.005	245	2000	very high
NC	21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	0.839923978	1273440.002	1446450.005	245	2000	very high
NC	21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	0.82801199	1273470.002	1446450.005	245	2000	very high
NC	21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	0.716010988	1273380.002	1446420.005	245	2000	very high
NC	21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	0.833586991	1273410.002	1446420.005	245	2000	very high
NC	21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	0.776193976	1273440.002	1446420.005	245	2000	very high
NC	21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	0.682959974	1273470.002	1446420.005	245	2000	very high
NC	21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	0.598461986	1273380.002	1446390.005	245	2000	very high
NC	36696	Hexastylis naniflora	312	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	2006-11-14	Current	A	2-High	0.294203997	1266150.002	1452780.005	312	2000	very high
NC	36696	Hexastylis naniflora	312	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	2006-11-14	Current	A	2-High	0.273434013	1266120.002	1452750.005	312	2000	very high
NC	36696	Hexastylis naniflora	312	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	2006-11-14	Current	A	2-High	0.231141999	1266150.002	1452750.005	312	2000	very high
NC	36696	Hexastylis naniflora	312	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	2006-11-14	Current	A	2-High	0.30370599	1266090.002	1452720.005	312	2000	very high
NC	36696	Hexastylis naniflora	312	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	2006-11-14	Current	A	2-High	0.213052005	1266120.002	1452720.005	312	2000	very high
NC	36696	Hexastylis naniflora	312	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	2006-11-14	Current	A	2-High	0.231141999	1266150.002	1452720.005	312	2000	very high
NC	20238	Hexastylis naniflora	77	Dwarf-flowered Heartleaf	2013-05-15	2013-05-15	2000-04-12	Current	CD	2-High	0.413053989	1298790.002	1521150.005	77	1000	high
NC	20238	Hexastylis naniflora	77	Dwarf-flowered Heartleaf	2013-05-15	2013-05-15	2000-04-12	Current	CD	2-High	0.490348995	1298790.002	1521120.005	77	1000	high
NC	20238	Hexastylis naniflora	77	Dwarf-flowered Heartleaf	2013-05-15	2013-05-15	2000-04-12	Current	CD	2-High	0.515606999	1298760.002	1521090.005	77	1000	high
NC	20238	Hexastylis naniflora	77	Dwarf-flowered Heartleaf	2013-05-15	2013-05-15	2000-04-12	Current	CD	2-High	0.751806974	1298490.002	1521000.005	77	1000	high
NC	20238	Hexastylis naniflora	77	Dwarf-flowered Heartleaf	2013-05-15	2013-05-15	2000-04-12	Current	CD	2-High	0.762076974	1298520.002	1521000.005	77	1000	high
NC	30019	Hexastylis naniflora	294	Dwarf-flowered Heartleaf	2016-03-20	2016-03-20	2011-11-05	Current	Ci	2-High	0.222849995	1305960.002	1512690.005	295	500	moderate
NC	30019	Hexastylis naniflora	294	Dwarf-flowered Heartleaf	2016-03-20	2016-03-20	2011-11-05	Current	Ci	2-High	0.220265999	1305990.002	1512690.005	295	500	moderate
NC	30019	Hexastylis naniflora	294	Dwarf-flowered Heartleaf	2016-03-20	2016-03-20	2011-11-05	Current	Ci	2-High	0.118069001	1305960.002	1512660.005	295	500	moderate
NC	30019	Hexastylis naniflora	294	Dwarf-flowered Heartleaf	2016-03-20	2016-03-20	2011-11-05	Current	Ci	2-High	0.221802995	1305990.002	1512660.005	295	500	moderate
NC	30019	Hexastylis naniflora	294	Dwarf-flowered Heartleaf	2016-03-20	2016-03-20	2011-11-05	Current	Ci	2-High	0.211954996	1306020.002	1512660.005	295	500	moderate
NC	6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	0.317018002	1271220.002	1451610.005	247	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	0.387686014	1271400.002	1451370.005	247	2000	very high
NC	6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	0.372931004	1271310.002	1451340.005	247	2000	very high
NC	6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	0.402339011	1271340.002	1451340.005	247	2000	very high
NC	6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	0.399051994	1271370.002	1451340.005	247	2000	very high
NC	6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	0.384095013	1271250.002	1451310.005	247	2000	very high
NC	6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	0.410629988	1271280.002	1451310.005	247	2000	very high
NC	22414	Hexastylis naniflora	246	Dwarf-flowered Heartleaf	2001	2001	2001	Current	D	2-High	0.646570027	1285920.002	1448310.005	100	2000	very high
NC	22414	Hexastylis naniflora	246	Dwarf-flowered Heartleaf	2001	2001	2001	Current	D	2-High	0.619744003	1285830.002	1448280.005	100	2000	very high
NC	22414	Hexastylis naniflora	246	Dwarf-flowered Heartleaf	2001	2001	2001	Current	D	2-High	0.815747976	1285860.002	1448280.005	100	2000	very high
NC	22414	Hexastylis naniflora	246	Dwarf-flowered Heartleaf	2001	2001	2001	Current	D	2-High	0.827763021	1285890.002	1448280.005	100	2000	very high
NC	22414	Hexastylis naniflora	246	Dwarf-flowered Heartleaf	2001	2001	2001	Current	D	2-High	0.797095001	1285920.002	1448280.005	100	2000	very high
NC	22414	Hexastylis naniflora	246	Dwarf-flowered Heartleaf	2001	2001	2001	Current	D	2-High	0.774429023	1285860.002	1448250.005	100	2000	very high
NC	22204	Hexastylis naniflora	197	Dwarf-flowered Heartleaf	2000-11-01	2000-11-01	1998-2000	Current	A	2-High	0.599618018	1303590.002	1461840.005	216	2000	very high
NC	22204	Hexastylis naniflora	197	Dwarf-flowered Heartleaf	2000-11-01	2000-11-01	1998-2000	Current	A	2-High	0.591782987	1303620.002	1461840.005	216	2000	very high
NC	22204	Hexastylis naniflora	197	Dwarf-flowered Heartleaf	2000-11-01	2000-11-01	1998-2000	Current	A	2-High	0.589827001	1303650.002	1461840.005	216	2000	very high
NC	22204	Hexastylis naniflora	197	Dwarf-flowered Heartleaf	2000-11-01	2000-11-01	1998-2000	Current	A	2-High	0.589827001	1303680.002	1461840.005	216	2000	very high
NC	22204	Hexastylis naniflora	197	Dwarf-flowered Heartleaf	2000-11-01	2000-11-01	1998-2000	Current	A	2-High	0.593739986	1303710.002	1461840.005	216	2000	very high
NC	22204	Hexastylis naniflora	197	Dwarf-flowered Heartleaf	2000-11-01	2000-11-01	1998-2000	Current	A	2-High	0.621908009	1303740.002	1461810.005	216	2000	very high
NC	385	Hexastylis naniflora	23	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1992-1993	Current	A	2-High	0.613435984	1253130.002	1444920.005	23	2000	very high
NC	385	Hexastylis naniflora	23	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1992-1993	Current	A	2-High	0.621523976	1253130.002	1444890.005	23	2000	very high
NC	385	Hexastylis naniflora	23	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1992-1993	Current	A	2-High	0.603628993	1253130.002	1444860.005	23	2000	very high
NC	385	Hexastylis naniflora	23	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1992-1993	Current	A	2-High	0.607550025	1253130.002	1444830.005	23	2000	very high
NC	385	Hexastylis naniflora	23	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1992-1993	Current	A	2-High	0.622438014	1253130.002	1444800.005	23	2000	very high
NC	385	Hexastylis naniflora	23	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1992-1993	Current	A	2-High	0.617595017	1253130.002	1444770.005	23	2000	very high
NC	24777	Hexastylis naniflora	270	Dwarf-flowered Heartleaf	2012-07	2012-07	2006	Current	C?	2-High	0.831802011	1304100.002	1494960.005	243	2000	very high
NC	24777	Hexastylis naniflora	270	Dwarf-flowered Heartleaf	2012-07	2012-07	2006	Current	C?	2-High	0.834999025	1304130.002	1494960.005	243	2000	very high
NC	24777	Hexastylis naniflora	270	Dwarf-flowered Heartleaf	2012-07	2012-07	2006	Current	C?	2-High	0.307094991	1304100.002	1494930.005	243	2000	very high
NC	24777	Hexastylis naniflora	270	Dwarf-flowered Heartleaf	2012-07	2012-07	2006	Current	C?	2-High	0.311199009	1304130.002	1494930.005	243	2000	very high
NC	24777	Hexastylis naniflora	270	Dwarf-flowered Heartleaf	2012-07	2012-07	2006	Current	C?	2-High	0.312577009	1304160.002	1494930.005	243	2000	very high
NC	24777	Hexastylis naniflora	270	Dwarf-flowered Heartleaf	2012-07	2012-07	2006	Current	C?	2-High	0.842872024	1304190.002	1494930.005	243	2000	very high
NC	22493	Hexastylis naniflora	256	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	C?r	2-High	0.858299971	1290720.002	1511400.005	178	2000	very high
NC	22493	Hexastylis naniflora	256	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	C?r	2-High	0.858299971	1290720.002	1511370.005	178	2000	very high
NC	22493	Hexastylis naniflora	256	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	C?r	2-High	0.856814027	1290720.002	1511340.005	178	2000	very high
NC	22493	Hexastylis naniflora	256	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	C?r	2-High	0.758033991	1290720.002	1511310.005	178	2000	very high
NC	37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	0.114859	1295400.002	1507410.005	318	500	moderate
NC	37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	0.096382499	1295430.002	1507410.005	318	500	moderate
NC	37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	0.542050004	1295490.002	1507410.005	318	500	moderate
NC	37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	0.139296994	1295520.002	1507410.005	318	500	moderate
NC	37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	0.133077994	1295796.43	1507353.689	318	500	moderate
NC	37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	0.056764301	1295352.827	1507308.152	318	500	moderate
NC	37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	0.111135997	1295637.446	1507362.056	318	500	moderate
NC	37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	0.139947996	1295676.15	1507367.448	318	500	moderate
NC	37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	0.123364002	1295363.403	1507333.356	318	500	moderate
NC	33039	Hexastylis naniflora	298	Dwarf-flowered Heartleaf	2014-04-15	2014-04-15	2014-04-15	Current	C	2-High	0.231151	1292760.002	1465800.005	298	500	moderate
NC	33039	Hexastylis naniflora	298	Dwarf-flowered Heartleaf	2014-04-15	2014-04-15	2014-04-15	Current	C	2-High	0.240605995	1292790.002	1465800.005	298	500	moderate
NC	33039	Hexastylis naniflora	298	Dwarf-flowered Heartleaf	2014-04-15	2014-04-15	2014-04-15	Current	C	2-High	0.294750005	1292820.002	1465800.005	298	500	moderate
NC	33039	Hexastylis naniflora	298	Dwarf-flowered Heartleaf	2014-04-15	2014-04-15	2014-04-15	Current	C	2-High	0.212110996	1292790.002	1465770.005	298	500	moderate
NC	33039	Hexastylis naniflora	298	Dwarf-flowered Heartleaf	2014-04-15	2014-04-15	2014-04-15	Current	C	2-High	0.297396988	1292850.002	1465770.005	298	500	moderate
NC	33039	Hexastylis naniflora	298	Dwarf-flowered Heartleaf	2014-04-15	2014-04-15	2014-04-15	Current	C	2-High	0.302747011	1292880.002	1465770.005	298	500	moderate
NC	8307	Hexastylis naniflora	21	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1994-04-12	Current	A	2-High	0.128147006	1305690.002	1512750.005	295	500	moderate
NC	8307	Hexastylis naniflora	21	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1994-04-12	Current	A	2-High	0.070150703	1305720.002	1512750.005	295	500	moderate
NC	8307	Hexastylis naniflora	21	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1994-04-12	Current	A	2-High	0.130649999	1305660.002	1512720.005	295	500	moderate
NC	8307	Hexastylis naniflora	21	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1994-04-12	Current	A	2-High	0.068803102	1305690.002	1512720.005	295	500	moderate
NC	8307	Hexastylis naniflora	21	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1994-04-12	Current	A	2-High	0.129168004	1305660.002	1512690.005	295	500	moderate

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	8307	Hexastylis naniflora	21	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1994-04-12	Current	A	2-High	0.124279	1305660.002	1512660.005	295	500	moderate
NC	22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	0.613647997	1305870.002	1457070.005	214	2000	very high
NC	22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	0.608770013	1305900.002	1457070.005	214	2000	very high
NC	22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	0.608470023	1305840.002	1457040.005	214	2000	very high
NC	22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	0.630886972	1305870.002	1457040.005	214	2000	very high
NC	22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	0.693579972	1305780.002	1457010.005	214	2000	very high
NC	22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	0.58197701	1305810.002	1457010.005	214	2000	very high
NC	22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	0.58197701	1305810.002	1456980.005	214	2000	very high
NC	22491	Hexastylis naniflora	254	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	D?r	2-High	0.901903987	1290360.002	1511310.005	178	2000	very high
NC	22491	Hexastylis naniflora	254	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	D?r	2-High	0.878132999	1290390.002	1511310.005	178	2000	very high
NC	22491	Hexastylis naniflora	254	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	D?r	2-High	0.899478972	1290420.002	1511310.005	178	2000	very high
NC	22491	Hexastylis naniflora	254	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	D?r	2-High	0.624961972	1290450.002	1511310.005	178	2000	very high
NC	22491	Hexastylis naniflora	254	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	D?r	2-High	0.509958029	1290360.002	1511280.005	178	2000	very high
NC	22491	Hexastylis naniflora	254	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	D?r	2-High	0.817798018	1290390.002	1511280.005	178	2000	very high
NC	22492	Hexastylis naniflora	255	Dwarf-flowered Heartleaf	2006-06	2006-06	2006-06	Current	D	2-High	0.655520022	1290630.002	1511430.005	178	2000	very high
NC	22492	Hexastylis naniflora	255	Dwarf-flowered Heartleaf	2006-06	2006-06	2006-06	Current	D	2-High	0.778518021	1290660.002	1511430.005	178	2000	very high
NC	22492	Hexastylis naniflora	255	Dwarf-flowered Heartleaf	2006-06	2006-06	2006-06	Current	D	2-High	0.657485008	1290630.002	1511400.005	178	2000	very high
NC	22492	Hexastylis naniflora	255	Dwarf-flowered Heartleaf	2006-06	2006-06	2006-06	Current	D	2-High	0.708462	1290660.002	1511400.005	178	2000	very high
NC	22492	Hexastylis naniflora	255	Dwarf-flowered Heartleaf	2006-06	2006-06	2006-06	Current	D	2-High	0.630761027	1290600.002	1511370.005	178	2000	very high
NC	28343	Hexastylis naniflora	280	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-06-12	Current	C	2-High	0.58208102	1290450.002	1510350.005	178	2000	very high
NC	28343	Hexastylis naniflora	280	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-06-12	Current	C	2-High	0.812294006	1290360.002	1510320.005	178	2000	very high
NC	28343	Hexastylis naniflora	280	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-06-12	Current	C	2-High	0.810609996	1290390.002	1510320.005	178	2000	very high
NC	28343	Hexastylis naniflora	280	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-06-12	Current	C	2-High	0.803812981	1290420.002	1510320.005	178	2000	very high
NC	28343	Hexastylis naniflora	280	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-06-12	Current	C	2-High	0.737587988	1290450.002	1510320.005	178	2000	very high
NC	21385	Hexastylis naniflora	157	Dwarf-flowered Heartleaf	2010-12-01	2010-12-01	2004-11-01	Current	AB	2-High	0.531940997	1288410.002	1479240.005	157	500	moderate
NC	21385	Hexastylis naniflora	157	Dwarf-flowered Heartleaf	2010-12-01	2010-12-01	2004-11-01	Current	AB	2-High	0.530040026	1288440.002	1479240.005	157	500	moderate
NC	21385	Hexastylis naniflora	157	Dwarf-flowered Heartleaf	2010-12-01	2010-12-01	2004-11-01	Current	AB	2-High	0.212193996	1288320.002	1479210.005	157	500	moderate
NC	21385	Hexastylis naniflora	157	Dwarf-flowered Heartleaf	2010-12-01	2010-12-01	2004-11-01	Current	AB	2-High	0.561273992	1288350.002	1479210.005	157	500	moderate
NC	21385	Hexastylis naniflora	157	Dwarf-flowered Heartleaf	2010-12-01	2010-12-01	2004-11-01	Current	AB	2-High	0.456874996	1288380.002	1479210.005	157	500	moderate
NC	20243	Hexastylis naniflora	80	Dwarf-flowered Heartleaf	2012-07	2012-07	2003-03-13	Current	D	2-High	0.754791021	1270800.002	1448640.005	247	2000	very high
NC	20243	Hexastylis naniflora	80	Dwarf-flowered Heartleaf	2012-07	2012-07	2003-03-13	Current	D	2-High	0.754157007	1270800.002	1448610.005	247	2000	very high
NC	20243	Hexastylis naniflora	80	Dwarf-flowered Heartleaf	2012-07	2012-07	2003-03-13	Current	D	2-High	0.777263999	1270530.002	1448550.005	247	2000	very high
NC	20243	Hexastylis naniflora	80	Dwarf-flowered Heartleaf	2012-07	2012-07	2003-03-13	Current	D	2-High	0.669008017	1270560.002	1448520.005	247	2000	very high
NC	20243	Hexastylis naniflora	80	Dwarf-flowered Heartleaf	2012-07	2012-07	2003-03-13	Current	D	2-High	0.75207603	1270737.027	1448589.652	247	2000	very high
NC	8495	Hexastylis naniflora	39	Dwarf-flowered Heartleaf	2002-04-18	2002-04-18	1996-06	Current	D	2-High	0.494042009	1331970.002	1506570.005	96	2000	very high
NC	8495	Hexastylis naniflora	39	Dwarf-flowered Heartleaf	2002-04-18	2002-04-18	1996-06	Current	D	2-High	0.666383028	1331910.002	1506540.005	96	2000	very high
NC	8495	Hexastylis naniflora	39	Dwarf-flowered Heartleaf	2002-04-18	2002-04-18	1996-06	Current	D	2-High	0.57318902	1331940.002	1506540.005	96	2000	very high
NC	8495	Hexastylis naniflora	39	Dwarf-flowered Heartleaf	2002-04-18	2002-04-18	1996-06	Current	D	2-High	0.616801023	1331850.002	1506510.005	96	2000	very high
NC	8495	Hexastylis naniflora	39	Dwarf-flowered Heartleaf	2002-04-18	2002-04-18	1996-06	Current	D	2-High	0.578969002	1331880.002	1506510.005	96	2000	very high
NC	36589	Hexastylis naniflora	309	Dwarf-flowered Heartleaf	2016-05-06	2016-05-06	2016-05-06	Current	D?	2-High	0.021056199	1288410.002	1494180.005	309	99	low
NC	36589	Hexastylis naniflora	309	Dwarf-flowered Heartleaf	2016-05-06	2016-05-06	2016-05-06	Current	D?	2-High	0.0279072	1288440.002	1494180.005	309	99	low
NC	36589	Hexastylis naniflora	309	Dwarf-flowered Heartleaf	2016-05-06	2016-05-06	2016-05-06	Current	D?	2-High	0.028108601	1288410.002	1494150.005	309	99	low
NC	36589	Hexastylis naniflora	309	Dwarf-flowered Heartleaf	2016-05-06	2016-05-06	2016-05-06	Current	D?	2-High	0.027311699	1288440.002	1494150.005	309	99	low
NC	19611	Hexastylis naniflora	47	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1999-03-29	Current	D	2-High	0.711143017	1322310.002	1480080.005	302	2000	very high
NC	19611	Hexastylis naniflora	47	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1999-03-29	Current	D	2-High	0.714976013	1322340.002	1480080.005	302	2000	very high
NC	19611	Hexastylis naniflora	47	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1999-03-29	Current	D	2-High	0.722836018	1322370.002	1480080.005	302	2000	very high
NC	19611	Hexastylis naniflora	47	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1999-03-29	Current	D	2-High	0.594713986	1322340.002	1480050.005	302	2000	very high
NC	19611	Hexastylis naniflora	47	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1999-03-29	Current	D	2-High	0.620490015	1322370.002	1480050.005	302	2000	very high
NC	4172	Hexastylis naniflora	62	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2002-02-02	Current	C	2-High	0.787732005	1270380.002	1445100.005	99	2000	very high
NC	4172	Hexastylis naniflora	62	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2002-02-02	Current	C	2-High	0.689383984	1270410.002	1445100.005	99	2000	very high
NC	4172	Hexastylis naniflora	62	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2002-02-02	Current	C	2-High	0.813504994	1270230.002	1444980.005	99	2000	very high
NC	4172	Hexastylis naniflora	62	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2002-02-02	Current	C	2-High	0.801554024	1270260.002	1444950.005	99	2000	very high
NC	4172	Hexastylis naniflora	62	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2002-02-02	Current	C	2-High	0.823319972	1270171.343	1444998.916	99	2000	very high
NC	4030	Hexastylis naniflora	54	Dwarf-flowered Heartleaf	2005-04-12	2014-05	2001-04-01	Current	D	2-High	0.78333497	1266300.002	1443510.005	248	500	moderate

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	4030	Hexastylis naniflora	54	Dwarf-flowered Heartleaf	2005-04-12	2014-05	2001-04-01	Current	D	2-High	0.67928201	1266300.002	1443480.005	248	500	moderate
NC	4030	Hexastylis naniflora	54	Dwarf-flowered Heartleaf	2005-04-12	2014-05	2001-04-01	Current	D	2-High	0.598812997	1266330.002	1443480.005	248	500	moderate
NC	4030	Hexastylis naniflora	54	Dwarf-flowered Heartleaf	2005-04-12	2014-05	2001-04-01	Current	D	2-High	0.67928201	1266330.002	1443450.005	248	500	moderate
NC	21395	Hexastylis naniflora	164	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-31	Current	A	2-High	0.267347008	1264530.002	1454910.005	177	2000	very high
NC	21395	Hexastylis naniflora	164	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-31	Current	A	2-High	0.584971011	1264500.002	1454880.005	177	2000	very high
NC	21395	Hexastylis naniflora	164	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-31	Current	A	2-High	0.573270977	1264530.002	1454880.005	177	2000	very high
NC	21395	Hexastylis naniflora	164	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-31	Current	A	2-High	0.596956015	1264440.002	1454850.005	177	2000	very high
NC	21395	Hexastylis naniflora	164	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-31	Current	A	2-High	0.583018005	1264470.002	1454850.005	177	2000	very high
NC	13728	Hexastylis naniflora	34	Dwarf-flowered Heartleaf	2005-05-19	2005-05-19	1997-06-04	Current	D	2-High	0.903896987	1296300.002	1457250.005	93	500	moderate
NC	13728	Hexastylis naniflora	34	Dwarf-flowered Heartleaf	2005-05-19	2005-05-19	1997-06-04	Current	D	2-High	0.895529985	1296270.002	1457220.005	93	500	moderate
NC	13728	Hexastylis naniflora	34	Dwarf-flowered Heartleaf	2005-05-19	2005-05-19	1997-06-04	Current	D	2-High	0.894689977	1296240.002	1457190.005	93	500	moderate
NC	12925	Hexastylis naniflora	63	Dwarf-flowered Heartleaf	2001-07-31	2001-07-31	2001-07-31	Current	D	2-High	0.604880989	1269330.002	1445130.005	99	2000	very high
NC	12925	Hexastylis naniflora	63	Dwarf-flowered Heartleaf	2001-07-31	2001-07-31	2001-07-31	Current	D	2-High	0.565705001	1269360.002	1445130.005	99	2000	very high
NC	12925	Hexastylis naniflora	63	Dwarf-flowered Heartleaf	2001-07-31	2001-07-31	2001-07-31	Current	D	2-High	0.611626029	1269300.002	1445100.005	99	2000	very high
NC	12925	Hexastylis naniflora	63	Dwarf-flowered Heartleaf	2001-07-31	2001-07-31	2001-07-31	Current	D	2-High	0.328646004	1269300.002	1445070.005	99	2000	very high
NC	5682	Hexastylis naniflora	16	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1977	Current	E	2-High	0.368497014	1264680.002	1455180.005	177	2000	very high
NC	5682	Hexastylis naniflora	16	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1977	Current	E	2-High	0.370052993	1264710.002	1455150.005	177	2000	very high
NC	36703	Hexastylis naniflora	314	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.605863988	1304970.002	1512810.005	295	500	moderate
NC	36703	Hexastylis naniflora	314	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.618345976	1305000.002	1512780.005	295	500	moderate
NC	36703	Hexastylis naniflora	314	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.176633	1304970.002	1512720.005	295	500	moderate
NC	36703	Hexastylis naniflora	314	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	0.175105006	1304970.002	1512690.005	295	500	moderate
NC	21397	Hexastylis naniflora	166	Dwarf-flowered Heartleaf	2005-03-31	2005-03-31	2005-03-31	Current	CD	2-High	0.487511009	1264530.002	1455900.005	177	2000	very high
NC	21397	Hexastylis naniflora	166	Dwarf-flowered Heartleaf	2005-03-31	2005-03-31	2005-03-31	Current	CD	2-High	0.401271999	1264560.002	1455900.005	177	2000	very high
NC	24776	Hexastylis naniflora	269	Dwarf-flowered Heartleaf	2007	2007	2006	Current	B	2-High	0.701411009	1303740.002	1494660.005	243	2000	very high
NC	24776	Hexastylis naniflora	269	Dwarf-flowered Heartleaf	2007	2007	2006	Current	B	2-High	0.662096977	1303710.002	1494630.005	243	2000	very high
NC	24776	Hexastylis naniflora	269	Dwarf-flowered Heartleaf	2007	2007	2006	Current	B	2-High	0.703644991	1303680.002	1494600.005	243	2000	very high
NC	20302	Hexastylis naniflora	107	Dwarf-flowered Heartleaf	2008	2008	2003-04-29	Current	B	2-High	0.180245996	1263510.002	1456170.005	177	2000	very high
NC	20302	Hexastylis naniflora	107	Dwarf-flowered Heartleaf	2008	2008	2003-04-29	Current	B	2-High	0.174123004	1263510.002	1456140.005	177	2000	very high
NC	20302	Hexastylis naniflora	107	Dwarf-flowered Heartleaf	2008	2008	2003-04-29	Current	B	2-High	0.173278004	1263510.002	1456110.005	177	2000	very high
NC	20302	Hexastylis naniflora	107	Dwarf-flowered Heartleaf	2008	2008	2003-04-29	Current	B	2-High	0.172437996	1263510.002	1456080.005	177	2000	very high
NC	21401	Hexastylis naniflora	170	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	C	2-High	0.48842901	1262730.002	1457760.005	176	2000	very high
NC	21401	Hexastylis naniflora	170	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	C	2-High	0.486595005	1262760.002	1457760.005	176	2000	very high
NC	21401	Hexastylis naniflora	170	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	C	2-High	0.48476401	1262790.002	1457760.005	176	2000	very high
NC	20354	Hexastylis naniflora	121	Dwarf-flowered Heartleaf	2004-05-15	2004-05-15	2004-05-15	Current	B	2-High	0.867326975	1267230.002	1446270.005	99	2000	very high
NC	20354	Hexastylis naniflora	121	Dwarf-flowered Heartleaf	2004-05-15	2004-05-15	2004-05-15	Current	B	2-High	0.86334002	1267230.002	1446240.005	99	2000	very high
NC	21386	Hexastylis naniflora	158	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	2001-05-07	Current	D	2-High	0.732609987	1300020.002	1498560.005	158	500	moderate
NC	21386	Hexastylis naniflora	158	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	2001-05-07	Current	D	2-High	0.789227009	1299960.002	1498530.005	158	500	moderate
NC	21386	Hexastylis naniflora	158	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	2001-05-07	Current	D	2-High	0.732609987	1300020.002	1498530.005	158	500	moderate
NC	34003	Hexastylis naniflora	300	Dwarf-flowered Heartleaf	2013-04	2013-04	2013-04	Current	D	2-High	0.062470902	1336830.002	1520190.005	300	99	low
NC	34003	Hexastylis naniflora	300	Dwarf-flowered Heartleaf	2013-04	2013-04	2013-04	Current	D	2-High	0.062795699	1336800.002	1520160.005	300	99	low
NC	34003	Hexastylis naniflora	300	Dwarf-flowered Heartleaf	2013-04	2013-04	2013-04	Current	D	2-High	0.193918005	1336830.002	1520160.005	300	99	low
NC	28199	Hexastylis naniflora	279	Dwarf-flowered Heartleaf	2009-04-20	2009-04-20	2009-04-20	Current	D?	2-High	0.908352017	1322430.002	1483680.005	279	99	low
NC	28199	Hexastylis naniflora	279	Dwarf-flowered Heartleaf	2009-04-20	2009-04-20	2009-04-20	Current	D?	2-High	0.895425022	1322430.002	1483650.005	279	99	low
NC	28199	Hexastylis naniflora	279	Dwarf-flowered Heartleaf	2009-04-20	2009-04-20	2009-04-20	Current	D?	2-High	0.907795012	1322460.002	1483650.005	279	99	low
NC	22400	Hexastylis naniflora	242	Dwarf-flowered Heartleaf	2005-05	2005-05	2005-05	Current	D	2-High	0.830003023	1302210.002	1495080.005	243	2000	very high
NC	22400	Hexastylis naniflora	242	Dwarf-flowered Heartleaf	2005-05	2005-05	2005-05	Current	D	2-High	0.831999004	1302240.002	1495080.005	243	2000	very high
NC	22400	Hexastylis naniflora	242	Dwarf-flowered Heartleaf	2005-05	2005-05	2005-05	Current	D	2-High	0.810387015	1302240.002	1495050.005	243	2000	very high
NC	32858	Hexastylis naniflora	297	Dwarf-flowered Heartleaf	2011	2011	2011	Current	CD	2-High	0.535811007	1292730.002	1449270.005	297	99	unknown
NC	32858	Hexastylis naniflora	297	Dwarf-flowered Heartleaf	2011	2011	2011	Current	CD	2-High	0.181260005	1292760.002	1449270.005	297	99	unknown
NC	26004	Hexastylis naniflora	275	Dwarf-flowered Heartleaf	2014-05-21	2014-05-21	2007-04-17	Current	C	2-High	0.115281001	1337100.002	1513560.005	275	500	moderate
NC	26004	Hexastylis naniflora	275	Dwarf-flowered Heartleaf	2014-05-21	2014-05-21	2007-04-17	Current	C	2-High	0.100580998	1337130.002	1513560.005	275	500	moderate
NC	26004	Hexastylis naniflora	275	Dwarf-flowered Heartleaf	2014-05-21	2014-05-21	2007-04-17	Current	C	2-High	0.08072	1337160.002	1513560.005	275	500	moderate
NC	7324	Hexastylis naniflora	37	Dwarf-flowered Heartleaf	2005	2005	1994-06	Current	C	2-High	0.878709018	1267050.002	1444590.005	99	2000	very high
NC	7324	Hexastylis naniflora	37	Dwarf-flowered Heartleaf	2005	2005	1994-06	Current	C	2-High	0.870370984	1267020.002	1444500.005	99	2000	very high

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	36693	Hexastylis naniflora	311	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2007-11-28	Current	A	2-High	0.248705	1251450.002	1441920.005	311	500	moderate
NC	13542	Hexastylis naniflora	20	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	B	2-High	0.465449989	1311030.002	1503030.005	252	500	moderate
NC	13542	Hexastylis naniflora	20	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	B	2-High	0.127724007	1311060.002	1503030.005	252	500	moderate
NC	13542	Hexastylis naniflora	20	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	B	2-High	0.753198981	1310910.002	1503000.005	252	500	moderate
NC	13542	Hexastylis naniflora	20	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	B	2-High	0.788065016	1310940.002	1503000.005	252	500	moderate
NC	21053	Hexastylis naniflora	122	Dwarf-flowered Heartleaf	2008	2008	2003-04-29	Current	B?	2-High	0.179266006	1263630.002	1456290.005	177	2000	very high
NC	21053	Hexastylis naniflora	122	Dwarf-flowered Heartleaf	2008	2008	2003-04-29	Current	B?	2-High	0.124429002	1263570.002	1456260.005	177	2000	very high
NC	21396	Hexastylis naniflora	165	Dwarf-flowered Heartleaf	2005-04-05	2005-04-05	2005-04-05	Current	C	2-High	0.537446976	1263900.002	1455420.005	177	2000	very high
NC	21396	Hexastylis naniflora	165	Dwarf-flowered Heartleaf	2005-04-05	2005-04-05	2005-04-05	Current	C	2-High	0.612614989	1263900.002	1455390.005	177	2000	very high
NC	24748	Hexastylis naniflora	267	Dwarf-flowered Heartleaf	2006-07-06	2006-07-06	2006-07-06	Current	CD	2-High	0.799870014	1267650.002	1447920.005	99	2000	very high
NC	24748	Hexastylis naniflora	267	Dwarf-flowered Heartleaf	2006-07-06	2006-07-06	2006-07-06	Current	CD	2-High	0.842028975	1267680.002	1447920.005	99	2000	very high
NC	22199	Hexastylis naniflora	192	Dwarf-flowered Heartleaf	2000-10-27	2000-10-27	1998-2000	Current	C	2-High	0.760140002	1294350.002	1460520.005	217	2000	very high
NC	22199	Hexastylis naniflora	192	Dwarf-flowered Heartleaf	2000-10-27	2000-10-27	1998-2000	Current	C	2-High	0.743032992	1294272.001	1460526.397	217	2000	very high
NC	24749	Hexastylis naniflora	268	Dwarf-flowered Heartleaf	2006-07-06	2006-07-06	2006-07-06	Current	D	2-High	0.318064988	1267380.002	1447470.005	99	2000	very high
NC	22235	Hexastylis naniflora	212	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	1998-2000	Current	D	2-High	0.226468995	1304910.002	1458180.005	214	2000	very high
NC	21405	Hexastylis naniflora	174	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-03	Current	D	2-High	0.712642014	1270593.346	1448867.041	247	2000	very high
NC	9779	Hexastylis naniflora	53	Dwarf-flowered Heartleaf	2003-05	2003-05	2001-04-02	Current	D	2-High	0.328837007	1268400.002	1444860.005	99	2000	very high
NC	3553	Hexastylis naniflora	76	Dwarf-flowered Heartleaf	2015-05-19	2015-05-19	2004-05-03	Current	BC	2-High	0.658973992	1273710.002	1443240.005	99	2000	very high
NC	3553	Hexastylis naniflora	76	Dwarf-flowered Heartleaf	2015-05-19	2015-05-19	2004-05-03	Current	BC	2-High	0.774775028	1273726.806	1443170.59	99	2000	very high
NC	22387	Hexastylis naniflora	239	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001	Current	D	2-High	0.745696008	1286220.002	1448340.005	100	2000	very high
NC	21403	Hexastylis naniflora	172	Dwarf-flowered Heartleaf	2012-03-12	2012-03-12	2003-05-14	Current	D	2-High	0.745675981	1273686.203	1442978.818	99	2000	very high
NC	37214	Hexastylis naniflora	315	Dwarf-flowered Heartleaf	2017-05-02	2017-05-02	2016-05-05	Current	D	2-High	0.733089983	1310880.002	1517040.005	316	1000	high
NC	20256	Hexastylis naniflora	91	Dwarf-flowered Heartleaf	2012-07	2012-07	2003-03-13	Current	D	2-High	0.663347006	1272424.1	1445950.524	245	2000	very high
NC	37216	Hexastylis naniflora	317	Dwarf-flowered Heartleaf	2017-05-02	2017-05-02	2016-05-05	Current	D	2-High	0.227891997	1311120.002	1518540.005	317	99	low
NC	22394	Hexastylis naniflora	240	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001	Historical	F	2-High	0.846042991	1285920.002	1450260.005	100	2000	very high
NC	33240	Hexastylis naniflora	299	Dwarf-flowered Heartleaf	2014-04-01	2014-04-01	2010-04-13	Current	D	2-High	0.177424997	1329040.518	1479040.687	299	99	low
NC	33240	Hexastylis naniflora	299	Dwarf-flowered Heartleaf	2014-04-01	2014-04-01	2010-04-13	Current	D	2-High	0.391653001	1329061.952	1479050.257	299	99	low
NC	21393	Hexastylis naniflora	162	Dwarf-flowered Heartleaf	2012-12-17	2012-12-17	2005-Fall	Current	D	2-High	0.187804997	1314527.879	1509098.456	179	2000	very high
NC	20333	Hexastylis naniflora	114	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-03	Current	D	2-High	0.734135985	1270699.913	1448904.6	247	2000	very high
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.716103971	1277220.002	1437840.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.319674999	1277100.002	1437660.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.322490007	1277130.002	1437660.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.713163018	1277160.002	1437660.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.32457	1277130.002	1437630.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.686896026	1276680.002	1437240.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.684948981	1276710.002	1437240.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.659170985	1276740.002	1437240.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.202700004	1276770.002	1437240.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.696844995	1276680.002	1437210.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.725637019	1278240.002	1436670.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.71035099	1277340.002	1436640.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.712270975	1277370.002	1436640.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.718666971	1278210.002	1436640.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.698541999	1277430.002	1436610.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.716103971	1277460.002	1436610.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.719926	1277490.002	1436610.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.725637019	1278210.002	1436610.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.719926	1277610.002	1436580.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.718666971	1278180.002	1436580.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.728416026	1278150.002	1436550.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.493173987	1278180.002	1436550.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.717778027	1278150.002	1436520.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.483814001	1278150.002	1436490.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.491346985	1278120.002	1436460.005	3	2000	Very High

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.482003003	1278150.002	1436460.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.485628992	1278120.002	1436430.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.403299004	1278150.002	1436430.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.496838003	1278090.002	1436400.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.485628992	1278120.002	1436400.005	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.333936989	1278270.201	1436724.456	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.723735988	1277685.605	1436515.531	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.721872985	1277721.636	1436459.279	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.308423012	1276596.647	1437170.269	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.22281	1276574.931	1437154.523	3	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.703342021	1267590.002	1432770.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.704586983	1267620.002	1432770.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.533393025	1268640.002	1432710.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.694410026	1267440.002	1432680.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.69156599	1267350.002	1432620.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.812223971	1268850.002	1432560.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.328658998	1266840.002	1432500.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.684677005	1271700.002	1432410.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.59740001	1271700.002	1432380.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.624197006	1271790.002	1432260.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.54698801	1271820.002	1432260.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.421312004	1271400.002	1432200.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.409595996	1271430.002	1432200.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.721213996	1269630.002	1432050.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.536931992	1271580.002	1432020.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.595227003	1271610.002	1431960.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.630172014	1271670.002	1431930.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.504938006	1271700.002	1431930.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.390439004	1269090.002	1431900.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.812223971	1269180.002	1431870.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.713437974	1269150.002	1431840.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.728721023	1269270.002	1431840.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.801818013	1269270.002	1431810.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.321491987	1270290.002	1431630.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.319435	1270290.002	1431600.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.614543974	1271070.002	1431270.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.51494801	1271140.904	1431243.357	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.392729998	1271839.979	1431852.731	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.460646003	1270216.76	1432005.233	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.422847986	1268998.768	1431858.019	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.630293012	1269732.547	1432051.766	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.730363011	1269564.774	1432059.834	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.703251004	1269481.884	1432095.536	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.764190018	1271264.686	1432760.98	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.723635018	1266022.481	1431931.821	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.780157983	1268915.107	1432552.503	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.733242989	1271107.627	1432924.401	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.642969012	1271031.368	1432948.706	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.607770026	1268683.268	1432764.414	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.645066977	1266565.594	1432449.253	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.640946984	1266608.648	1432473.057	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.690257013	1268021.215	1432781.926	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.701218009	1267887.858	1432778.852	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.611715019	1273980.002	1428660.005	1	2000	Very High

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.607918024	1274100.002	1428660.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.626619995	1273980.002	1428630.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.612942994	1274010.002	1428630.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.614171982	1274070.002	1428630.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.607918024	1274100.002	1428630.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.624073982	1273980.002	1428600.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.580762982	1274070.002	1428570.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.79382199	1273590.002	1427520.005	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.818481028	1273632.548	1427581.4	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.575430989	1274067.796	1428432.046	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.734013021	1272673.576	1428410.354	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.660341024	1271866.924	1429582.397	1	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.396959007	1274700.002	1421520.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.29806301	1274700.002	1421490.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.368039012	1274670.002	1421430.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.301452011	1274460.002	1421340.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.215278998	1274460.002	1421310.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.26809001	1274460.002	1421280.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.615503013	1274940.002	1421280.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.647014022	1275000.002	1421280.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.632743001	1275030.002	1421280.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.581062973	1275060.002	1421280.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.520690978	1275090.002	1421280.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.318221003	1274490.002	1421250.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.60155201	1274850.002	1421250.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.702921987	1274880.002	1421250.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.709164023	1274910.002	1421250.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.610521972	1274970.002	1421250.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.608861983	1275000.002	1421250.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.603175998	1274520.002	1421220.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.609751999	1274550.002	1421220.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.320820004	1274580.002	1421220.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.320820004	1274610.002	1421220.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.263047993	1274820.002	1421220.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.587342978	1274850.002	1421220.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.610521972	1274880.002	1421220.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.634283006	1274910.002	1421220.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.293242991	1274520.002	1421190.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.60295701	1274550.002	1421190.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.619768977	1274580.002	1421190.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.313771993	1274610.002	1421190.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.313226998	1274640.002	1421190.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.298815995	1274670.002	1421190.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.305346996	1274820.002	1421190.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.619768977	1274670.002	1421160.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.623462975	1274700.002	1421160.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.325500995	1274730.002	1421160.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.65267998	1274760.002	1421160.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.674583018	1274790.002	1421160.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.609751999	1274820.002	1421160.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.665633023	1274730.002	1421130.005	2	2000	Very High
SC		Hexastylis naniflora		Dwarf-flowered Heartleaf							0.674709022	1274760.002	1421130.005	2	2000	Very High
NC	37915	Hexastylis naniflora	319	Dwarf-flowered Heartleaf							0.835763991	1273499.852	1443293.951	99	2000	very high
NC	37916	Hexastylis naniflora	320	Dwarf-flowered Heartleaf							0.916894019	1299526.67	1456756.853	320	99	low

State	EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	Maxent Score	X	Y	PopNumber	EstPlantsMax	Resilience
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.660769999	1295700.002	1520370.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.158732995	1295760.002	1520370.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.914484978	1295910.002	1520370.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.914484978	1295940.002	1520370.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.653447986	1295700.002	1520340.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.154902995	1295760.002	1520340.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.40802899	1295940.002	1520340.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.396299988	1295970.002	1520340.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.360368997	1295970.002	1520310.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.127737001	1295880.002	1520280.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.67366302	1296510.002	1520040.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.733918011	1296510.002	1520010.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.310393006	1296510.002	1519980.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.732119977	1296540.002	1519980.005	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.193808004	1295426.793	1520604.93	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.243605003	1295593.69	1520610.39	321	2000	very high
NC	37929	Hexastylis naniflora	321	Dwarf-flowered Heartleaf							0.812672019	1295624.527	1520617.147	321	2000	very high
SC											0.00477683	1240369.49	1419083.964	4	99	low
SC											0.00595996	1240676.032	1419026.488	4	99	low
SC											0.00251037	1225042.373	1411324.612	5	99	low

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282350.002	1528530.005	0.506
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282710.002	1528530.005	0.771
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528530.005	0.752
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282320.002	1528500.005	0.540
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282350.002	1528500.005	0.513
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282650.002	1528500.005	0.717
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282680.002	1528500.005	0.785
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282710.002	1528500.005	0.771
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528500.005	0.755
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282230.002	1528470.005	0.707
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282260.002	1528470.005	0.589
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282290.002	1528470.005	0.530
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282320.002	1528470.005	0.515
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282350.002	1528470.005	0.510
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282650.002	1528470.005	0.732
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282680.002	1528470.005	0.635
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282710.002	1528470.005	0.723
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528470.005	0.706
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282800.002	1528470.005	0.679
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282230.002	1528440.005	0.705
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282260.002	1528440.005	0.587
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282290.002	1528440.005	0.526
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282680.002	1528440.005	0.641
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282710.002	1528440.005	0.727
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528440.005	0.719
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282770.002	1528440.005	0.763
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282800.002	1528440.005	0.693
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282830.002	1528440.005	0.675
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282230.002	1528410.005	0.713
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282260.002	1528410.005	0.540
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282290.002	1528410.005	0.533
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282680.002	1528410.005	0.692
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282710.002	1528410.005	0.692
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528410.005	0.719
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282770.002	1528410.005	0.715
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282800.002	1528410.005	0.689
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282830.002	1528410.005	0.678
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282860.002	1528410.005	0.652
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282230.002	1528380.005	0.720
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282260.002	1528380.005	0.547
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1528380.005	0.676
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282440.002	1528380.005	0.537
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282470.002	1528380.005	0.556
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282680.002	1528380.005	0.704
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282710.002	1528380.005	0.684
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528380.005	0.719
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282770.002	1528380.005	0.706
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282800.002	1528380.005	0.694
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282830.002	1528380.005	0.685
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282110.002	1528350.005	0.609
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282230.002	1528350.005	0.734
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282260.002	1528350.005	0.618

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1528350.005	0.607
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282440.002	1528350.005	0.543
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282470.002	1528350.005	0.605
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282710.002	1528350.005	0.726
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528350.005	0.807
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282800.002	1528350.005	0.707
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282830.002	1528350.005	0.680
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282110.002	1528320.005	0.532
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282140.002	1528320.005	0.603
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282260.002	1528320.005	0.712
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282380.002	1528320.005	0.685
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1528320.005	0.605
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282440.002	1528320.005	0.621
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282470.002	1528320.005	0.711
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282500.002	1528320.005	0.610
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282530.002	1528320.005	0.544
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528320.005	0.741
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282770.002	1528320.005	0.723
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282800.002	1528320.005	0.693
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282380.002	1528290.005	0.636
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1528290.005	0.555
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282440.002	1528290.005	0.618
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282470.002	1528290.005	0.728
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282500.002	1528290.005	0.615
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282530.002	1528290.005	0.610
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282560.002	1528290.005	0.552
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282710.002	1528290.005	0.738
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528290.005	0.685
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282770.002	1528290.005	0.709
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282800.002	1528290.005	0.692
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282380.002	1528260.005	0.648
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1528260.005	0.558
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282500.002	1528260.005	0.622
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282530.002	1528260.005	0.611
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282710.002	1528260.005	0.741
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528260.005	0.689
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282770.002	1528260.005	0.616
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282350.002	1528230.005	0.742
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282380.002	1528230.005	0.626
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1528230.005	0.563
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282530.002	1528230.005	0.613
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282710.002	1528230.005	0.738
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528230.005	0.639
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282770.002	1528230.005	0.573
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282230.002	1528200.005	0.607
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282260.002	1528200.005	0.694
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282350.002	1528200.005	0.744
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282380.002	1528200.005	0.655
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1528200.005	0.570
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282710.002	1528200.005	0.737
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528200.005	0.568
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282200.002	1528170.005	0.550

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282260.002	1528170.005	0.558
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282380.002	1528170.005	0.751
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1528170.005	0.579
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282230.002	1528140.005	0.560
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282290.002	1528140.005	0.568
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282380.002	1528140.005	0.705
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1528140.005	0.625
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282380.002	1528110.005	0.633
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1528110.005	0.626
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282380.002	1528080.005	0.639
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282740.002	1528080.005	0.589
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282230.002	1527990.005	0.588
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282290.002	1527990.005	0.713
4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	59	500	NC	1332510.002	1527990.005	0.328
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282290.002	1527960.005	0.572
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282320.002	1527960.005	0.580
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282350.002	1527960.005	0.636
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282320.002	1527930.005	0.566
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282350.002	1527930.005	0.565
4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	59	500	NC	1332420.002	1527930.005	0.302
4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	59	500	NC	1332000.002	1527900.005	0.274
4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	59	500	NC	1332030.002	1527900.005	0.305
4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	59	500	NC	1332360.002	1527900.005	0.339
4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	59	500	NC	1332390.002	1527900.005	0.329
4708	Hexastylis naniflora	59	Dwarf-flowered Heartleaf	2010-03-21	2010-03-21	2002-04-05	Current	C	2-High	59	500	NC	1332420.002	1527900.005	0.255
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282320.002	1527810.005	0.572
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282350.002	1527810.005	0.649
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282380.002	1527810.005	0.712
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1527810.005	0.714
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282440.002	1527810.005	0.714
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282470.002	1527810.005	0.672
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282380.002	1527780.005	0.577
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1527780.005	0.580
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282440.002	1527780.005	0.581
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282470.002	1527780.005	0.585
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282500.002	1527780.005	0.592
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282530.002	1527780.005	0.668
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282560.002	1527780.005	0.672
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282410.002	1527750.005	0.538
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282440.002	1527750.005	0.572
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282470.002	1527750.005	0.572
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282500.002	1527750.005	0.574
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282530.002	1527750.005	0.581
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282560.002	1527750.005	0.640
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282590.002	1527720.005	0.600
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282620.002	1527720.005	0.656
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282650.002	1527720.005	0.658
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282680.002	1527720.005	0.664
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282710.002	1527720.005	0.674
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282590.002	1527690.005	0.581
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282620.002	1527690.005	0.584
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282650.002	1527690.005	0.584

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282680.002	1527690.005	0.645
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282650.002	1527660.005	0.484
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321560.002	1526760.005	0.186
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321650.002	1526670.005	0.332
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321680.002	1526670.005	0.302
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321620.002	1526640.005	0.270
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321650.002	1526640.005	0.260
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321680.002	1526640.005	0.263
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321710.002	1526640.005	0.334
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321530.002	1526610.005	0.218
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321560.002	1526610.005	0.220
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321590.002	1526610.005	0.271
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321620.002	1526610.005	0.335
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321740.002	1526610.005	0.334
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282650.592	1527514.316	0.555
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282542.034	1528156.343	0.626
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282118.265	1528152.725	0.548
22306	Hexastylis naniflora	227	Dwarf-flowered Heartleaf	2014-04-19	2014-04-19	2003-04	Current	A	2-High	227	2000	NC	1282736.134	1527882.367	0.556
36541	Hexastylis naniflora	308	Dwarf-flowered Heartleaf	2015-03	2015-03	2014-08-14	Current	C	2-High	308	2000	NC	1321608.517	1526714.568	0.270
28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	291	99	NC	1293150.002	1521600.005	0.835
28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	291	99	NC	1293180.002	1521600.005	0.829
28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	291	99	NC	1293120.002	1521570.005	0.830
28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	291	99	NC	1293150.002	1521570.005	0.824
28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	291	99	NC	1293120.002	1521540.005	0.820
28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	291	99	NC	1293390.002	1521510.005	0.617
28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	291	99	NC	1293420.002	1521510.005	0.653
28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	291	99	NC	1293390.002	1521480.005	0.606
28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	291	99	NC	1293690.002	1521300.005	0.652
28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	291	99	NC	1293690.002	1521270.005	0.643
28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	291	99	NC	1293660.002	1521240.005	0.650
28659	Hexastylis naniflora	291	Dwarf-flowered Heartleaf	2010-04-21	2010-04-21	2007-03-28	Current	C	2-High	291	99	NC	1293660.002	1521210.005	0.646
20238	Hexastylis naniflora	77	Dwarf-flowered Heartleaf	2013-05-15	2013-05-15	2000-04-12	Current	CD	2-High	77	1000	NC	1298790.002	1521150.005	0.413
20238	Hexastylis naniflora	77	Dwarf-flowered Heartleaf	2013-05-15	2013-05-15	2000-04-12	Current	CD	2-High	77	1000	NC	1298790.002	1521120.005	0.490
20238	Hexastylis naniflora	77	Dwarf-flowered Heartleaf	2013-05-15	2013-05-15	2000-04-12	Current	CD	2-High	77	1000	NC	1298760.002	1521090.005	0.516
20238	Hexastylis naniflora	77	Dwarf-flowered Heartleaf	2013-05-15	2013-05-15	2000-04-12	Current	CD	2-High	77	1000	NC	1298490.002	1521000.005	0.752
20238	Hexastylis naniflora	77	Dwarf-flowered Heartleaf	2013-05-15	2013-05-15	2000-04-12	Current	CD	2-High	77	1000	NC	1298520.002	1521000.005	0.762
35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	306	99	NC	1354590.002	1520610.005	0.110
35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	306	99	NC	1354620.002	1520610.005	0.110
35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	306	99	NC	1354560.002	1520580.005	0.112
35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	306	99	NC	1354590.002	1520580.005	0.102
35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	306	99	NC	1354620.002	1520580.005	0.102
35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	306	99	NC	1354650.002	1520580.005	0.114
35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	306	99	NC	1354560.002	1520550.005	0.087
35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	306	99	NC	1354590.002	1520550.005	0.050
35871	Hexastylis naniflora	306	Dwarf-flowered Heartleaf	2015	2015	2015	Current	D	2-High	306	99	NC	1354620.002	1520550.005	0.066
37929		321											1295700.002	1520370.005	0.661
37929		321											1295760.002	1520370.005	0.159
37929		321											1295910.002	1520370.005	0.914
37929		321											1295940.002	1520370.005	0.914
37929		321											1295700.002	1520340.005	0.653
37929		321											1295760.002	1520340.005	0.155
37929		321											1295940.002	1520340.005	0.408

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
37929		321											1295970.002	1520340.005	0.396
37929		321											1295970.002	1520310.005	0.360
37929		321											1295880.002	1520280.005	0.128
34003	Hexastylis naniflora	300	Dwarf-flowered Heartleaf	2013-04	2013-04	2013-04	Current	D	2-High	300	99	NC	1336830.002	1520190.005	0.062
34003	Hexastylis naniflora	300	Dwarf-flowered Heartleaf	2013-04	2013-04	2013-04	Current	D	2-High	300	99	NC	1336800.002	1520160.005	0.063
34003	Hexastylis naniflora	300	Dwarf-flowered Heartleaf	2013-04	2013-04	2013-04	Current	D	2-High	300	99	NC	1336830.002	1520160.005	0.194
37929		321											1296510.002	1520040.005	0.674
37929		321											1296510.002	1520010.005	0.734
37929		321											1296510.002	1519980.005	0.310
37929		321											1296540.002	1519980.005	0.732
37929		321											1295426.793	1520604.93	0.194
37929		321											1295593.69	1520610.39	0.244
37929		321											1295624.527	1520617.147	0.813
37216	Hexastylis naniflora	317	Dwarf-flowered Heartleaf	2017-05-02	2017-05-02	2016-05-05	Current	D	2-High	317	99	NC	1311120.002	1518540.005	0.228
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298910.002	1518240.005	0.128
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298850.002	1518210.005	0.097
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298880.002	1518210.005	0.167
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298910.002	1518210.005	0.127
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298940.002	1518210.005	0.124
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298820.002	1518180.005	0.097
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298850.002	1518180.005	0.265
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298880.002	1518180.005	0.604
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298910.002	1518180.005	0.120
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298940.002	1518180.005	0.102
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298820.002	1518150.005	0.287
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298850.002	1518150.005	0.260
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298880.002	1518150.005	0.583
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298790.002	1518120.005	0.697
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298820.002	1518120.005	0.286
12549	Hexastylis naniflora	44	Dwarf-flowered Heartleaf	2011-05-02	2011-05-02	1998-05-18	Current	ABr	2-High	44	1000	NC	1298700.002	1518030.005	0.697
37214	Hexastylis naniflora	315	Dwarf-flowered Heartleaf	2017-05-02	2017-05-02	2016-05-05	Current	D	2-High	316	1000	NC	1310880.002	1517040.005	0.733
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311930.002	1516770.005	0.193
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311780.002	1516740.005	0.683
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311810.002	1516740.005	0.683
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311840.002	1516740.005	0.671
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311870.002	1516740.005	0.388
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311900.002	1516740.005	0.374
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311930.002	1516740.005	0.203
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311780.002	1516710.005	0.691
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311810.002	1516710.005	0.679
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311840.002	1516710.005	0.675
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311870.002	1516710.005	0.371
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311900.002	1516710.005	0.379
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311930.002	1516710.005	0.394
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311960.002	1516710.005	0.762
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311780.002	1516680.005	0.683
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311810.002	1516680.005	0.685
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311840.002	1516680.005	0.389
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311870.002	1516680.005	0.396
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311900.002	1516680.005	0.389
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311930.002	1516680.005	0.654
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311960.002	1516680.005	0.668

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311660.002	1516650.005	0.897
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311780.002	1516650.005	0.775
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311810.002	1516650.005	0.773
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311840.002	1516650.005	0.739
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311870.002	1516650.005	0.474
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311900.002	1516650.005	0.824
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311930.002	1516650.005	0.715
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311960.002	1516650.005	0.758
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311690.002	1516620.005	0.783
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311720.002	1516620.005	0.898
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311750.002	1516620.005	0.790
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311780.002	1516620.005	0.783
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311810.002	1516620.005	0.893
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311840.002	1516620.005	0.858
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311870.002	1516620.005	0.858
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311900.002	1516620.005	0.857
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311930.002	1516620.005	0.800
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311720.002	1516590.005	0.819
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311750.002	1516590.005	0.900
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311780.002	1516590.005	0.897
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311810.002	1516590.005	0.895
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311840.002	1516590.005	0.894
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311870.002	1516590.005	0.894
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311900.002	1516590.005	0.892
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311930.002	1516590.005	0.798
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311750.002	1516560.005	0.309
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311780.002	1516560.005	0.314
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311810.002	1516560.005	0.863
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311840.002	1516560.005	0.869
25718	Hexastylis naniflora	273	Dwarf-flowered Heartleaf	2006-09	2006-09	2006-09	Current	C	2-High	316	1000	NC	1311780.002	1516530.005	0.301
26004	Hexastylis naniflora	275	Dwarf-flowered Heartleaf	2014-05-21	2014-05-21	2007-04-17	Current	C	2-High	275	500	NC	1337100.002	1513560.005	0.115
26004	Hexastylis naniflora	275	Dwarf-flowered Heartleaf	2014-05-21	2014-05-21	2007-04-17	Current	C	2-High	275	500	NC	1337130.002	1513560.005	0.101
26004	Hexastylis naniflora	275	Dwarf-flowered Heartleaf	2014-05-21	2014-05-21	2007-04-17	Current	C	2-High	275	500	NC	1337160.002	1513560.005	0.081
36703	Hexastylis naniflora	314	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1304970.002	1512810.005	0.606
36703	Hexastylis naniflora	314	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305000.002	1512780.005	0.618
8307	Hexastylis naniflora	21	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1994-04-12	Current	A	2-High	295	500	NC	1305690.002	1512750.005	0.128
8307	Hexastylis naniflora	21	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1994-04-12	Current	A	2-High	295	500	NC	1305720.002	1512750.005	0.070
36703	Hexastylis naniflora	314	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1304970.002	1512720.005	0.177
8307	Hexastylis naniflora	21	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1994-04-12	Current	A	2-High	295	500	NC	1305660.002	1512720.005	0.131
8307	Hexastylis naniflora	21	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1994-04-12	Current	A	2-High	295	500	NC	1305690.002	1512720.005	0.069
36703	Hexastylis naniflora	314	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1304970.002	1512690.005	0.175
8307	Hexastylis naniflora	21	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1994-04-12	Current	A	2-High	295	500	NC	1305660.002	1512690.005	0.129
30019	Hexastylis naniflora	294	Dwarf-flowered Heartleaf	2016-03-20	2016-03-20	2011-11-05	Current	Ci	2-High	295	500	NC	1305960.002	1512690.005	0.223
30019	Hexastylis naniflora	294	Dwarf-flowered Heartleaf	2016-03-20	2016-03-20	2011-11-05	Current	Ci	2-High	295	500	NC	1305990.002	1512690.005	0.220
8307	Hexastylis naniflora	21	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1994-04-12	Current	A	2-High	295	500	NC	1305660.002	1512660.005	0.124
30019	Hexastylis naniflora	294	Dwarf-flowered Heartleaf	2016-03-20	2016-03-20	2011-11-05	Current	Ci	2-High	295	500	NC	1305960.002	1512660.005	0.118
30019	Hexastylis naniflora	294	Dwarf-flowered Heartleaf	2016-03-20	2016-03-20	2011-11-05	Current	Ci	2-High	295	500	NC	1305990.002	1512660.005	0.222
30019	Hexastylis naniflora	294	Dwarf-flowered Heartleaf	2016-03-20	2016-03-20	2011-11-05	Current	Ci	2-High	295	500	NC	1306020.002	1512660.005	0.212
36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305750.002	1511730.005	0.537
36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305780.002	1511730.005	0.870
36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305750.002	1511700.005	0.638
36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305780.002	1511700.005	0.837

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305750.002	1511670.005	0.676
36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305780.002	1511670.005	0.859
36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305810.002	1511670.005	0.711
36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305750.002	1511640.005	0.665
36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305780.002	1511640.005	0.829
36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305810.002	1511640.005	0.673
36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305780.002	1511610.005	0.851
36701	Hexastylis naniflora	313	Dwarf-flowered Heartleaf	2012	2012	2012	Current	E	2-High	295	500	NC	1305810.002	1511580.005	0.662
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289850.002	1511520.005	0.752
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289880.002	1511520.005	0.736
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289730.002	1511490.005	0.743
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289760.002	1511490.005	0.745
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289790.002	1511490.005	0.745
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289820.002	1511490.005	0.704
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289730.002	1511460.005	0.721
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289760.002	1511460.005	0.731
22492	Hexastylis naniflora	255	Dwarf-flowered Heartleaf	2006-06	2006-06	2006-06	Current	D	2-High	178	2000	NC	1290630.002	1511430.005	0.656
22492	Hexastylis naniflora	255	Dwarf-flowered Heartleaf	2006-06	2006-06	2006-06	Current	D	2-High	178	2000	NC	1290660.002	1511430.005	0.779
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289100.002	1511400.005	0.751
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289520.002	1511400.005	0.823
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289550.002	1511400.005	0.724
22492	Hexastylis naniflora	255	Dwarf-flowered Heartleaf	2006-06	2006-06	2006-06	Current	D	2-High	178	2000	NC	1290630.002	1511400.005	0.657
22492	Hexastylis naniflora	255	Dwarf-flowered Heartleaf	2006-06	2006-06	2006-06	Current	D	2-High	178	2000	NC	1290660.002	1511400.005	0.708
22493	Hexastylis naniflora	256	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	C?r	2-High	178	2000	NC	1290720.002	1511400.005	0.858
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289070.002	1511370.005	0.736
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289100.002	1511370.005	0.837
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289490.002	1511370.005	0.823
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289520.002	1511370.005	0.728
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289610.002	1511370.005	0.904
22492	Hexastylis naniflora	255	Dwarf-flowered Heartleaf	2006-06	2006-06	2006-06	Current	D	2-High	178	2000	NC	1290600.002	1511370.005	0.631
22493	Hexastylis naniflora	256	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	C?r	2-High	178	2000	NC	1290720.002	1511370.005	0.858
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289040.002	1511340.005	0.889
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289070.002	1511340.005	0.729
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289100.002	1511340.005	0.725
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289460.002	1511340.005	0.830
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289490.002	1511340.005	0.729
22493	Hexastylis naniflora	256	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	C?r	2-High	178	2000	NC	1290720.002	1511340.005	0.857
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289010.002	1511310.005	0.911
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289040.002	1511310.005	0.743
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289070.002	1511310.005	0.721
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289310.002	1511310.005	0.849
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289430.002	1511310.005	0.759
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289460.002	1511310.005	0.733
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289490.002	1511310.005	0.763
22491	Hexastylis naniflora	254	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	D?r	2-High	178	2000	NC	1290360.002	1511310.005	0.902
22491	Hexastylis naniflora	254	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	D?r	2-High	178	2000	NC	1290390.002	1511310.005	0.878
22491	Hexastylis naniflora	254	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	D?r	2-High	178	2000	NC	1290420.002	1511310.005	0.899
22491	Hexastylis naniflora	254	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	D?r	2-High	178	2000	NC	1290450.002	1511310.005	0.625
22493	Hexastylis naniflora	256	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	C?r	2-High	178	2000	NC	1290720.002	1511310.005	0.758
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288980.002	1511280.005	0.845
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289010.002	1511280.005	0.798
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289040.002	1511280.005	0.741

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289460.002	1511280.005	0.781
22491	Hexastylis naniflora	254	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	D?r	2-High	178	2000	NC	1290360.002	1511280.005	0.510
22491	Hexastylis naniflora	254	Dwarf-flowered Heartleaf	2010-05-26	2010-05-26	2006-06	Current	D?r	2-High	178	2000	NC	1290390.002	1511280.005	0.818
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288980.002	1511250.005	0.819
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289010.002	1511250.005	0.869
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288980.002	1511220.005	0.871
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289610.002	1511220.005	0.897
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288980.002	1511190.005	0.785
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288860.002	1511130.005	0.884
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288890.002	1511130.005	0.827
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288920.002	1511130.005	0.701
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289550.002	1511130.005	0.808
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292490.002	1511130.005	0.785
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292520.002	1511130.005	0.787
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288830.002	1511100.005	0.812
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288860.002	1511100.005	0.901
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288890.002	1511100.005	0.789
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288920.002	1511100.005	0.706
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288950.002	1511100.005	0.773
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289550.002	1511100.005	0.803
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292460.002	1511100.005	0.782
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292490.002	1511100.005	0.780
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292520.002	1511100.005	0.778
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292550.002	1511100.005	0.790
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292610.002	1511100.005	0.782
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292640.002	1511100.005	0.791
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292670.002	1511100.005	0.791
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292700.002	1511100.005	0.793
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288830.002	1511070.005	0.915
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288860.002	1511070.005	0.864
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288890.002	1511070.005	0.720
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288920.002	1511070.005	0.678
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288950.002	1511070.005	0.759
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292400.002	1511070.005	0.777
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292430.002	1511070.005	0.775
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292460.002	1511070.005	0.742
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292490.002	1511070.005	0.684
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292550.002	1511070.005	0.683
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292580.002	1511070.005	0.782
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292610.002	1511070.005	0.786
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292640.002	1511070.005	0.786
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292670.002	1511070.005	0.791
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292700.002	1511070.005	0.801
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292730.002	1511070.005	0.800
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288590.002	1511040.005	0.914
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288830.002	1511040.005	0.882
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288860.002	1511040.005	0.803
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288890.002	1511040.005	0.695
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292400.002	1511040.005	0.770
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292460.002	1511040.005	0.662
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292580.002	1511040.005	0.726
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292610.002	1511040.005	0.728

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292640.002	1511040.005	0.673
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292670.002	1511040.005	0.676
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292700.002	1511040.005	0.791
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292730.002	1511040.005	0.798
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292760.002	1511040.005	0.803
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292790.002	1511040.005	0.796
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288590.002	1511010.005	0.856
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288620.002	1511010.005	0.829
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288830.002	1511010.005	0.880
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288860.002	1511010.005	0.819
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288890.002	1511010.005	0.690
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292730.002	1511010.005	0.793
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292760.002	1511010.005	0.821
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292790.002	1511010.005	0.808
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292820.002	1511010.005	0.800
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288560.002	1510980.005	0.922
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288590.002	1510980.005	0.847
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288620.002	1510980.005	0.795
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288860.002	1510980.005	0.826
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288890.002	1510980.005	0.709
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289430.002	1510980.005	0.806
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292760.002	1510980.005	0.763
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292790.002	1510980.005	0.818
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292820.002	1510980.005	0.817
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510980.005	0.812
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293000.002	1510980.005	0.828
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293030.002	1510980.005	0.808
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510980.005	0.242
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288530.002	1510950.005	0.923
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288560.002	1510950.005	0.916
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288590.002	1510950.005	0.850
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288620.002	1510950.005	0.906
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288860.002	1510950.005	0.904
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288890.002	1510950.005	0.766
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292790.002	1510950.005	0.793
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292820.002	1510950.005	0.805
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510950.005	0.815
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292880.002	1510950.005	0.822
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292910.002	1510950.005	0.823
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292940.002	1510950.005	0.826
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292970.002	1510950.005	0.832
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293000.002	1510950.005	0.815
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293030.002	1510950.005	0.725
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510950.005	0.732
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293090.002	1510950.005	0.850
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288500.002	1510920.005	0.920
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288530.002	1510920.005	0.884
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288560.002	1510920.005	0.851
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288590.002	1510920.005	0.850
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288620.002	1510920.005	0.880
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288890.002	1510920.005	0.898
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289460.002	1510920.005	0.766

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510920.005	0.720
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292880.002	1510920.005	0.810
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292910.002	1510920.005	0.743
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292940.002	1510920.005	0.733
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292970.002	1510920.005	0.735
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293000.002	1510920.005	0.660
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293030.002	1510920.005	0.661
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510920.005	0.668
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293090.002	1510920.005	0.818
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288500.002	1510890.005	0.918
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288530.002	1510890.005	0.854
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288560.002	1510890.005	0.806
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288590.002	1510890.005	0.845
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288620.002	1510890.005	0.879
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292880.002	1510890.005	0.691
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292910.002	1510890.005	0.705
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292940.002	1510890.005	0.660
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510890.005	0.704
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293090.002	1510890.005	0.808
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288470.002	1510860.005	0.919
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288500.002	1510860.005	0.919
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288530.002	1510860.005	0.809
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288560.002	1510860.005	0.785
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288590.002	1510860.005	0.823
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293090.002	1510860.005	0.727
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293120.002	1510860.005	0.843
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288470.002	1510830.005	0.922
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288500.002	1510830.005	0.913
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288530.002	1510830.005	0.804
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289340.002	1510830.005	0.877
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293120.002	1510830.005	0.825
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293150.002	1510830.005	0.839
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288500.002	1510800.005	0.918
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1289310.002	1510800.005	0.882
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293120.002	1510800.005	0.704
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293150.002	1510800.005	0.790
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293180.002	1510800.005	0.832
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1288500.002	1510770.005	0.856
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293150.002	1510770.005	0.689
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293180.002	1510770.005	0.700
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293210.002	1510770.005	0.730
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293240.002	1510710.005	0.834
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292970.002	1510650.005	0.706
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288620.002	1510620.005	0.886
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288650.002	1510620.005	0.881
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288680.002	1510620.005	0.882
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288710.002	1510620.005	0.842
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292490.002	1510620.005	0.805
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292910.002	1510620.005	0.828
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292940.002	1510620.005	0.830
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510620.005	0.792
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288620.002	1510590.005	0.691

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288650.002	1510590.005	0.685
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288680.002	1510590.005	0.865
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288710.002	1510590.005	0.877
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288740.002	1510590.005	0.877
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292490.002	1510590.005	0.753
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292520.002	1510590.005	0.794
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292700.002	1510590.005	0.812
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292730.002	1510590.005	0.808
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292760.002	1510590.005	0.818
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292790.002	1510590.005	0.820
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292820.002	1510590.005	0.817
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510590.005	0.792
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292880.002	1510590.005	0.787
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292910.002	1510590.005	0.830
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288680.002	1510560.005	0.772
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288710.002	1510560.005	0.776
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288740.002	1510560.005	0.871
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288770.002	1510560.005	0.874
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292550.002	1510560.005	0.810
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292700.002	1510560.005	0.774
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292730.002	1510560.005	0.667
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292760.002	1510560.005	0.726
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292790.002	1510560.005	0.661
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292820.002	1510560.005	0.706
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510560.005	0.706
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292880.002	1510560.005	0.828
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510560.005	0.840
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293090.002	1510560.005	0.835
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293120.002	1510560.005	0.830
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293150.002	1510560.005	0.828
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293180.002	1510560.005	0.735
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293210.002	1510560.005	0.806
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288710.002	1510530.005	0.464
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288740.002	1510530.005	0.772
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288770.002	1510530.005	0.837
28353	Hexastylis naniflora	284	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288800.002	1510530.005	0.875
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289880.002	1510530.005	0.805
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289910.002	1510530.005	0.857
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289940.002	1510530.005	0.813
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289970.002	1510530.005	0.815
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290000.002	1510530.005	0.899
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292790.002	1510530.005	0.638
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292820.002	1510530.005	0.657
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510530.005	0.780
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292910.002	1510530.005	0.830
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292940.002	1510530.005	0.830
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292970.002	1510530.005	0.741
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293000.002	1510530.005	0.745
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293030.002	1510530.005	0.817
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510530.005	0.721
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293090.002	1510530.005	0.711
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293120.002	1510530.005	0.728

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293150.002	1510530.005	0.704
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293180.002	1510530.005	0.708
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293210.002	1510530.005	0.776
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293240.002	1510530.005	0.827
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293270.002	1510530.005	0.810
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293300.002	1510530.005	0.805
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293360.002	1510530.005	0.805
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293390.002	1510530.005	0.801
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293420.002	1510530.005	0.796
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293450.002	1510530.005	0.793
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293480.002	1510530.005	0.791
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293510.002	1510530.005	0.782
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289610.002	1510500.005	0.786
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289640.002	1510500.005	0.821
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289670.002	1510500.005	0.735
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289790.002	1510500.005	0.719
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289820.002	1510500.005	0.838
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289850.002	1510500.005	0.809
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289880.002	1510500.005	0.854
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289910.002	1510500.005	0.804
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289940.002	1510500.005	0.799
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289970.002	1510500.005	0.707
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290000.002	1510500.005	0.700
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292820.002	1510500.005	0.702
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510500.005	0.817
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292880.002	1510500.005	0.830
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292910.002	1510500.005	0.822
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292940.002	1510500.005	0.817
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292970.002	1510500.005	0.618
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293000.002	1510500.005	0.669
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293030.002	1510500.005	0.665
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510500.005	0.663
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293090.002	1510500.005	0.695
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293120.002	1510500.005	0.589
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293150.002	1510500.005	0.586
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293180.002	1510500.005	0.586
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293210.002	1510500.005	0.611
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293240.002	1510500.005	0.813
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293270.002	1510500.005	0.825
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293300.002	1510500.005	0.815
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293330.002	1510500.005	0.814
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293360.002	1510500.005	0.805
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293390.002	1510500.005	0.798
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293420.002	1510500.005	0.793
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293450.002	1510500.005	0.786
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293480.002	1510500.005	0.784
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293510.002	1510500.005	0.748
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293540.002	1510500.005	0.797
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293570.002	1510500.005	0.788
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293600.002	1510500.005	0.724
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289580.002	1510470.005	0.716
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289610.002	1510470.005	0.747

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289640.002	1510470.005	0.751
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289670.002	1510470.005	0.745
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289820.002	1510470.005	0.355
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289850.002	1510470.005	0.756
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289880.002	1510470.005	0.718
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289910.002	1510470.005	0.705
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292490.002	1510470.005	0.794
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292520.002	1510470.005	0.798
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292820.002	1510470.005	0.810
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510470.005	0.833
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292880.002	1510470.005	0.829
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292910.002	1510470.005	0.696
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292940.002	1510470.005	0.692
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292970.002	1510470.005	0.675
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293000.002	1510470.005	0.669
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293030.002	1510470.005	0.659
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510470.005	0.655
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293090.002	1510470.005	0.715
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293210.002	1510470.005	0.586
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293240.002	1510470.005	0.714
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293270.002	1510470.005	0.805
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293300.002	1510470.005	0.806
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293330.002	1510470.005	0.722
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293360.002	1510470.005	0.773
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293390.002	1510470.005	0.764
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293420.002	1510470.005	0.814
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293450.002	1510470.005	0.777
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293480.002	1510470.005	0.710
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293510.002	1510470.005	0.714
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293540.002	1510470.005	0.745
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293570.002	1510470.005	0.724
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293600.002	1510470.005	0.721
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289550.002	1510440.005	0.828
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289580.002	1510440.005	0.730
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289610.002	1510440.005	0.745
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289640.002	1510440.005	0.648
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292370.002	1510440.005	0.760
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292400.002	1510440.005	0.786
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292490.002	1510440.005	0.794
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292790.002	1510440.005	0.786
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292820.002	1510440.005	0.773
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510440.005	0.814
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292880.002	1510440.005	0.834
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292970.002	1510440.005	0.727
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293000.002	1510440.005	0.687
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293270.002	1510440.005	0.756
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293300.002	1510440.005	0.760
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293330.002	1510440.005	0.764
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293360.002	1510440.005	0.749
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293390.002	1510440.005	0.745
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293420.002	1510440.005	0.743
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293450.002	1510440.005	0.766

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293480.002	1510440.005	0.757
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293510.002	1510440.005	0.742
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293540.002	1510440.005	0.738
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293570.002	1510440.005	0.719
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289550.002	1510410.005	0.823
28350	Hexastylis naniflora	281	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289580.002	1510410.005	0.649
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292460.002	1510410.005	0.788
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292790.002	1510410.005	0.744
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292820.002	1510410.005	0.767
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510410.005	0.780
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292880.002	1510410.005	0.720
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292910.002	1510410.005	0.683
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292940.002	1510410.005	0.794
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293000.002	1510410.005	0.733
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293030.002	1510410.005	0.720
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510410.005	0.683
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293300.002	1510410.005	0.743
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293330.002	1510410.005	0.743
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293360.002	1510410.005	0.754
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293390.002	1510410.005	0.738
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293420.002	1510410.005	0.749
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293450.002	1510410.005	0.830
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293480.002	1510410.005	0.799
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293510.002	1510410.005	0.680
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293540.002	1510410.005	0.684
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290840.002	1510380.005	0.765
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292790.002	1510380.005	0.742
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292820.002	1510380.005	0.758
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510380.005	0.771
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292880.002	1510380.005	0.711
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292910.002	1510380.005	0.669
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292940.002	1510380.005	0.720
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292970.002	1510380.005	0.741
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293000.002	1510380.005	0.752
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510380.005	0.728
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293090.002	1510380.005	0.773
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293120.002	1510380.005	0.730
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293150.002	1510380.005	0.768
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293420.002	1510380.005	0.735
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293450.002	1510380.005	0.793
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293480.002	1510380.005	0.797
28343	Hexastylis naniflora	280	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-06-12	Current	C	2-High	178	2000	NC	1290450.002	1510350.005	0.582
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290570.002	1510350.005	0.790
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290600.002	1510350.005	0.827
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290630.002	1510350.005	0.766
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290810.002	1510350.005	0.707
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290840.002	1510350.005	0.705
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290870.002	1510350.005	0.755
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290900.002	1510350.005	0.757
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290930.002	1510350.005	0.687
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292790.002	1510350.005	0.749
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292820.002	1510350.005	0.755

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510350.005	0.742
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292880.002	1510350.005	0.747
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292910.002	1510350.005	0.690
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292940.002	1510350.005	0.694
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292970.002	1510350.005	0.706
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293000.002	1510350.005	0.728
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293030.002	1510350.005	0.804
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293090.002	1510350.005	0.722
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293120.002	1510350.005	0.778
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293150.002	1510350.005	0.613
28343	Hexastylis naniflora	280	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-06-12	Current	C	2-High	178	2000	NC	1290360.002	1510320.005	0.812
28343	Hexastylis naniflora	280	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-06-12	Current	C	2-High	178	2000	NC	1290390.002	1510320.005	0.811
28343	Hexastylis naniflora	280	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-06-12	Current	C	2-High	178	2000	NC	1290420.002	1510320.005	0.804
28343	Hexastylis naniflora	280	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-06-12	Current	C	2-High	178	2000	NC	1290450.002	1510320.005	0.738
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290540.002	1510320.005	0.741
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290570.002	1510320.005	0.832
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290600.002	1510320.005	0.770
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290630.002	1510320.005	0.672
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290810.002	1510320.005	0.692
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290840.002	1510320.005	0.685
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290870.002	1510320.005	0.684
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290900.002	1510320.005	0.680
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290930.002	1510320.005	0.340
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290960.002	1510320.005	0.342
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290990.002	1510320.005	0.340
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292850.002	1510320.005	0.733
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292880.002	1510320.005	0.738
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292910.002	1510320.005	0.740
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292940.002	1510320.005	0.747
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292970.002	1510320.005	0.696
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293000.002	1510320.005	0.706
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293030.002	1510320.005	0.721
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510320.005	0.832
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293120.002	1510320.005	0.823
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293150.002	1510320.005	0.679
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293180.002	1510320.005	0.611
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290480.002	1510290.005	0.857
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290510.002	1510290.005	0.728
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290540.002	1510290.005	0.826
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290570.002	1510290.005	0.778
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290600.002	1510290.005	0.770
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290810.002	1510290.005	0.691
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290840.002	1510290.005	0.684
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292940.002	1510290.005	0.742
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1292970.002	1510290.005	0.693
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293000.002	1510290.005	0.698
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293030.002	1510290.005	0.713
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510290.005	0.751
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293150.002	1510290.005	0.726
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293180.002	1510290.005	0.617
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293330.002	1510290.005	0.701
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293360.002	1510290.005	0.737

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293390.002	1510290.005	0.375
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290450.002	1510260.005	0.858
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290480.002	1510260.005	0.764
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290510.002	1510260.005	0.857
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290540.002	1510260.005	0.836
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290570.002	1510260.005	0.738
21388	Hexastylis naniflora	160	Dwarf-flowered Heartleaf	2013-05-14	2013-05-14	2004-Fall	Current	A	3-Medium	178	2000	NC	1290810.002	1510260.005	0.343
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293030.002	1510260.005	0.416
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510260.005	0.526
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293150.002	1510260.005	0.820
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293180.002	1510260.005	0.783
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293210.002	1510260.005	0.724
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293240.002	1510260.005	0.722
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293270.002	1510260.005	0.702
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293300.002	1510260.005	0.752
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289970.002	1510230.005	0.805
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290000.002	1510230.005	0.805
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290420.002	1510230.005	0.772
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290450.002	1510230.005	0.768
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290480.002	1510230.005	0.856
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290510.002	1510230.005	0.868
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290540.002	1510230.005	0.783
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293030.002	1510230.005	0.729
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293060.002	1510230.005	0.826
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293150.002	1510230.005	0.820
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293180.002	1510230.005	0.780
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293210.002	1510230.005	0.726
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288860.002	1510200.005	0.851
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289790.002	1510200.005	0.881
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289820.002	1510200.005	0.886
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289850.002	1510200.005	0.884
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289880.002	1510200.005	0.883
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289910.002	1510200.005	0.802
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289940.002	1510200.005	0.791
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289970.002	1510200.005	0.791
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290000.002	1510200.005	0.699
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290030.002	1510200.005	0.835
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290420.002	1510200.005	0.763
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290450.002	1510200.005	0.853
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290480.002	1510200.005	0.819
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290510.002	1510200.005	0.828
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288800.002	1510170.005	0.853
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288830.002	1510170.005	0.812
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289580.002	1510170.005	0.881
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289610.002	1510170.005	0.885
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289640.002	1510170.005	0.886
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289670.002	1510170.005	0.889
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289700.002	1510170.005	0.889
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289730.002	1510170.005	0.888
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289760.002	1510170.005	0.898
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289790.002	1510170.005	0.886
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289820.002	1510170.005	0.870

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289850.002	1510170.005	0.847
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289880.002	1510170.005	
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289910.002	1510170.005	0.697
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289940.002	1510170.005	0.741
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289970.002	1510170.005	0.739
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290000.002	1510170.005	0.828
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290030.002	1510170.005	0.737
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290450.002	1510170.005	0.826
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290480.002	1510170.005	0.896
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290510.002	1510170.005	0.764
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288770.002	1510140.005	0.859
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288800.002	1510140.005	0.853
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289430.002	1510140.005	0.682
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289460.002	1510140.005	0.682
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289490.002	1510140.005	0.786
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289520.002	1510140.005	0.881
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289550.002	1510140.005	0.884
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289580.002	1510140.005	0.883
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289610.002	1510140.005	0.885
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289640.002	1510140.005	0.853
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289670.002	1510140.005	0.803
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289700.002	1510140.005	0.803
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289730.002	1510140.005	0.793
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289760.002	1510140.005	0.882
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289790.002	1510140.005	0.879
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290450.002	1510140.005	0.898
21389	Hexastylis naniflora	161	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2004-Fall	Current	A	3-Medium	178	2000	NC	1290480.002	1510140.005	0.862
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288740.002	1510110.005	0.790
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288770.002	1510110.005	0.862
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289370.002	1510110.005	0.352
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289400.002	1510110.005	0.682
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289430.002	1510110.005	0.872
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289460.002	1510110.005	0.874
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289490.002	1510110.005	0.879
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289520.002	1510110.005	0.877
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289550.002	1510110.005	0.879
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289580.002	1510110.005	0.797
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289610.002	1510110.005	0.879
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289640.002	1510110.005	0.790
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289670.002	1510110.005	0.784
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288710.002	1510080.005	0.865
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288740.002	1510080.005	0.868
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288770.002	1510080.005	0.856
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288860.002	1510080.005	0.826
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288890.002	1510080.005	0.851
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289310.002	1510080.005	0.426
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289340.002	1510080.005	0.813
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289370.002	1510080.005	0.838
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289400.002	1510080.005	0.843
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289430.002	1510080.005	0.874
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289460.002	1510080.005	0.787
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289490.002	1510080.005	0.678

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289520.002	1510080.005	0.676
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289580.002	1510080.005	0.797
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289610.002	1510080.005	0.698
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289640.002	1510080.005	0.777
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288680.002	1510050.005	0.591
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288710.002	1510050.005	0.872
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288740.002	1510050.005	0.868
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288770.002	1510050.005	0.863
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288800.002	1510050.005	0.860
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288830.002	1510050.005	0.860
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288860.002	1510050.005	0.854
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288890.002	1510050.005	0.848
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288920.002	1510050.005	0.845
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289280.002	1510050.005	0.748
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289310.002	1510050.005	0.752
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289340.002	1510050.005	0.873
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289370.002	1510050.005	0.839
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289400.002	1510050.005	0.876
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289430.002	1510050.005	0.828
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289550.002	1510050.005	0.799
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289580.002	1510050.005	0.759
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289610.002	1510050.005	0.680
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290000.002	1510050.005	0.729
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290030.002	1510050.005	0.679
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290060.002	1510050.005	0.696
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288650.002	1510020.005	0.887
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288680.002	1510020.005	0.885
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288710.002	1510020.005	0.865
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288740.002	1510020.005	0.856
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288770.002	1510020.005	0.856
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288800.002	1510020.005	0.853
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288830.002	1510020.005	0.853
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288860.002	1510020.005	0.851
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288890.002	1510020.005	0.775
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288920.002	1510020.005	0.723
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289250.002	1510020.005	0.747
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289280.002	1510020.005	0.744
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289310.002	1510020.005	0.744
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289340.002	1510020.005	0.865
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289550.002	1510020.005	0.874
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289580.002	1510020.005	0.874
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289610.002	1510020.005	0.682
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289730.002	1510020.005	0.846
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289760.002	1510020.005	0.847
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289790.002	1510020.005	0.801
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289820.002	1510020.005	0.710
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289850.002	1510020.005	0.794
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289880.002	1510020.005	0.799
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289910.002	1510020.005	0.804
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289940.002	1510020.005	0.806
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289970.002	1510020.005	0.807
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290000.002	1510020.005	0.809

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290030.002	1510020.005	0.766
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290060.002	1510020.005	0.750
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290090.002	1510020.005	0.844
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288620.002	1509990.005	0.893
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288650.002	1509990.005	0.865
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288680.002	1509990.005	0.793
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288710.002	1509990.005	0.767
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288740.002	1509990.005	0.755
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288770.002	1509990.005	0.707
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288800.002	1509990.005	0.704
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288830.002	1509990.005	0.763
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289280.002	1509990.005	0.635
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289520.002	1509990.005	0.907
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289550.002	1509990.005	0.876
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289580.002	1509990.005	0.868
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289730.002	1509990.005	0.839
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289760.002	1509990.005	0.794
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289790.002	1509990.005	0.795
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289820.002	1509990.005	0.797
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289850.002	1509990.005	0.801
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289880.002	1509990.005	0.806
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289910.002	1509990.005	0.887
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289940.002	1509990.005	0.812
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289970.002	1509990.005	0.816
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290000.002	1509990.005	0.801
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1290030.002	1509990.005	0.785
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288620.002	1509960.005	0.886
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288650.002	1509960.005	0.796
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288680.002	1509960.005	0.767
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288710.002	1509960.005	0.753
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289460.002	1509960.005	0.825
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289490.002	1509960.005	0.886
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289520.002	1509960.005	0.874
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289550.002	1509960.005	0.862
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289580.002	1509960.005	0.776
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289760.002	1509960.005	0.788
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289790.002	1509960.005	0.853
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289820.002	1509960.005	0.803
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289850.002	1509960.005	0.801
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289880.002	1509960.005	0.797
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288620.002	1509930.005	0.813
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1288650.002	1509930.005	0.771
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289430.002	1509930.005	0.901
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289460.002	1509930.005	0.865
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289490.002	1509930.005	0.871
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289520.002	1509930.005	0.877
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289550.002	1509930.005	0.802
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289370.002	1509900.005	0.879
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289400.002	1509900.005	0.872
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289430.002	1509900.005	0.872
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289460.002	1509900.005	0.864
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289490.002	1509900.005	0.864

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289520.002	1509900.005	0.842
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289340.002	1509870.005	0.859
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289370.002	1509870.005	0.869
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289400.002	1509870.005	0.865
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289430.002	1509870.005	0.833
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289310.002	1509840.005	0.732
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289340.002	1509840.005	0.863
28351	Hexastylis naniflora	282	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289370.002	1509840.005	0.863
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289070.002	1509780.005	0.682
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289100.002	1509780.005	0.684
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289040.002	1509750.005	0.721
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289070.002	1509750.005	0.721
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289100.002	1509750.005	0.714
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289130.002	1509750.005	0.675
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289160.002	1509750.005	0.712
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289190.002	1509750.005	0.712
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289040.002	1509720.005	0.746
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289070.002	1509720.005	0.743
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289100.002	1509720.005	0.836
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289130.002	1509720.005	0.653
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289160.002	1509720.005	0.621
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289040.002	1509690.005	0.870
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289070.002	1509690.005	0.778
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289100.002	1509690.005	0.756
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289130.002	1509690.005	0.605
28352	Hexastylis naniflora	283	Dwarf-flowered Heartleaf	2009-04-07	2009-04-07	2008-10-21	Current	E	3-Medium	178	2000	NC	1289160.002	1509690.005	0.602
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315590.002	1509420.005	0.547
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315560.002	1509390.005	0.549
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315590.002	1509390.005	0.551
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315530.002	1509360.005	0.554
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315560.002	1509360.005	0.558
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315530.002	1509330.005	0.558
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315440.002	1509270.005	0.374
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315470.002	1509270.005	0.385
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315500.002	1509270.005	0.389
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315440.002	1509240.005	0.457
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315470.002	1509240.005	0.471
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315500.002	1509240.005	0.506
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315440.002	1509210.005	0.611
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315470.002	1509210.005	0.607
14501	Hexastylis naniflora	30	Dwarf-flowered Heartleaf	2013-06-05	2013-06-05	1995-03-22	Current	CD	2-High	179	2000	NC	1315500.002	1509210.005	0.603
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1290780.002	1509180.005	0.158
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1290810.002	1509180.005	0.814
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1290840.002	1509180.005	0.754
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1290870.002	1509180.005	0.691
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1290900.002	1509180.005	0.668
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1290930.002	1509180.005	0.768
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1290780.002	1509150.005	0.167
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1290810.002	1509150.005	0.461
36661	Hexastylis naniflora	310	Dwarf-flowered Heartleaf	2016-04-05	2016-04-05	2016-04-05	Current	A	1-Very High	178	2000	NC	1290840.002	1509150.005	0.449
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313220.002	1508070.005	0.061
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313220.002	1508040.005	0.406

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313250.002	1508040.005	0.665
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313100.002	1507920.005	0.587
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313130.002	1507920.005	0.655
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313160.002	1507920.005	0.453
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313070.002	1507890.005	0.426
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313100.002	1507890.005	0.445
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313130.002	1507890.005	0.598
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313160.002	1507890.005	0.438
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313100.002	1507860.005	0.638
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313130.002	1507860.005	0.645
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1314810.002	1507860.005	0.741
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1314780.002	1507830.005	0.815
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1314810.002	1507830.005	0.733
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313790.002	1507650.005	0.406
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313820.002	1507650.005	0.702
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313850.002	1507650.005	0.408
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332120.002	1507650.005	0.769
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332150.002	1507650.005	0.773
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332180.002	1507650.005	0.773
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332210.002	1507650.005	0.773
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313760.002	1507620.005	0.189
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313790.002	1507620.005	0.646
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313820.002	1507620.005	0.604
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313850.002	1507620.005	0.608
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313880.002	1507620.005	0.405
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507620.005	0.767
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507620.005	0.777
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332090.002	1507620.005	0.773
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332120.002	1507620.005	0.771
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332150.002	1507620.005	0.766
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313760.002	1507590.005	0.167
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313790.002	1507590.005	0.579
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313820.002	1507590.005	0.596
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313850.002	1507590.005	0.598
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313880.002	1507590.005	0.697
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313910.002	1507590.005	0.698
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331970.002	1507590.005	0.766
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507590.005	0.771
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507590.005	0.771
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507590.005	0.764
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332090.002	1507590.005	0.734
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332120.002	1507590.005	0.678
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332150.002	1507590.005	0.663
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313730.002	1507560.005	0.193
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313760.002	1507560.005	0.590
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313790.002	1507560.005	0.592
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313820.002	1507560.005	0.691
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313850.002	1507560.005	0.691
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313880.002	1507560.005	0.745
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313910.002	1507560.005	0.745
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331910.002	1507560.005	0.768
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331940.002	1507560.005	0.769

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331970.002	1507560.005	0.718
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507560.005	0.721
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507560.005	0.729
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507560.005	0.638
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332090.002	1507560.005	0.660
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332120.002	1507560.005	0.655
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313760.002	1507530.005	0.737
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313790.002	1507530.005	0.687
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313820.002	1507530.005	0.773
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313850.002	1507530.005	0.774
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313880.002	1507530.005	0.743
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313910.002	1507530.005	0.689
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331880.002	1507530.005	0.768
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331910.002	1507530.005	0.718
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331940.002	1507530.005	0.688
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331970.002	1507530.005	0.697
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507530.005	0.692
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507530.005	0.624
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507530.005	0.654
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332090.002	1507530.005	0.656
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313760.002	1507500.005	0.733
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313790.002	1507500.005	0.683
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313820.002	1507500.005	0.735
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313850.002	1507500.005	0.737
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313880.002	1507500.005	0.739
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331880.002	1507500.005	0.734
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331910.002	1507500.005	0.772
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331940.002	1507500.005	0.642
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331970.002	1507500.005	0.626
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507500.005	0.620
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507500.005	0.618
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507500.005	0.616
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313790.002	1507470.005	0.733
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313820.002	1507470.005	0.735
20023	Hexastylis naniflora	31	Dwarf-flowered Heartleaf	2010-12-21	2010-12-21	1995-05-04	Current	C?	3-Medium	31	2000	NC	1313850.002	1507470.005	0.683
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331880.002	1507470.005	0.739
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331910.002	1507470.005	0.776
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331940.002	1507470.005	0.760
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331970.002	1507470.005	0.642
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507470.005	0.642
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507470.005	0.640
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507470.005	0.641
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332090.002	1507470.005	0.728
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332360.002	1507470.005	0.735
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331850.002	1507440.005	0.770
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331880.002	1507440.005	0.682
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331910.002	1507440.005	0.731
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331940.002	1507440.005	0.770
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331970.002	1507440.005	0.728
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507440.005	0.769
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507440.005	0.770
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507440.005	0.729

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332090.002	1507440.005	0.764
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332120.002	1507440.005	0.752
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332150.002	1507440.005	0.646
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332300.002	1507440.005	0.634
37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	318	500	NC	1295400.002	1507410.005	0.115
37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	318	500	NC	1295430.002	1507410.005	0.096
37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	318	500	NC	1295490.002	1507410.005	0.542
37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	318	500	NC	1295520.002	1507410.005	0.139
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331760.002	1507410.005	0.740
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331790.002	1507410.005	0.740
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331820.002	1507410.005	0.767
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331850.002	1507410.005	0.672
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331880.002	1507410.005	0.646
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331910.002	1507410.005	0.616
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331940.002	1507410.005	0.762
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331970.002	1507410.005	0.762
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507410.005	0.728
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507410.005	0.762
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507410.005	0.770
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332090.002	1507410.005	0.765
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332120.002	1507410.005	0.750
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332150.002	1507410.005	0.640
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332240.002	1507410.005	0.659
14504	Hexastylis naniflora	29	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	1995-03-21	Current	A	2-High	29	2000	NC	1293676.469	1510541.206	0.373
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332295.953	1507578.747	0.186
21393	Hexastylis naniflora	162	Dwarf-flowered Heartleaf	2012-12-17	2012-12-17	2005-Fall	Current	D	2-High	179	2000	NC	1314527.879	1509098.456	0.188
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331730.002	1507380.005	0.651
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331850.002	1507380.005	0.655
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331880.002	1507380.005	0.602
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331910.002	1507380.005	0.644
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331940.002	1507380.005	0.672
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331970.002	1507380.005	0.732
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507380.005	0.729
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507380.005	0.671
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507380.005	0.768
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332090.002	1507380.005	0.771
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332120.002	1507380.005	0.659
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331970.002	1507350.005	0.668
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507350.005	0.684
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507350.005	0.728
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507350.005	0.766
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332090.002	1507350.005	0.763
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332120.002	1507350.005	0.662
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331970.002	1507320.005	0.140
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507320.005	0.676
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507320.005	0.770
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507320.005	0.726
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332090.002	1507320.005	0.670
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331970.002	1507290.005	0.175
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507290.005	0.765
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507290.005	0.771
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507290.005	0.721

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1331970.002	1507260.005	0.344
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507260.005	0.772
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507260.005	0.772
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332060.002	1507260.005	0.719
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332000.002	1507230.005	0.345
21920	Hexastylis naniflora	184	Dwarf-flowered Heartleaf	2013-10-30	2013-10-30	1994-05-11	Current	A	3-Medium	96	2000	NC	1332030.002	1507230.005	0.753
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330650.002	1506840.005	0.378
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330680.002	1506840.005	0.380
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330710.002	1506840.005	0.307
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330620.002	1506810.005	0.380
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330650.002	1506810.005	0.380
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330680.002	1506810.005	0.382
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330710.002	1506810.005	0.347
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330740.002	1506810.005	0.307
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330620.002	1506780.005	0.689
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330650.002	1506780.005	0.745
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330680.002	1506780.005	0.347
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330710.002	1506780.005	0.375
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330740.002	1506780.005	0.377
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330770.002	1506780.005	0.375
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330590.002	1506750.005	0.570
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330620.002	1506750.005	0.572
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330650.002	1506750.005	0.502
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330680.002	1506750.005	0.679
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330710.002	1506750.005	0.780
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330740.002	1506750.005	0.749
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330770.002	1506750.005	0.350
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330590.002	1506720.005	0.085
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330620.002	1506720.005	0.411
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330650.002	1506720.005	0.413
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330680.002	1506720.005	0.567
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330710.002	1506720.005	0.609
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330740.002	1506720.005	0.611
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330770.002	1506720.005	0.380
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330620.002	1506690.005	0.565
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330650.002	1506690.005	0.567
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330680.002	1506690.005	0.607
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330710.002	1506690.005	0.623
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330740.002	1506690.005	0.613
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330650.002	1506660.005	0.569
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330680.002	1506660.005	0.617
9318	Hexastylis naniflora	38	Dwarf-flowered Heartleaf	1996-06	1996-06	1996-06	Current	CD	3-Medium	96	2000	NC	1330710.002	1506660.005	0.699
8495	Hexastylis naniflora	39	Dwarf-flowered Heartleaf	2002-04-18	2002-04-18	1996-06	Current	D	2-High	96	2000	NC	1331970.002	1506570.005	0.494
8495	Hexastylis naniflora	39	Dwarf-flowered Heartleaf	2002-04-18	2002-04-18	1996-06	Current	D	2-High	96	2000	NC	1331910.002	1506540.005	0.666
8495	Hexastylis naniflora	39	Dwarf-flowered Heartleaf	2002-04-18	2002-04-18	1996-06	Current	D	2-High	96	2000	NC	1331940.002	1506540.005	0.573
8495	Hexastylis naniflora	39	Dwarf-flowered Heartleaf	2002-04-18	2002-04-18	1996-06	Current	D	2-High	96	2000	NC	1331850.002	1506510.005	0.617
8495	Hexastylis naniflora	39	Dwarf-flowered Heartleaf	2002-04-18	2002-04-18	1996-06	Current	D	2-High	96	2000	NC	1331880.002	1506510.005	0.579
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305360.002	1506330.005	0.741
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305390.002	1506330.005	0.792
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305420.002	1506330.005	0.768
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305330.002	1506300.005	0.655
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305360.002	1506300.005	0.792

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305390.002	1506300.005	0.802
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305420.002	1506300.005	0.823
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305450.002	1506300.005	0.814
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305300.002	1506270.005	0.221
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305330.002	1506270.005	0.509
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305360.002	1506270.005	0.565
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305390.002	1506270.005	0.716
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305420.002	1506270.005	0.808
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305450.002	1506270.005	0.829
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305300.002	1506240.005	0.242
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305330.002	1506240.005	0.532
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305360.002	1506240.005	0.530
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305390.002	1506240.005	0.686
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305420.002	1506240.005	0.712
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305450.002	1506240.005	0.305
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305480.002	1506240.005	0.828
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305300.002	1506210.005	0.203
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305330.002	1506210.005	0.198
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305360.002	1506210.005	0.515
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305390.002	1506210.005	0.526
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305420.002	1506210.005	0.702
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305450.002	1506210.005	0.808
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305330.002	1506180.005	0.201
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305360.002	1506180.005	0.201
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305390.002	1506180.005	0.526
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305420.002	1506180.005	0.536
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305450.002	1506180.005	0.719
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305360.002	1506150.005	0.526
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305390.002	1506150.005	0.528
14983	Hexastylis naniflora	32	Dwarf-flowered Heartleaf	2013-06-06	2013-06-06	1995-03-21	Current	D	3-Medium	32	500	NC	1305420.002	1506150.005	0.532
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309530.002	1505130.005	0.741
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309530.002	1505100.005	0.235
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309560.002	1505100.005	0.241
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309590.002	1505100.005	0.745
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309560.002	1505070.005	0.235
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309590.002	1505070.005	0.768
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309590.002	1505040.005	0.680
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309590.002	1505010.005	0.768
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309590.002	1504890.005	0.763
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309560.002	1504860.005	0.766
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309590.002	1504860.005	0.761
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309560.002	1504830.005	0.766
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309590.002	1504830.005	0.757
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309530.002	1504800.005	0.765
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309560.002	1504800.005	0.719
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309470.002	1504770.005	0.483
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309500.002	1504770.005	0.481
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309530.002	1504770.005	0.607
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309440.002	1504740.005	0.612
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309470.002	1504740.005	0.500
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309500.002	1504740.005	0.498
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309830.002	1504650.005	0.727

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309860.002	1504650.005	0.492
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309890.002	1504650.005	0.789
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309770.002	1504620.005	0.246
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309800.002	1504620.005	0.729
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309830.002	1504620.005	0.488
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1310100.002	1504440.005	0.690
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1310010.002	1504410.005	0.797
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1310040.002	1504410.005	0.789
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1310070.002	1504410.005	0.660
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1310100.002	1504410.005	0.595
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309950.002	1504380.005	0.543
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309980.002	1504380.005	0.644
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1310010.002	1504380.005	0.747
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1310040.002	1504380.005	0.679
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1310070.002	1504380.005	0.597
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309920.002	1504350.005	0.515
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309950.002	1504350.005	0.595
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1309980.002	1504350.005	0.524
13541	Hexastylis naniflora	19	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	D?	3-Medium	252	500	NC	1310010.002	1504350.005	0.534
37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	318	500	NC	1295796.43	1507353.689	0.133
37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	318	500	NC	1295352.827	1507308.152	0.057
37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	318	500	NC	1295637.446	1507362.056	0.111
37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	318	500	NC	1295676.15	1507367.448	0.140
37217	Hexastylis naniflora	318	Dwarf-flowered Heartleaf	2017-04	2017-04	2017-04	Current	C	2-High	318	500	NC	1295363.403	1507333.356	0.123
13542	Hexastylis naniflora	20	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	B	2-High	252	500	NC	1311030.002	1503030.005	0.465
13542	Hexastylis naniflora	20	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	B	2-High	252	500	NC	1311060.002	1503030.005	0.128
13542	Hexastylis naniflora	20	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	B	2-High	252	500	NC	1310910.002	1503000.005	0.753
13542	Hexastylis naniflora	20	Dwarf-flowered Heartleaf	2007	2007	1993-08-06	Current	B	2-High	252	500	NC	1310940.002	1503000.005	0.788
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287180.002	1499340.005	0.238
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287150.002	1499310.005	0.265
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287180.002	1499310.005	0.316
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287120.002	1499280.005	0.456
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287150.002	1499280.005	0.378
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287540.002	1499280.005	0.657
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287090.002	1499250.005	0.360
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287120.002	1499250.005	0.368
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287390.002	1499250.005	0.725
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287420.002	1499250.005	0.803
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287510.002	1499250.005	0.810
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287060.002	1499220.005	0.646
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287360.002	1499220.005	0.807
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287390.002	1499220.005	0.744
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287420.002	1499220.005	0.715
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287540.002	1499220.005	0.513
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287060.002	1499190.005	0.175
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287300.002	1499190.005	0.342
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287330.002	1499190.005	0.083
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287360.002	1499190.005	0.748
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287390.002	1499190.005	0.746
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287420.002	1499190.005	0.638
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287450.002	1499190.005	0.636
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287540.002	1499190.005	0.633

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287300.002	1499160.005	0.391
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287390.002	1499160.005	0.512
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287420.002	1499160.005	0.412
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287570.002	1499160.005	0.637
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287600.002	1499160.005	0.184
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287630.002	1499160.005	0.672
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287330.002	1499130.005	0.623
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287360.002	1499130.005	0.805
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287390.002	1499130.005	0.634
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287420.002	1499130.005	0.816
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287570.002	1499130.005	0.633
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287630.002	1499130.005	0.727
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287420.002	1499100.005	0.629
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287600.002	1499100.005	0.544
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287630.002	1499070.005	0.435
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287660.002	1499070.005	0.817
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287630.002	1499040.005	0.547
21386	Hexastylis naniflora	158	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	2001-05-07	Current	D	2-High	158	500	NC	1300020.002	1498560.005	0.733
21386	Hexastylis naniflora	158	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	2001-05-07	Current	D	2-High	158	500	NC	1299960.002	1498530.005	0.789
21386	Hexastylis naniflora	158	Dwarf-flowered Heartleaf	2016-05-24	2016-05-24	2001-05-07	Current	D	2-High	158	500	NC	1300020.002	1498530.005	0.733
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285020.002	1496040.005	0.301
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285050.002	1496040.005	0.361
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1284990.002	1496010.005	0.274
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285020.002	1496010.005	0.178
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285050.002	1496010.005	0.274
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1284960.002	1495980.005	0.485
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1284990.002	1495980.005	0.372
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285020.002	1495980.005	0.461
35113	Hexastylis naniflora	303	Dwarf-flowered Heartleaf	2015-04-28	2015-04-28	2015-04-28	Current	AB	2-High	303	500	NC	1287491.3	1499319.491	0.732
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285530.002	1495800.005	0.609
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285500.002	1495770.005	0.747
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285530.002	1495770.005	0.715
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285560.002	1495770.005	0.674
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285590.002	1495770.005	0.682
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285500.002	1495740.005	0.726
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285530.002	1495740.005	0.674
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285560.002	1495740.005	0.520
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285590.002	1495740.005	0.561
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285560.002	1495710.005	0.626
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285590.002	1495710.005	0.571
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285620.002	1495710.005	0.560
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285590.002	1495680.005	0.684
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285620.002	1495680.005	0.566
35185	Hexastylis naniflora	304	Dwarf-flowered Heartleaf	2015-05-05	2015-05-05	2015-03	Current	B?	2-High	304	500	NC	1285620.002	1495650.005	0.670
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302540.002	1495590.005	0.781
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302570.002	1495590.005	0.645
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302510.002	1495560.005	0.774
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302540.002	1495560.005	0.661
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302570.002	1495560.005	0.684
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302600.002	1495560.005	0.672
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302480.002	1495530.005	0.777
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302510.002	1495530.005	0.668

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302540.002	1495530.005	0.651
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302570.002	1495530.005	0.738
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306440.002	1495530.005	0.647
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302450.002	1495500.005	0.764
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302480.002	1495500.005	0.713
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302510.002	1495500.005	0.687
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302540.002	1495500.005	0.728
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302570.002	1495500.005	0.747
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306470.002	1495500.005	0.655
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306500.002	1495500.005	0.603
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306560.002	1495500.005	0.914
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306590.002	1495500.005	0.913
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302420.002	1495470.005	0.840
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302450.002	1495470.005	0.857
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302480.002	1495470.005	0.762
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302510.002	1495470.005	0.730
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302540.002	1495470.005	0.722
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302570.002	1495470.005	0.626
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306530.002	1495470.005	0.698
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306560.002	1495470.005	0.920
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306590.002	1495470.005	0.891
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302390.002	1495440.005	0.844
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302420.002	1495440.005	0.860
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302450.002	1495440.005	0.861
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302480.002	1495440.005	0.828
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302510.002	1495440.005	0.710
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302540.002	1495440.005	0.588
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302570.002	1495440.005	0.630
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302600.002	1495440.005	0.656
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306350.002	1495440.005	0.679
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306560.002	1495440.005	0.920
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306590.002	1495440.005	0.891
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302360.002	1495410.005	0.845
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302390.002	1495410.005	0.852
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302420.002	1495410.005	0.857
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302450.002	1495410.005	0.761
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302480.002	1495410.005	0.710
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302510.002	1495410.005	0.701
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302570.002	1495410.005	0.607
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302600.002	1495410.005	0.652
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306380.002	1495410.005	0.686
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306410.002	1495410.005	0.684
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306440.002	1495410.005	0.649
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306560.002	1495410.005	0.891
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306590.002	1495410.005	0.822
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306620.002	1495410.005	0.840
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306650.002	1495410.005	0.256
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306680.002	1495410.005	0.219
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306710.002	1495410.005	0.217
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302270.002	1495380.005	0.803
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302300.002	1495380.005	0.833
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302330.002	1495380.005	0.840

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302360.002	1495380.005	0.851
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302390.002	1495380.005	0.855
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302420.002	1495380.005	0.771
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302450.002	1495380.005	0.708
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306530.002	1495380.005	0.888
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306560.002	1495380.005	0.890
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302180.002	1495350.005	0.669
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302210.002	1495350.005	0.796
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302240.002	1495350.005	0.801
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302270.002	1495350.005	0.837
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302300.002	1495350.005	0.810
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302330.002	1495350.005	0.822
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302360.002	1495350.005	0.849
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302390.002	1495350.005	0.815
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302420.002	1495350.005	0.708
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306590.002	1495350.005	0.601
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302330.002	1495320.005	0.822
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302360.002	1495320.005	0.848
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302390.002	1495320.005	0.760
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306530.002	1495320.005	0.661
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302300.002	1495290.005	0.833
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302330.002	1495290.005	0.851
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302360.002	1495290.005	0.838
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302390.002	1495290.005	0.751
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302300.002	1495260.005	0.845
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302330.002	1495260.005	0.803
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302360.002	1495260.005	0.812
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302390.002	1495260.005	0.833
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302300.002	1495230.005	0.842
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302330.002	1495230.005	0.832
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302360.002	1495230.005	0.798
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302390.002	1495230.005	0.842
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306740.002	1495230.005	0.262
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302300.002	1495200.005	0.838
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302330.002	1495200.005	0.825
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306530.002	1495200.005	0.659
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306560.002	1495200.005	0.562
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302300.002	1495170.005	0.842
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306560.002	1495170.005	0.623
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306590.002	1495170.005	0.619
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306620.002	1495170.005	0.613
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302270.002	1495140.005	0.832
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302300.002	1495140.005	0.838
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306560.002	1495140.005	0.692
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306590.002	1495140.005	0.653
10553	Hexastylis naniflora	12	Dwarf-flowered Heartleaf	1995	1995	1981-05	Current	A	2-High	243	2000	NC	1302270.002	1495110.005	0.838
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306560.002	1495110.005	0.690
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306590.002	1495110.005	0.595
22400	Hexastylis naniflora	242	Dwarf-flowered Heartleaf	2005-05	2005-05	2005-05	Current	D	2-High	243	2000	NC	1302210.002	1495080.005	0.830
22400	Hexastylis naniflora	242	Dwarf-flowered Heartleaf	2005-05	2005-05	2005-05	Current	D	2-High	243	2000	NC	1302240.002	1495080.005	0.832
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306560.002	1495080.005	0.693
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306590.002	1495080.005	0.582

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22400	Hexastylis naniflora	242	Dwarf-flowered Heartleaf	2005-05	2005-05	2005-05	Current	D	2-High	243	2000	NC	1302240.002	1495050.005	0.810
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306560.002	1495050.005	0.653
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306590.002	1495050.005	0.560
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306560.002	1495020.005	0.653
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306590.002	1495020.005	0.653
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306620.002	1495020.005	0.585
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306590.002	1494990.005	0.651
24778	Hexastylis naniflora	271	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2008	Current	C?	2-High	271	99	NC	1306620.002	1494990.005	0.591
24777	Hexastylis naniflora	270	Dwarf-flowered Heartleaf	2012-07	2012-07	2006	Current	C?	2-High	243	2000	NC	1304100.002	1494960.005	0.832
24777	Hexastylis naniflora	270	Dwarf-flowered Heartleaf	2012-07	2012-07	2006	Current	C?	2-High	243	2000	NC	1304130.002	1494960.005	0.835
24777	Hexastylis naniflora	270	Dwarf-flowered Heartleaf	2012-07	2012-07	2006	Current	C?	2-High	243	2000	NC	1304100.002	1494930.005	0.307
24777	Hexastylis naniflora	270	Dwarf-flowered Heartleaf	2012-07	2012-07	2006	Current	C?	2-High	243	2000	NC	1304130.002	1494930.005	0.311
24777	Hexastylis naniflora	270	Dwarf-flowered Heartleaf	2012-07	2012-07	2006	Current	C?	2-High	243	2000	NC	1304160.002	1494930.005	0.313
24777	Hexastylis naniflora	270	Dwarf-flowered Heartleaf	2012-07	2012-07	2006	Current	C?	2-High	243	2000	NC	1304190.002	1494930.005	0.843
24776	Hexastylis naniflora	269	Dwarf-flowered Heartleaf	2007	2007	2006	Current	B	2-High	243	2000	NC	1303740.002	1494660.005	0.701
24776	Hexastylis naniflora	269	Dwarf-flowered Heartleaf	2007	2007	2006	Current	B	2-High	243	2000	NC	1303710.002	1494630.005	0.662
24776	Hexastylis naniflora	269	Dwarf-flowered Heartleaf	2007	2007	2006	Current	B	2-High	243	2000	NC	1303680.002	1494600.005	0.704
36589	Hexastylis naniflora	309	Dwarf-flowered Heartleaf	2016-05-06	2016-05-06	2016-05-06	Current	D?	2-High	309	99	NC	1288410.002	1494180.005	0.021
36589	Hexastylis naniflora	309	Dwarf-flowered Heartleaf	2016-05-06	2016-05-06	2016-05-06	Current	D?	2-High	309	99	NC	1288440.002	1494180.005	0.028
36589	Hexastylis naniflora	309	Dwarf-flowered Heartleaf	2016-05-06	2016-05-06	2016-05-06	Current	D?	2-High	309	99	NC	1288410.002	1494150.005	0.028
36589	Hexastylis naniflora	309	Dwarf-flowered Heartleaf	2016-05-06	2016-05-06	2016-05-06	Current	D?	2-High	309	99	NC	1288440.002	1494150.005	0.027
29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	293	99	NC	1335810.002	1494150.005	0.713
29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	293	99	NC	1335780.002	1494120.005	0.750
29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	293	99	NC	1335810.002	1494120.005	0.608
29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	293	99	NC	1335840.002	1494120.005	0.608
29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	293	99	NC	1335780.002	1494090.005	0.752
29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	293	99	NC	1335810.002	1494090.005	0.752
29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	293	99	NC	1335840.002	1494090.005	0.617
29086	Hexastylis naniflora	293	Dwarf-flowered Heartleaf	2010?	2010?	2010?	Current	E	2-High	293	99	NC	1335810.002	1494060.005	0.138
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305420.002	1487760.005	0.677
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305450.002	1487760.005	0.610
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305360.002	1487730.005	0.587
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305390.002	1487730.005	0.568
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305420.002	1487730.005	0.599
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305450.002	1487730.005	0.599
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305300.002	1487700.005	0.680
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305330.002	1487700.005	0.784
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305360.002	1487700.005	0.747
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305390.002	1487700.005	0.673
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305420.002	1487700.005	0.491
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305450.002	1487700.005	0.491
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305210.002	1487670.005	0.783
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305240.002	1487670.005	0.676
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305270.002	1487670.005	0.676
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305300.002	1487670.005	0.745
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305330.002	1487670.005	0.781
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305360.002	1487670.005	0.690
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305390.002	1487670.005	0.461
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305420.002	1487670.005	0.486
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305150.002	1487640.005	0.740
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305180.002	1487640.005	0.742
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305210.002	1487640.005	0.686

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305240.002	1487640.005	0.775
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305270.002	1487640.005	0.688
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305300.002	1487640.005	0.753
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305330.002	1487640.005	0.743
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305360.002	1487640.005	0.742
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305060.002	1487610.005	0.772
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305090.002	1487610.005	0.772
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305120.002	1487610.005	0.678
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305150.002	1487610.005	0.467
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305030.002	1487580.005	0.680
109	Hexastylis naniflora	4	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1981-10	Current	CD	3-Medium	98	500	NC	1305090.002	1487580.005	0.777
13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	98	500	NC	1305480.002	1487340.005	0.579
13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	98	500	NC	1305510.002	1487340.005	0.585
13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	98	500	NC	1305540.002	1487340.005	0.587
13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	98	500	NC	1305570.002	1487340.005	0.589
13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	98	500	NC	1305600.002	1487340.005	0.593
13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	98	500	NC	1305630.002	1487340.005	0.559
13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	98	500	NC	1305660.002	1487340.005	0.595
13027	Hexastylis naniflora	3	Dwarf-flowered Heartleaf	2001-04-02	2001-04-02	1957-04-28	Current	D	2-High	98	500	NC	1305690.002	1487340.005	0.601
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304670.002	1487280.005	0.175
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304700.002	1487280.005	0.159
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304730.002	1487280.005	0.400
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304640.002	1487250.005	0.181
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304670.002	1487250.005	0.181
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304700.002	1487250.005	0.399
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304730.002	1487250.005	0.402
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304760.002	1487250.005	0.399
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304610.002	1487220.005	0.359
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304640.002	1487220.005	0.082
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304670.002	1487220.005	0.180
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304700.002	1487220.005	0.156
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304730.002	1487220.005	0.397
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304760.002	1487220.005	0.366
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304790.002	1487220.005	0.315
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304610.002	1487190.005	0.358
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304640.002	1487190.005	0.358
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304670.002	1487190.005	0.179
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304700.002	1487190.005	0.207
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304730.002	1487190.005	0.390
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304760.002	1487190.005	0.444
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304790.002	1487190.005	0.444
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304610.002	1487160.005	0.171
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304640.002	1487160.005	0.356
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304670.002	1487160.005	0.368
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304700.002	1487160.005	0.205
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304730.002	1487160.005	0.493
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304760.002	1487160.005	0.427
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304790.002	1487160.005	0.172
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304640.002	1487130.005	0.353
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304670.002	1487130.005	0.356
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304700.002	1487130.005	0.409
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304730.002	1487130.005	0.204

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304760.002	1487130.005	0.172
7166	Hexastylis naniflora	2	Dwarf-flowered Heartleaf	2001	1957-04-28	1957-04-28	Historical	X	3-Medium	98	500	NC	1304700.002	1487100.005	0.176
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303500.002	1485810.005	0.262
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303530.002	1485810.005	0.263
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303560.002	1485810.005	0.174
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303470.002	1485780.005	0.591
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303500.002	1485780.005	0.504
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303530.002	1485780.005	0.262
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303560.002	1485780.005	0.502
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303590.002	1485780.005	0.506
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303440.002	1485750.005	0.651
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303470.002	1485750.005	0.653
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303500.002	1485750.005	0.653
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303530.002	1485750.005	0.507
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303560.002	1485750.005	0.507
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303590.002	1485750.005	0.653
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303620.002	1485750.005	0.653
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303440.002	1485720.005	0.722
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303470.002	1485720.005	0.719
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303500.002	1485720.005	0.510
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303530.002	1485720.005	0.508
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303560.002	1485720.005	0.716
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303590.002	1485720.005	0.752
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303620.002	1485720.005	0.474
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303470.002	1485690.005	0.714
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303500.002	1485690.005	0.501
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303530.002	1485690.005	0.635
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303560.002	1485690.005	0.424
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303590.002	1485690.005	0.657
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303620.002	1485690.005	0.667
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303470.002	1485660.005	0.654
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303500.002	1485660.005	0.495
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303530.002	1485660.005	0.420
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303560.002	1485660.005	0.418
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303590.002	1485660.005	0.421
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303530.002	1485630.005	0.414
4709	Hexastylis naniflora	60	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2001-04-06	Current	D	3-Medium	98	500	NC	1303560.002	1485630.005	0.413
28199	Hexastylis naniflora	279	Dwarf-flowered Heartleaf	2009-04-20	2009-04-20	2009-04-20	Current	D?	2-High	279	99	NC	1322430.002	1483680.005	0.908
28199	Hexastylis naniflora	279	Dwarf-flowered Heartleaf	2009-04-20	2009-04-20	2009-04-20	Current	D?	2-High	279	99	NC	1322430.002	1483650.005	0.895
28199	Hexastylis naniflora	279	Dwarf-flowered Heartleaf	2009-04-20	2009-04-20	2009-04-20	Current	D?	2-High	279	99	NC	1322460.002	1483650.005	0.908
19611	Hexastylis naniflora	47	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1999-03-29	Current	D	2-High	302	2000	NC	1322310.002	1480080.005	0.711
19611	Hexastylis naniflora	47	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1999-03-29	Current	D	2-High	302	2000	NC	1322340.002	1480080.005	0.715
19611	Hexastylis naniflora	47	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1999-03-29	Current	D	2-High	302	2000	NC	1322370.002	1480080.005	0.723
19611	Hexastylis naniflora	47	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1999-03-29	Current	D	2-High	302	2000	NC	1322340.002	1480050.005	0.595
19611	Hexastylis naniflora	47	Dwarf-flowered Heartleaf	2005-05-11	2005-05-11	1999-03-29	Current	D	2-High	302	2000	NC	1322370.002	1480050.005	0.620
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283580.002	1479900.005	0.646
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283550.002	1479870.005	0.652
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283580.002	1479870.005	0.646
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283580.002	1479840.005	0.650
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283820.002	1479750.005	0.646
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283790.002	1479720.005	0.654
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283820.002	1479720.005	0.646

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283850.002	1479720.005	0.608
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283760.002	1479690.005	0.660
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283790.002	1479690.005	0.620
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283820.002	1479690.005	0.449
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283850.002	1479690.005	0.432
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283880.002	1479690.005	0.426
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283790.002	1479660.005	0.544
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283820.002	1479660.005	0.431
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283850.002	1479660.005	0.427
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322460.002	1479270.005	0.785
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322490.002	1479270.005	0.769
21385	Hexastylis naniflora	157	Dwarf-flowered Heartleaf	2010-12-01	2010-12-01	2004-11-01	Current	AB	2-High	157	500	NC	1288410.002	1479240.005	0.532
21385	Hexastylis naniflora	157	Dwarf-flowered Heartleaf	2010-12-01	2010-12-01	2004-11-01	Current	AB	2-High	157	500	NC	1288440.002	1479240.005	0.530
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322430.002	1479240.005	0.792
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322460.002	1479240.005	0.748
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322490.002	1479240.005	0.578
21385	Hexastylis naniflora	157	Dwarf-flowered Heartleaf	2010-12-01	2010-12-01	2004-11-01	Current	AB	2-High	157	500	NC	1288320.002	1479210.005	0.212
21385	Hexastylis naniflora	157	Dwarf-flowered Heartleaf	2010-12-01	2010-12-01	2004-11-01	Current	AB	2-High	157	500	NC	1288350.002	1479210.005	0.561
21385	Hexastylis naniflora	157	Dwarf-flowered Heartleaf	2010-12-01	2010-12-01	2004-11-01	Current	AB	2-High	157	500	NC	1288380.002	1479210.005	0.457
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322400.002	1479210.005	0.798
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322430.002	1479210.005	0.750
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322370.002	1479180.005	0.798
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322400.002	1479180.005	0.754
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322340.002	1479150.005	0.806
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322370.002	1479150.005	0.791
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322310.002	1479120.005	0.826
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322340.002	1479120.005	0.825
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322550.002	1479120.005	0.782
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322280.002	1479090.005	0.836
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322310.002	1479090.005	0.787
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322340.002	1479090.005	0.735
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322370.002	1479090.005	0.718
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322400.002	1479090.005	0.720
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322430.002	1479090.005	0.767
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322460.002	1479090.005	0.794
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322490.002	1479090.005	0.750
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322520.002	1479090.005	0.693
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322250.002	1479060.005	0.838
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322280.002	1479060.005	0.725
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322310.002	1479060.005	0.698
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322340.002	1479060.005	0.690
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322400.002	1479060.005	0.682
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322430.002	1479060.005	0.679
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322460.002	1479060.005	0.679
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322250.002	1479030.005	0.831
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322280.002	1479030.005	0.711
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322250.002	1479000.005	0.802
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322700.002	1478850.005	0.789
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322730.002	1478850.005	0.454
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322760.002	1478850.005	0.449
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322790.002	1478850.005	0.248
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322640.002	1478820.005	0.801

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322670.002	1478820.005	0.796
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322700.002	1478820.005	0.541
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322730.002	1478820.005	0.530
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322640.002	1478790.005	0.803
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322670.002	1478790.005	0.547
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322010.002	1478760.005	0.624
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322040.002	1478760.005	0.628
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322070.002	1478760.005	0.745
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322100.002	1478760.005	0.745
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322130.002	1478760.005	0.744
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322160.002	1478760.005	0.628
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322220.002	1478760.005	0.611
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322250.002	1478760.005	0.615
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322640.002	1478760.005	0.796
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322100.002	1478730.005	0.735
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322130.002	1478730.005	0.733
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322220.002	1478730.005	0.742
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322250.002	1478730.005	0.746
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322430.002	1478700.005	0.680
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322610.002	1478700.005	0.682
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322700.002	1478700.005	0.801
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322760.002	1478700.005	0.546
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322790.002	1478700.005	0.540
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322610.002	1478670.005	0.817
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322640.002	1478670.005	0.808
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322670.002	1478670.005	0.769
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322700.002	1478670.005	0.754
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322610.002	1478640.005	0.684
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322640.002	1478640.005	0.801
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322280.002	1478400.005	0.766
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322310.002	1478400.005	0.745
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322340.002	1478400.005	0.738
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322370.002	1478400.005	0.736
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322400.002	1478400.005	0.745
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322430.002	1478400.005	0.817
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322610.002	1478400.005	0.836
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322640.002	1478400.005	0.836
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322670.002	1478400.005	0.834
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322280.002	1478370.005	0.717
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322310.002	1478370.005	0.703
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322340.002	1478370.005	0.730
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322370.002	1478370.005	0.513
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322400.002	1478370.005	0.722
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322430.002	1478370.005	0.797
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322460.002	1478370.005	0.827
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322490.002	1478370.005	0.848
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322520.002	1478370.005	0.846
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322550.002	1478370.005	0.844
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322580.002	1478370.005	0.832
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322610.002	1478370.005	0.828
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322640.002	1478370.005	0.832
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322670.002	1478370.005	0.831

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322700.002	1478370.005	0.834
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322730.002	1478370.005	0.842
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322760.002	1478370.005	0.831
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322790.002	1478370.005	0.829
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322820.002	1478370.005	0.754
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322850.002	1478370.005	0.747
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322430.002	1478340.005	0.713
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322460.002	1478340.005	0.715
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322490.002	1478340.005	0.737
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322520.002	1478340.005	0.788
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322550.002	1478340.005	0.792
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322580.002	1478340.005	0.836
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322610.002	1478340.005	0.833
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322640.002	1478340.005	0.733
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322670.002	1478340.005	0.733
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322700.002	1478340.005	0.779
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322730.002	1478340.005	0.816
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322760.002	1478340.005	0.815
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322790.002	1478340.005	0.819
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322820.002	1478340.005	0.738
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322850.002	1478340.005	0.737
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322880.002	1478340.005	0.653
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322520.002	1478310.005	0.724
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322580.002	1478310.005	0.746
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322610.002	1478310.005	0.804
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322640.002	1478310.005	0.692
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322850.002	1478310.005	0.695
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322880.002	1478310.005	0.647
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322610.002	1478280.005	0.790
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322640.002	1478280.005	0.783
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322610.002	1478250.005	0.774
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322640.002	1478250.005	0.808
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322670.002	1478250.005	0.722
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322640.002	1478220.005	0.792
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322670.002	1478220.005	0.799
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322700.002	1478220.005	0.714
24218	Hexastylis naniflora	262	Dwarf-flowered Heartleaf	2016-05-05	2016-05-05	2000-04-05	Current	Ar	2-High	302	2000	NC	1322700.002	1478190.005	0.789
24982	Hexastylis naniflora	272	Dwarf-flowered Heartleaf	2007-04-20	2007-04-20	2007-04-20	Current	BC	2-High	272	500	NC	1283800.859	1479875.481	0.632
33240	Hexastylis naniflora	299	Dwarf-flowered Heartleaf	2014-04-01	2014-04-01	2010-04-13	Current	D	2-High	299	99	NC	1329040.518	1479040.687	0.177
33240	Hexastylis naniflora	299	Dwarf-flowered Heartleaf	2014-04-01	2014-04-01	2010-04-13	Current	D	2-High	299	99	NC	1329061.952	1479050.257	0.392
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303080.002	1466220.005	0.718
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303110.002	1466220.005	0.792
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303140.002	1466220.005	0.787
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303170.002	1466220.005	0.788
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303200.002	1466220.005	0.679
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303230.002	1466220.005	0.760
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303050.002	1466190.005	0.827
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303080.002	1466190.005	0.787
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303110.002	1466190.005	0.842
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303140.002	1466190.005	0.842
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303170.002	1466190.005	0.842
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303200.002	1466190.005	0.859

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303230.002	1466190.005	0.858
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303050.002	1466160.005	0.798
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303080.002	1466160.005	0.789
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303110.002	1466160.005	0.848
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303140.002	1466160.005	0.845
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303170.002	1466160.005	0.837
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303200.002	1466160.005	0.831
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303050.002	1466130.005	0.800
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303080.002	1466130.005	0.793
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303110.002	1466130.005	0.843
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303050.002	1466100.005	0.749
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303080.002	1466100.005	0.848
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303110.002	1466100.005	0.843
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303140.002	1466100.005	0.832
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303050.002	1466070.005	0.660
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303080.002	1466070.005	0.711
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303110.002	1466070.005	0.794
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303140.002	1466070.005	0.785
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303020.002	1466040.005	0.713
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303050.002	1466040.005	0.718
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303080.002	1466040.005	0.697
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303110.002	1466040.005	0.688
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303020.002	1466010.005	0.668
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303050.002	1466010.005	0.731
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303080.002	1466010.005	0.705
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303110.002	1466010.005	0.690
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303020.002	1465980.005	0.668
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303050.002	1465980.005	0.648
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303080.002	1465980.005	0.709
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303110.002	1465980.005	0.699
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303050.002	1465950.005	0.260
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303080.002	1465950.005	0.781
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303110.002	1465950.005	0.723
16646	Hexastylis naniflora	46	Dwarf-flowered Heartleaf	2005-11-15	2005-11-15	1998-05-18	Current	A	3-Medium	232	1000	NC	1303140.002	1465950.005	0.714
33039	Hexastylis naniflora	298	Dwarf-flowered Heartleaf	2014-04-15	2014-04-15	2014-04-15	Current	C	2-High	298	500	NC	1292760.002	1465800.005	0.231
33039	Hexastylis naniflora	298	Dwarf-flowered Heartleaf	2014-04-15	2014-04-15	2014-04-15	Current	C	2-High	298	500	NC	1292790.002	1465800.005	0.241
33039	Hexastylis naniflora	298	Dwarf-flowered Heartleaf	2014-04-15	2014-04-15	2014-04-15	Current	C	2-High	298	500	NC	1292820.002	1465800.005	0.295
33039	Hexastylis naniflora	298	Dwarf-flowered Heartleaf	2014-04-15	2014-04-15	2014-04-15	Current	C	2-High	298	500	NC	1292790.002	1465770.005	0.212
33039	Hexastylis naniflora	298	Dwarf-flowered Heartleaf	2014-04-15	2014-04-15	2014-04-15	Current	C	2-High	298	500	NC	1292850.002	1465770.005	0.297
33039	Hexastylis naniflora	298	Dwarf-flowered Heartleaf	2014-04-15	2014-04-15	2014-04-15	Current	C	2-High	298	500	NC	1292880.002	1465770.005	0.303
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303260.002	1465590.005	0.316
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303290.002	1465590.005	0.743
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303260.002	1465560.005	0.410
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303290.002	1465560.005	0.687
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303290.002	1465380.005	0.734
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303320.002	1465380.005	0.735
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303350.002	1465380.005	0.744
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303380.002	1465380.005	0.751
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303410.002	1465380.005	0.803
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303440.002	1465380.005	0.677
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303380.002	1465350.005	0.793
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303410.002	1465350.005	0.749

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303440.002	1465350.005	0.741
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303380.002	1465320.005	0.793
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303410.002	1465320.005	0.814
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303440.002	1465320.005	0.741
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303380.002	1465290.005	0.786
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303410.002	1465290.005	0.814
22372	Hexastylis naniflora	231	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	1998-05-18	Current	D	3-Medium	232	1000	NC	1303440.002	1465290.005	0.814
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303620.002	1463640.005	0.814
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303650.002	1463640.005	0.777
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303590.002	1463610.005	0.817
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303620.002	1463610.005	0.812
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303650.002	1463610.005	0.709
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303530.002	1463580.005	0.757
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303560.002	1463580.005	0.818
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303590.002	1463580.005	0.816
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303620.002	1463580.005	0.707
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303650.002	1463580.005	0.435
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303500.002	1463550.005	0.736
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303530.002	1463550.005	0.749
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303560.002	1463550.005	0.729
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303590.002	1463550.005	0.712
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303620.002	1463550.005	0.560
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303500.002	1463520.005	0.757
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303530.002	1463520.005	0.713
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303560.002	1463520.005	0.774
643	Hexastylis naniflora	28	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	1996-05-03	Current	B	2-High	216	2000	NC	1303500.002	1463490.005	0.770
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302750.002	1462410.005	0.344
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302780.002	1462410.005	0.346
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302720.002	1462380.005	0.767
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302750.002	1462380.005	0.778
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302780.002	1462380.005	0.780
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302810.002	1462380.005	0.781
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302840.002	1462380.005	0.772
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302720.002	1462350.005	0.667
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302750.002	1462350.005	0.771
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302780.002	1462350.005	0.654
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302810.002	1462350.005	0.656
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302840.002	1462350.005	0.675
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302870.002	1462350.005	0.729
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302900.002	1462350.005	0.673
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302780.002	1462320.005	0.483
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302810.002	1462320.005	0.661
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302840.002	1462320.005	0.667
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302870.002	1462320.005	0.669
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302900.002	1462320.005	0.469
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302840.002	1462290.005	0.667
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302870.002	1462290.005	0.466
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302900.002	1462290.005	0.466
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302930.002	1462290.005	0.169
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302870.002	1462260.005	0.460
22203	Hexastylis naniflora	196	Dwarf-flowered Heartleaf	2006-04-29	2006-04-29	1998-2000	Current	D	3-Medium	216	2000	NC	1302900.002	1462260.005	0.461
22204	Hexastylis naniflora	197	Dwarf-flowered Heartleaf	2000-11-01	2000-11-01	1998-2000	Current	A	2-High	216	2000	NC	1303590.002	1461840.005	0.600

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22204	Hexastylis naniflora	197	Dwarf-flowered Heartleaf	2000-11-01	2000-11-01	1998-2000	Current	A	2-High	216	2000	NC	1303620.002	1461840.005	0.592
22204	Hexastylis naniflora	197	Dwarf-flowered Heartleaf	2000-11-01	2000-11-01	1998-2000	Current	A	2-High	216	2000	NC	1303650.002	1461840.005	0.590
22204	Hexastylis naniflora	197	Dwarf-flowered Heartleaf	2000-11-01	2000-11-01	1998-2000	Current	A	2-High	216	2000	NC	1303680.002	1461840.005	0.590
22204	Hexastylis naniflora	197	Dwarf-flowered Heartleaf	2000-11-01	2000-11-01	1998-2000	Current	A	2-High	216	2000	NC	1303710.002	1461840.005	0.594
22204	Hexastylis naniflora	197	Dwarf-flowered Heartleaf	2000-11-01	2000-11-01	1998-2000	Current	A	2-High	216	2000	NC	1303740.002	1461810.005	0.622
22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	216	2000	NC	1303890.002	1461210.005	0.514
22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	216	2000	NC	1303920.002	1461210.005	0.857
22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	216	2000	NC	1303890.002	1461180.005	0.860
22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	216	2000	NC	1303920.002	1461180.005	0.852
22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	216	2000	NC	1303950.002	1461180.005	0.866
22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	216	2000	NC	1303890.002	1461150.005	0.579
22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	216	2000	NC	1303920.002	1461150.005	0.775
22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	216	2000	NC	1303950.002	1461150.005	0.866
22205	Hexastylis naniflora	198	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	1998-2000	Current	B	2-High	216	2000	NC	1303920.002	1461120.005	0.563
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1292550.002	1461000.005	0.590
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1292550.002	1460970.005	0.742
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1292580.002	1460970.005	0.697
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1292550.002	1460940.005	0.744
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1292580.002	1460940.005	0.703
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1292610.002	1460940.005	0.693
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1293360.002	1460850.005	0.295
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1293390.002	1460850.005	0.682
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1293360.002	1460820.005	0.300
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1292670.002	1460670.005	0.384
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1292700.002	1460670.005	0.382
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295580.002	1460640.005	0.781
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295610.002	1460640.005	0.637
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295550.002	1460610.005	0.775
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295580.002	1460610.005	0.773
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295610.002	1460610.005	0.631
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295640.002	1460610.005	0.619
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303770.002	1460610.005	0.569
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303800.002	1460610.005	0.633
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303830.002	1460610.005	0.637
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295520.002	1460580.005	0.776
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295550.002	1460580.005	0.773
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295580.002	1460580.005	0.733
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295610.002	1460580.005	0.625
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303740.002	1460580.005	0.486
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303770.002	1460580.005	0.557
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303800.002	1460580.005	0.570
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303830.002	1460580.005	0.629
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295520.002	1460550.005	0.771
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295550.002	1460550.005	0.732
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295580.002	1460550.005	0.633
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303740.002	1460550.005	0.400
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303770.002	1460550.005	0.568
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303800.002	1460550.005	0.494
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303830.002	1460550.005	0.677
22199	Hexastylis naniflora	192	Dwarf-flowered Heartleaf	2000-10-27	2000-10-27	1998-2000	Current	C	2-High	217	2000	NC	1294350.002	1460520.005	0.760
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295520.002	1460520.005	0.769
22200	Hexastylis naniflora	193	Dwarf-flowered Heartleaf	2000-10	2000-10	1998-2000	Current	C	3-Medium	217	2000	NC	1295550.002	1460520.005	0.698

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303740.002	1460520.005	0.399
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303770.002	1460520.005	0.488
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303800.002	1460520.005	0.559
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303830.002	1460520.005	0.562
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460490.005	0.642
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460490.005	0.506
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303800.002	1460490.005	0.589
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303830.002	1460490.005	0.659
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303860.002	1460490.005	0.550
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1293960.002	1460460.005	0.722
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1293990.002	1460460.005	0.797
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460460.005	0.400
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460460.005	0.535
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303800.002	1460460.005	0.657
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303830.002	1460460.005	0.657
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303860.002	1460460.005	0.474
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1293930.002	1460430.005	0.663
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1293960.002	1460430.005	0.719
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1293990.002	1460430.005	0.784
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460430.005	0.730
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460430.005	0.535
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294080.002	1460430.005	0.497
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303830.002	1460430.005	0.550
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1293990.002	1460400.005	0.714
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460400.005	0.724
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460400.005	0.727
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294080.002	1460400.005	0.721
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1293990.002	1460370.005	0.709
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460370.005	0.383
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460370.005	0.640
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294080.002	1460370.005	0.719
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460340.005	0.603
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460340.005	0.646
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294080.002	1460340.005	0.717
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460310.005	0.669
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460310.005	0.703
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294080.002	1460310.005	0.704
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460280.005	0.663
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460280.005	0.683
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294080.002	1460280.005	0.692
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460250.005	0.659
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460250.005	0.677
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294080.002	1460250.005	0.608
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460220.005	0.663
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460220.005	0.677
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294080.002	1460220.005	0.667
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1293990.002	1460190.005	0.568
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460190.005	0.342
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460190.005	0.673
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294080.002	1460190.005	0.278
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1293990.002	1460160.005	0.277
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460160.005	0.465

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460160.005	0.671
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294080.002	1460160.005	0.566
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294020.002	1460130.005	0.668
22198	Hexastylis naniflora	191	Dwarf-flowered Heartleaf	2013-06-03	2014	1998-2000	Current	D	3-Medium	217	2000	NC	1294050.002	1460130.005	0.665
22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	217	2000	NC	1293660.002	1460040.005	0.712
22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	217	2000	NC	1293690.002	1460040.005	0.702
22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	217	2000	NC	1293660.002	1460010.005	0.703
22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	217	2000	NC	1293690.002	1460010.005	0.704
22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	217	2000	NC	1293720.002	1460010.005	0.579
22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	217	2000	NC	1293660.002	1459980.005	0.583
22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	217	2000	NC	1293690.002	1459980.005	0.706
22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	217	2000	NC	1293720.002	1459980.005	0.581
22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	217	2000	NC	1293750.002	1459980.005	0.646
22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	217	2000	NC	1293660.002	1459950.005	0.581
22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	217	2000	NC	1293690.002	1459950.005	0.585
22197	Hexastylis naniflora	190	Dwarf-flowered Heartleaf	2006-04-07	2000-10-27	2000-10-27	Historical	F	3-Medium	217	2000	NC	1293720.002	1459950.005	0.260
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1304010.002	1459680.005	0.680
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1304040.002	1459680.005	0.786
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1303980.002	1459650.005	0.686
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1304010.002	1459650.005	0.690
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1304040.002	1459650.005	0.599
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1304070.002	1459650.005	0.317
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1303950.002	1459620.005	0.544
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1303980.002	1459620.005	0.534
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1304010.002	1459620.005	0.636
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1304040.002	1459620.005	0.355
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1304070.002	1459620.005	0.581
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1303920.002	1459590.005	0.300
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1303950.002	1459590.005	0.529
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1303980.002	1459590.005	0.530
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1304010.002	1459590.005	0.632
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1304040.002	1459590.005	0.312
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1303920.002	1459560.005	0.237
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1303950.002	1459560.005	0.299
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1303980.002	1459560.005	0.113
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1304010.002	1459560.005	0.161
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1303950.002	1459530.005	0.111
22208	Hexastylis naniflora	200	Dwarf-flowered Heartleaf	2000-04-10	2000-04-10	2000-04-10	Current	D	3-Medium	216	2000	NC	1303980.002	1459530.005	0.112
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265370.002	1458600.005	0.307
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265400.002	1458600.005	0.446
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265430.002	1458600.005	0.415
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265370.002	1458570.005	0.457
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265400.002	1458570.005	0.458
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265430.002	1458570.005	0.458
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265370.002	1458540.005	0.453
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265400.002	1458540.005	0.453
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265370.002	1458510.005	0.450
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265400.002	1458510.005	0.451
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265340.002	1458480.005	0.372
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265370.002	1458480.005	0.418
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265400.002	1458480.005	0.406
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265430.002	1458480.005	0.385

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265370.002	1458450.005	0.411
29084	Hexastylis naniflora	292	Dwarf-flowered Heartleaf	2010	2010	2010	Current	D	2-High	292	500	NC	1265400.002	1458450.005	0.387
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304580.002	1458390.005	0.480
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304550.002	1458360.005	0.675
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304580.002	1458360.005	0.482
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304490.002	1458330.005	0.603
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304520.002	1458330.005	0.725
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304550.002	1458330.005	0.717
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304580.002	1458330.005	0.675
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304490.002	1458300.005	0.597
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304520.002	1458300.005	0.679
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304550.002	1458300.005	0.717
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304580.002	1458300.005	0.719
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304520.002	1458270.005	0.614
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304550.002	1458270.005	0.715
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304580.002	1458270.005	0.734
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304550.002	1458240.005	0.620
22221	Hexastylis naniflora	209	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	2000	Current	BC	3-Medium	214	2000	NC	1304580.002	1458240.005	0.722
22235	Hexastylis naniflora	212	Dwarf-flowered Heartleaf	2000-10-26	2000-10-26	1998-2000	Current	D	2-High	214	2000	NC	1304910.002	1458180.005	0.226
21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	176	2000	NC	1262910.002	1458060.005	0.484
21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	176	2000	NC	1262940.002	1458060.005	0.485
21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	176	2000	NC	1262970.002	1458060.005	0.485
21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	176	2000	NC	1263090.002	1458060.005	0.375
21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	176	2000	NC	1262820.002	1458030.005	0.485
21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	176	2000	NC	1262760.002	1458000.005	0.488
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261230.002	1457970.005	0.663
21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	176	2000	NC	1262520.002	1457970.005	0.498
21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	176	2000	NC	1262550.002	1457970.005	0.500
21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	176	2000	NC	1262580.002	1457970.005	0.496
21399	Hexastylis naniflora	168	Dwarf-flowered Heartleaf	2005-03-30	2005-03-30	2005-03-30	Current	A	2-High	176	2000	NC	1262670.002	1457970.005	0.492
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304730.002	1457970.005	0.792
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304760.002	1457970.005	0.647
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261260.002	1457940.005	0.661
21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	176	2000	NC	1261740.002	1457940.005	0.515
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304730.002	1457940.005	0.647
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304760.002	1457940.005	0.642
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261170.002	1457910.005	0.668
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261230.002	1457910.005	0.660
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261290.002	1457910.005	0.656
21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	176	2000	NC	1261740.002	1457910.005	0.488
21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	176	2000	NC	1261770.002	1457910.005	0.536
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304700.002	1457910.005	0.792
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304730.002	1457910.005	0.644
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304760.002	1457910.005	0.636
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261170.002	1457880.005	0.670
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261200.002	1457880.005	0.680
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261320.002	1457880.005	0.654
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261440.002	1457880.005	0.520
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261470.002	1457880.005	0.519
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261500.002	1457880.005	0.552
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261530.002	1457880.005	0.553
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261560.002	1457880.005	0.507

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	176	2000	NC	1261740.002	1457880.005	0.206
21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	176	2000	NC	1261770.002	1457880.005	0.525
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304730.002	1457880.005	0.644
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304760.002	1457880.005	0.623
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261200.002	1457850.005	0.662
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261440.002	1457850.005	0.524
21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	176	2000	NC	1261740.002	1457850.005	0.542
21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	176	2000	NC	1261770.002	1457850.005	0.534
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304730.002	1457850.005	0.649
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304760.002	1457850.005	0.691
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261380.002	1457820.005	0.648
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261440.002	1457820.005	0.558
21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	176	2000	NC	1261740.002	1457820.005	0.548
21400	Hexastylis naniflora	169	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	D	2-High	176	2000	NC	1261770.002	1457820.005	0.538
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304730.002	1457820.005	0.734
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304760.002	1457820.005	0.691
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304730.002	1457790.005	0.421
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304760.002	1457790.005	0.417
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304790.002	1457790.005	0.134
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261380.002	1457760.005	0.661
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261410.002	1457760.005	0.651
21401	Hexastylis naniflora	170	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	C	2-High	176	2000	NC	1262730.002	1457760.005	0.488
21401	Hexastylis naniflora	170	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	C	2-High	176	2000	NC	1262760.002	1457760.005	0.487
21401	Hexastylis naniflora	170	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-04-06	Current	C	2-High	176	2000	NC	1262790.002	1457760.005	0.485
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304760.002	1457760.005	0.116
22213	Hexastylis naniflora	202	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	1998-2000	Current	A	2-High	214	2000	NC	1304790.002	1457760.005	0.112
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261410.002	1457730.005	0.661
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261440.002	1457730.005	0.564
21398	Hexastylis naniflora	167	Dwarf-flowered Heartleaf	2005-04-06	2005-04-06	2005-04-06	Current	A	2-High	176	2000	NC	1261500.002	1457700.005	0.517
22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	214	2000	NC	1305150.002	1457700.005	0.811
22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	214	2000	NC	1305060.002	1457670.005	0.667
22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	214	2000	NC	1305090.002	1457670.005	0.809
22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	214	2000	NC	1305120.002	1457670.005	0.817
22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	214	2000	NC	1304970.002	1457640.005	0.616
22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	214	2000	NC	1305000.002	1457640.005	0.794
22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	214	2000	NC	1305030.002	1457640.005	0.795
22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	214	2000	NC	1305060.002	1457640.005	0.801
22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	214	2000	NC	1305090.002	1457640.005	0.821
22236	Hexastylis naniflora	213	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	2000-10-25	Current	CD	2-High	214	2000	NC	1305120.002	1457640.005	0.814
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305210.002	1457520.005	0.761
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305240.002	1457520.005	0.273
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305270.002	1457520.005	0.366
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305300.002	1457520.005	0.766
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273830.002	1457490.005	0.714
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305150.002	1457490.005	0.337
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305180.002	1457490.005	0.657
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305210.002	1457490.005	0.799
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305240.002	1457490.005	0.802
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305270.002	1457490.005	0.879
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305300.002	1457490.005	0.862
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305420.002	1457490.005	0.455
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305450.002	1457490.005	0.698

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22206	Hexastylis naniflora	199	Dwarf-flowered Heartleaf	2007-04	2007-04	1998-2000	Current	B	3-Medium	216	2000	NC	1303856.114	1460748.968	0.651
35870	Hexastylis naniflora	305	Dwarf-flowered Heartleaf	2015-09-16	2015-09-16	2015	Current	CDr	2-High	217	2000	NC	1293577.694	1460949.527	0.750
22199	Hexastylis naniflora	192	Dwarf-flowered Heartleaf	2000-10-27	2000-10-27	1998-2000	Current	C	2-High	217	2000	NC	1294272.001	1460526.397	0.743
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273770.002	1457460.005	0.737
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273800.002	1457460.005	0.635
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305150.002	1457460.005	0.523
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305180.002	1457460.005	0.713
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305210.002	1457460.005	0.802
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305240.002	1457460.005	0.816
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305270.002	1457460.005	0.819
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305300.002	1457460.005	0.821
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305330.002	1457460.005	0.826
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305420.002	1457460.005	0.610
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305450.002	1457460.005	0.615
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305480.002	1457460.005	0.705
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273470.002	1457430.005	0.814
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273500.002	1457430.005	0.868
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273650.002	1457430.005	0.686
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273680.002	1457430.005	0.738
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305180.002	1457430.005	0.529
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305210.002	1457430.005	0.715
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305270.002	1457430.005	0.790
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305300.002	1457430.005	0.783
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305420.002	1457430.005	0.700
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305450.002	1457430.005	0.706
22210	Hexastylis naniflora	201	Dwarf-flowered Heartleaf	2000-10-25	2000-10-25	2000	Current	D	3-Medium	214	2000	NC	1305480.002	1457430.005	0.712
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273470.002	1457400.005	0.779
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273500.002	1457400.005	0.768
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273530.002	1457400.005	0.728
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273560.002	1457400.005	0.770
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273590.002	1457400.005	0.745
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273620.002	1457400.005	0.731
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273650.002	1457400.005	0.716
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273470.002	1457370.005	0.829
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273500.002	1457370.005	0.709
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273530.002	1457370.005	0.710
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273560.002	1457370.005	0.701
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273590.002	1457370.005	0.711
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273680.002	1457340.005	0.720
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273710.002	1457340.005	0.747
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273740.002	1457340.005	0.739
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273680.002	1457310.005	0.752
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273650.002	1457280.005	0.742
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273680.002	1457280.005	0.748
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273620.002	1457250.005	0.861
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273650.002	1457250.005	0.747
13728	Hexastylis naniflora	34	Dwarf-flowered Heartleaf	2005-05-19	2005-05-19	1997-06-04	Current	D	2-High	93	500	NC	1296300.002	1457250.005	0.904
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273590.002	1457220.005	0.858
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273620.002	1457220.005	0.861
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273650.002	1457220.005	0.393
13728	Hexastylis naniflora	34	Dwarf-flowered Heartleaf	2005-05-19	2005-05-19	1997-06-04	Current	D	2-High	93	500	NC	1296270.002	1457220.005	0.896
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273140.002	1457190.005	0.845

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273200.002	1457190.005	0.836
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273560.002	1457190.005	0.853
13728	Hexastylis naniflora	34	Dwarf-flowered Heartleaf	2005-05-19	2005-05-19	1997-06-04	Current	D	2-High	93	500	NC	1296240.002	1457190.005	0.895
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273110.002	1457160.005	0.849
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273140.002	1457160.005	0.843
22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	214	2000	NC	1305870.002	1457070.005	0.614
22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	214	2000	NC	1305900.002	1457070.005	0.609
22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	214	2000	NC	1305840.002	1457040.005	0.608
22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	214	2000	NC	1305870.002	1457040.005	0.631
22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	214	2000	NC	1305780.002	1457010.005	0.694
22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	214	2000	NC	1305810.002	1457010.005	0.582
22214	Hexastylis naniflora	203	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2000	Current	B	2-High	214	2000	NC	1305810.002	1456980.005	0.582
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273200.002	1456950.005	0.820
21348	Hexastylis naniflora	154	Dwarf-flowered Heartleaf	2016-05-18	2016-05-18	2005-03-24	Current	C	2-High	154	2000	NC	1273170.002	1456860.005	0.820
3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	93	500	NC	1295040.002	1456860.005	0.800
3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	93	500	NC	1295070.002	1456860.005	0.744
3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	93	500	NC	1295100.002	1456860.005	0.733
3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	93	500	NC	1295040.002	1456830.005	0.370
3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	93	500	NC	1295070.002	1456830.005	0.325
3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	93	500	NC	1295100.002	1456830.005	0.225
3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	93	500	NC	1295070.002	1456800.005	0.220
3733	Hexastylis naniflora	35	Dwarf-flowered Heartleaf	2001-04-04	2001-04-04	1997-06-04	Current	D	2-High	93	500	NC	1295100.002	1456800.005	0.219
22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	214	2000	NC	1306260.002	1456590.005	0.370
22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	214	2000	NC	1306230.002	1456560.005	0.476
22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	214	2000	NC	1306260.002	1456560.005	0.495
22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	214	2000	NC	1306290.002	1456560.005	0.414
22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	214	2000	NC	1306200.002	1456530.005	0.576
22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	214	2000	NC	1306230.002	1456530.005	0.527
22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	214	2000	NC	1306260.002	1456530.005	0.576
22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	214	2000	NC	1306290.002	1456530.005	0.447
22216	Hexastylis naniflora	205	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	D	2-High	214	2000	NC	1306200.002	1456500.005	0.446
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306530.002	1456410.005	0.596
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306560.002	1456410.005	0.497
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306440.002	1456380.005	0.299
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306470.002	1456380.005	0.622
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306500.002	1456380.005	0.625
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306530.002	1456380.005	0.608
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306560.002	1456380.005	0.587
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306470.002	1456350.005	0.617
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306500.002	1456350.005	0.619
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306530.002	1456350.005	0.626
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306560.002	1456350.005	0.532
21053	Hexastylis naniflora	122	Dwarf-flowered Heartleaf	2008	2008	2003-04-29	Current	B?	2-High	177	2000	NC	1263630.002	1456290.005	0.179
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306380.002	1456290.005	0.709
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306410.002	1456290.005	0.798
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306440.002	1456290.005	0.784
21053	Hexastylis naniflora	122	Dwarf-flowered Heartleaf	2008	2008	2003-04-29	Current	B?	2-High	177	2000	NC	1263570.002	1456260.005	0.124
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306350.002	1456260.005	0.710
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306380.002	1456260.005	0.801
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306410.002	1456260.005	0.784
22215	Hexastylis naniflora	204	Dwarf-flowered Heartleaf	2000-10-03	2000-10-03	2000	Current	A?	2-High	214	2000	NC	1306380.002	1456230.005	0.434
20302	Hexastylis naniflora	107	Dwarf-flowered Heartleaf	2008	2008	2003-04-29	Current	B	2-High	177	2000	NC	1263510.002	1456170.005	0.180

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
20302	Hexastylis naniflora	107	Dwarf-flowered Heartleaf	2008	2008	2003-04-29	Current	B	2-High	177	2000	NC	1263510.002	1456140.005	0.174
20302	Hexastylis naniflora	107	Dwarf-flowered Heartleaf	2008	2008	2003-04-29	Current	B	2-High	177	2000	NC	1263510.002	1456110.005	0.173
20302	Hexastylis naniflora	107	Dwarf-flowered Heartleaf	2008	2008	2003-04-29	Current	B	2-High	177	2000	NC	1263510.002	1456080.005	0.172
21397	Hexastylis naniflora	166	Dwarf-flowered Heartleaf	2005-03-31	2005-03-31	2005-03-31	Current	CD	2-High	177	2000	NC	1264530.002	1455900.005	0.488
21397	Hexastylis naniflora	166	Dwarf-flowered Heartleaf	2005-03-31	2005-03-31	2005-03-31	Current	CD	2-High	177	2000	NC	1264560.002	1455900.005	0.401
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306020.002	1455690.005	0.796
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306050.002	1455690.005	0.438
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1305990.002	1455660.005	0.432
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306020.002	1455660.005	0.794
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306050.002	1455660.005	0.794
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306080.002	1455660.005	0.437
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1305990.002	1455630.005	0.385
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306020.002	1455630.005	0.789
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306050.002	1455630.005	0.801
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306080.002	1455630.005	0.471
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306020.002	1455600.005	0.702
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306050.002	1455600.005	0.793
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306080.002	1455600.005	0.807
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306110.002	1455600.005	0.798
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306050.002	1455570.005	0.711
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306080.002	1455570.005	0.801
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306110.002	1455570.005	0.807
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306080.002	1455540.005	0.793
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306140.002	1455450.005	0.632
21396	Hexastylis naniflora	165	Dwarf-flowered Heartleaf	2005-04-05	2005-04-05	2005-04-05	Current	C	2-High	177	2000	NC	1263900.002	1455420.005	0.537
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306140.002	1455420.005	0.640
22217	Hexastylis naniflora	206	Dwarf-flowered Heartleaf	2007-04-10	2007-04-10	2003	Current	D	3-Medium	206	99	NC	1306170.002	1455420.005	0.703
21396	Hexastylis naniflora	165	Dwarf-flowered Heartleaf	2005-04-05	2005-04-05	2005-04-05	Current	C	2-High	177	2000	NC	1263900.002	1455390.005	0.613
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308180.002	1455270.005	0.743
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308210.002	1455270.005	0.769
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308240.002	1455270.005	0.628
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308270.002	1455270.005	0.733
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308240.002	1455240.005	0.328
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308270.002	1455240.005	0.330
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308300.002	1455240.005	0.816
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308330.002	1455240.005	0.724
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308360.002	1455240.005	0.724
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308330.002	1455210.005	0.818
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308360.002	1455210.005	0.849
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308390.002	1455210.005	0.836
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308420.002	1455210.005	0.808
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308450.002	1455210.005	0.807
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308480.002	1455210.005	0.816
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308510.002	1455210.005	0.851
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308540.002	1455210.005	0.725
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308570.002	1455210.005	0.721
5682	Hexastylis naniflora	16	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1977	Current	E	2-High	177	2000	NC	1264680.002	1455180.005	0.368
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308240.002	1455180.005	0.318
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308270.002	1455180.005	0.323
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308300.002	1455180.005	0.325
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308390.002	1455180.005	0.756
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308420.002	1455180.005	0.766

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308450.002	1455180.005	0.802
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308480.002	1455180.005	0.814
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308510.002	1455180.005	0.842
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308540.002	1455180.005	0.721
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308570.002	1455180.005	0.713
5682	Hexastylis naniflora	16	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1977	Current	E	2-High	177	2000	NC	1264710.002	1455150.005	0.370
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308210.002	1455150.005	0.316
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308240.002	1455150.005	0.318
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308270.002	1455150.005	0.320
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308300.002	1455150.005	0.325
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308330.002	1455150.005	0.725
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308420.002	1455150.005	0.326
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308450.002	1455150.005	0.737
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308240.002	1455120.005	0.318
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308270.002	1455120.005	0.729
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308300.002	1455120.005	0.376
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308420.002	1455120.005	0.335
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308510.002	1455060.005	0.722
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308540.002	1455060.005	0.705
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308570.002	1455060.005	0.630
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308600.002	1455060.005	0.724
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308630.002	1455060.005	0.709
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308450.002	1455030.005	0.326
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308480.002	1455030.005	0.724
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308510.002	1455030.005	0.718
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308540.002	1455030.005	0.720
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308570.002	1455030.005	0.726
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308540.002	1455000.005	0.710
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308510.002	1454970.005	0.703
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308540.002	1454970.005	0.699
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308570.002	1454970.005	0.707
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308510.002	1454940.005	0.697
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308540.002	1454940.005	0.225
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308570.002	1454940.005	0.229
21395	Hexastylis naniflora	164	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-31	Current	A	2-High	177	2000	NC	1264530.002	1454910.005	0.267
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308510.002	1454910.005	0.558
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308540.002	1454910.005	0.205
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308570.002	1454910.005	0.205
21395	Hexastylis naniflora	164	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-31	Current	A	2-High	177	2000	NC	1264500.002	1454880.005	0.585
21395	Hexastylis naniflora	164	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-31	Current	A	2-High	177	2000	NC	1264530.002	1454880.005	0.573
22219	Hexastylis naniflora	208	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1998-2000	Current	A	3-Medium	208	99	NC	1308540.002	1454880.005	0.564
21395	Hexastylis naniflora	164	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-31	Current	A	2-High	177	2000	NC	1264440.002	1454850.005	0.597
21395	Hexastylis naniflora	164	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-31	Current	A	2-High	177	2000	NC	1264470.002	1454850.005	0.583
21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	177	2000	NC	1263510.002	1454460.005	0.461
21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	177	2000	NC	1263510.002	1454430.005	0.466
21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	177	2000	NC	1263540.002	1454430.005	0.466
21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	177	2000	NC	1263480.002	1454400.005	0.473
21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	177	2000	NC	1263510.002	1454400.005	0.464
21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	177	2000	NC	1263540.002	1454400.005	0.479
21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	177	2000	NC	1263540.002	1454370.005	0.385
21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	177	2000	NC	1263570.002	1454370.005	0.331
21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	177	2000	NC	1263630.002	1454370.005	0.217

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	177	2000	NC	1263660.002	1454340.005	0.219
21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	177	2000	NC	1263720.002	1454310.005	0.260
21394	Hexastylis naniflora	163	Dwarf-flowered Heartleaf	2016-05-11	2016-05-11	2005-03-30	Current	B	2-High	177	2000	NC	1263750.002	1454280.005	0.270
37916		320											1299526.67	1456756.853	0.917
36696	Hexastylis naniflora	312	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	2006-11-14	Current	A	2-High	312	2000	NC	1266150.002	1452780.005	0.294
36696	Hexastylis naniflora	312	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	2006-11-14	Current	A	2-High	312	2000	NC	1266120.002	1452750.005	0.273
36696	Hexastylis naniflora	312	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	2006-11-14	Current	A	2-High	312	2000	NC	1266150.002	1452750.005	0.231
36696	Hexastylis naniflora	312	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	2006-11-14	Current	A	2-High	312	2000	NC	1266090.002	1452720.005	0.304
36696	Hexastylis naniflora	312	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	2006-11-14	Current	A	2-High	312	2000	NC	1266120.002	1452720.005	0.213
36696	Hexastylis naniflora	312	Dwarf-flowered Heartleaf	2016-08-03	2016-08-03	2006-11-14	Current	A	2-High	312	2000	NC	1266150.002	1452720.005	0.231
6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	247	2000	NC	1271220.002	1451610.005	0.317
8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	247	2000	NC	1269420.002	1451460.005	0.608
8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	247	2000	NC	1269450.002	1451430.005	0.881
8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	247	2000	NC	1269480.002	1451430.005	0.842
8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	247	2000	NC	1269510.002	1451430.005	0.840
8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	247	2000	NC	1269510.002	1451400.005	0.850
8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	247	2000	NC	1269540.002	1451400.005	0.853
8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	247	2000	NC	1269570.002	1451400.005	0.892
8209	Hexastylis naniflora	56	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2001-04-06	Current	D	2-High	247	2000	NC	1269600.002	1451400.005	0.819
6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	247	2000	NC	1271400.002	1451370.005	0.388
6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	247	2000	NC	1271310.002	1451340.005	0.373
6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	247	2000	NC	1271340.002	1451340.005	0.402
6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	247	2000	NC	1271370.002	1451340.005	0.399
6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	247	2000	NC	1271250.002	1451310.005	0.384
6668	Hexastylis naniflora	13	Dwarf-flowered Heartleaf	2005-05	2005-05	1977	Current	D	2-High	247	2000	NC	1271280.002	1451310.005	0.411
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286160.002	1450500.005	0.799
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286190.002	1450500.005	0.767
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286130.002	1450470.005	0.752
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286490.002	1450290.005	0.775
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286520.002	1450290.005	0.773
22394	Hexastylis naniflora	240	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001	Historical	F	2-High	100	2000	NC	1285920.002	1450260.005	0.846
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286490.002	1450260.005	0.774
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286520.002	1450260.005	0.771
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286550.002	1450260.005	0.770
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286580.002	1450260.005	0.772
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286520.002	1450230.005	0.674
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286610.002	1450230.005	0.781
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286640.002	1450230.005	0.859
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286850.002	1450170.005	0.748
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286880.002	1450170.005	0.741
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286880.002	1450140.005	0.626
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286910.002	1450140.005	0.651
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286190.002	1450080.005	0.823
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286220.002	1450080.005	0.809
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286190.002	1450050.005	0.855
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286220.002	1450050.005	0.769
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286190.002	1450020.005	0.822
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286220.002	1450020.005	0.775
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286160.002	1449990.005	0.856
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286190.002	1449990.005	0.789
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286220.002	1449990.005	0.852
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286250.002	1449990.005	0.810

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286160.002	1449960.005	0.835
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286190.002	1449960.005	0.820
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286220.002	1449960.005	0.801
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286250.002	1449960.005	0.788
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286160.002	1449930.005	0.828
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286190.002	1449930.005	0.814
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286220.002	1449930.005	0.783
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286250.002	1449930.005	0.685
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286130.002	1449900.005	0.849
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286160.002	1449900.005	0.808
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286190.002	1449900.005	0.792
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286220.002	1449900.005	0.691
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286070.002	1449870.005	0.840
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286100.002	1449870.005	0.791
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286130.002	1449870.005	0.808
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286160.002	1449870.005	0.794
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286190.002	1449870.005	0.779
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286010.002	1449840.005	0.847
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286040.002	1449840.005	0.853
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286070.002	1449840.005	0.787
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286100.002	1449840.005	0.769
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286280.002	1449840.005	0.864
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286310.002	1449840.005	0.863
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286010.002	1449810.005	0.864
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286040.002	1449810.005	0.834
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286070.002	1449810.005	0.788
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286100.002	1449810.005	0.768
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286250.002	1449810.005	0.879
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286280.002	1449810.005	0.876
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286310.002	1449810.005	0.871
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286340.002	1449810.005	0.861
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286415.371	1450350.021	0.779
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286385.19	1450405.727	0.865
22386	Hexastylis naniflora	238	Dwarf-flowered Heartleaf	2012-05-17	2012-05-17	2001-2003	Current	A	2-High	100	2000	NC	1286280.616	1450427.99	0.876
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285980.002	1449780.005	0.840
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286010.002	1449780.005	0.859
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286040.002	1449780.005	0.861
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286070.002	1449780.005	0.761
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286100.002	1449780.005	0.772
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286130.002	1449780.005	0.816
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286160.002	1449780.005	0.892
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286190.002	1449780.005	0.891
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286220.002	1449780.005	0.881
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286250.002	1449780.005	0.879
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286010.002	1449750.005	0.860
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286040.002	1449750.005	0.807
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286070.002	1449750.005	0.767
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286100.002	1449750.005	0.772
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286130.002	1449750.005	0.862
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286160.002	1449750.005	0.885
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286190.002	1449750.005	0.891
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286220.002	1449750.005	0.837

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286250.002	1449750.005	0.788
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269570.002	1449720.005	0.702
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269600.002	1449720.005	0.838
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286040.002	1449720.005	0.842
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286070.002	1449720.005	0.752
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286100.002	1449720.005	0.729
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286130.002	1449720.005	0.773
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286160.002	1449720.005	0.792
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286190.002	1449720.005	0.785
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269600.002	1449690.005	0.702
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269630.002	1449690.005	0.795
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269660.002	1449690.005	0.798
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269690.002	1449690.005	0.838
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286040.002	1449690.005	0.739
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286070.002	1449690.005	0.785
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286100.002	1449690.005	0.773
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286640.002	1449690.005	0.699
31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	296	500	NC	1323900.002	1449690.005	0.006
31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	296	500	NC	1323930.002	1449690.005	0.081
31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	296	500	NC	1323960.002	1449690.005	0.082
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269690.002	1449660.005	0.756
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269720.002	1449660.005	0.839
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269750.002	1449660.005	0.845
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269780.002	1449660.005	0.842
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286040.002	1449660.005	0.722
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286070.002	1449660.005	0.798
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286610.002	1449660.005	0.701
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286640.002	1449660.005	0.759
31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	296	500	NC	1323900.002	1449660.005	0.019
31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	296	500	NC	1323930.002	1449660.005	0.075
31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	296	500	NC	1323960.002	1449660.005	0.098
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269780.002	1449630.005	0.841
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269810.002	1449630.005	0.848
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286010.002	1449630.005	0.785
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286040.002	1449630.005	0.803
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286070.002	1449630.005	0.770
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286550.002	1449630.005	0.766
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286580.002	1449630.005	0.630
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286610.002	1449630.005	0.753
31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	296	500	NC	1323900.002	1449630.005	0.019
31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	296	500	NC	1323930.002	1449630.005	0.078
31900	Hexastylis naniflora	296	Dwarf-flowered Heartleaf	2012-03-16	2012-03-16	2012-03-16	Current	CD	2-High	296	500	NC	1323960.002	1449630.005	0.099
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269780.002	1449600.005	0.857
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269810.002	1449600.005	0.808
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269840.002	1449600.005	0.844
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269870.002	1449600.005	0.849
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269900.002	1449600.005	0.898
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286010.002	1449600.005	0.805
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286040.002	1449600.005	0.798
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286070.002	1449600.005	0.767
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286520.002	1449600.005	0.797
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286550.002	1449600.005	0.693

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286580.002	1449600.005	0.685
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1449600.005	0.856
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269750.002	1449570.005	0.820
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269870.002	1449570.005	0.762
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269900.002	1449570.005	0.769
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269930.002	1449570.005	0.892
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269960.002	1449570.005	0.897
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269990.002	1449570.005	0.889
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285950.002	1449570.005	0.756
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285980.002	1449570.005	0.864
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1286010.002	1449570.005	0.843
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286460.002	1449570.005	0.777
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1449570.005	0.847
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287510.002	1449570.005	0.772
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269750.002	1449540.005	0.611
20301	Hexastylis naniflora	106	Dwarf-flowered Heartleaf	2015-04-23	2015-04-23	2003-05-15	Current	A	3-Medium	247	2000	NC	1269990.002	1449540.005	0.829
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285830.002	1449540.005	0.737
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285860.002	1449540.005	0.814
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285890.002	1449540.005	0.758
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285920.002	1449540.005	0.794
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285950.002	1449540.005	0.848
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285980.002	1449540.005	0.849
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286430.002	1449540.005	0.780
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286460.002	1449540.005	0.802
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1449540.005	0.849
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287480.002	1449540.005	0.777
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285770.002	1449510.005	0.799
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285800.002	1449510.005	0.879
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285830.002	1449510.005	0.888
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285860.002	1449510.005	0.890
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285890.002	1449510.005	0.819
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285920.002	1449510.005	0.822
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286430.002	1449510.005	0.775
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1449510.005	0.826
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287450.002	1449510.005	0.779
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285710.002	1449480.005	0.785
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285740.002	1449480.005	0.849
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285770.002	1449480.005	0.867
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285800.002	1449480.005	0.892
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285830.002	1449480.005	0.823
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285860.002	1449480.005	0.814
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285890.002	1449480.005	0.708
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286400.002	1449480.005	0.722
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286430.002	1449480.005	0.672
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1449480.005	0.853
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287450.002	1449480.005	0.781
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285650.002	1449450.005	0.803
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285680.002	1449450.005	0.859
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285710.002	1449450.005	0.895
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285740.002	1449450.005	0.866
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285770.002	1449450.005	0.735
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285800.002	1449450.005	0.728

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285830.002	1449450.005	0.722
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286370.002	1449450.005	0.788
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286430.002	1449450.005	0.666
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287450.002	1449450.005	0.690
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285560.002	1449420.005	0.601
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285590.002	1449420.005	0.639
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285620.002	1449420.005	0.653
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285650.002	1449420.005	0.799
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285680.002	1449420.005	0.840
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285710.002	1449420.005	0.752
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285740.002	1449420.005	0.749
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285770.002	1449420.005	0.728
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286340.002	1449420.005	0.789
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286370.002	1449420.005	0.814
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1449420.005	0.865
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287030.002	1449420.005	0.850
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287420.002	1449420.005	0.782
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287450.002	1449420.005	0.643
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287480.002	1449420.005	0.572
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285530.002	1449390.005	0.601
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285560.002	1449390.005	0.659
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285590.002	1449390.005	0.790
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286310.002	1449390.005	0.791
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1449390.005	0.858
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287030.002	1449390.005	0.850
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287390.002	1449390.005	0.855
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287420.002	1449390.005	0.811
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287450.002	1449390.005	0.779
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285500.002	1449360.005	0.639
13149	Hexastylis naniflora	73	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-03-06	Current	A	2-High	100	2000	NC	1285530.002	1449360.005	0.840
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286280.002	1449360.005	0.824
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286310.002	1449360.005	0.819
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1449360.005	0.859
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287030.002	1449360.005	0.850
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287390.002	1449360.005	0.852
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287420.002	1449360.005	0.849
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286190.002	1449330.005	0.816
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286220.002	1449330.005	0.799
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286250.002	1449330.005	0.822
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1449330.005	0.859
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287030.002	1449330.005	0.788
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287390.002	1449330.005	0.813
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286190.002	1449300.005	0.786
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286220.002	1449300.005	0.695
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286250.002	1449300.005	0.692
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1449300.005	0.827
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287030.002	1449300.005	0.762
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287390.002	1449300.005	0.816
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286970.002	1449270.005	0.858
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1449270.005	0.827
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287030.002	1449270.005	0.826
32858	Hexastylis naniflora	297	Dwarf-flowered Heartleaf	2011	2011	2011	Current	CD	2-High	297	99	NC	1292730.002	1449270.005	0.536

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
32858	Hexastylis naniflora	297	Dwarf-flowered Heartleaf	2011	2011	2011	Current	CD	2-High	297	99	NC	1292760.002	1449270.005	0.181
22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	100	2000	NC	1285500.002	1449240.005	0.572
22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	100	2000	NC	1285530.002	1449240.005	0.811
22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	100	2000	NC	1285560.002	1449240.005	0.800
22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	100	2000	NC	1285590.002	1449240.005	0.782
22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	100	2000	NC	1285620.002	1449240.005	0.800
22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	100	2000	NC	1285650.002	1449240.005	0.800
22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	100	2000	NC	1285680.002	1449240.005	0.800
22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	100	2000	NC	1285710.002	1449240.005	0.800
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1449240.005	0.856
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287030.002	1449240.005	0.824
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287360.002	1449240.005	0.872
22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	100	2000	NC	1285500.002	1449210.005	0.615
22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	100	2000	NC	1285800.002	1449210.005	0.775
22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	100	2000	NC	1285830.002	1449210.005	0.772
22399	Hexastylis naniflora	241	Dwarf-flowered Heartleaf	2012-04-03	2012-04-03	2001-2003	Current	D	2-High	100	2000	NC	1285860.002	1449210.005	0.791
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1449210.005	0.863
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287840.002	1449210.005	0.678
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285530.002	1449180.005	0.744
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285560.002	1449180.005	0.775
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285590.002	1449180.005	0.791
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285620.002	1449180.005	0.787
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285650.002	1449180.005	0.791
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285680.002	1449180.005	0.790
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285710.002	1449180.005	0.784
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285740.002	1449180.005	0.787
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285770.002	1449180.005	0.766
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285800.002	1449180.005	0.722
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1449180.005	0.864
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287810.002	1449180.005	0.773
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287840.002	1449180.005	0.682
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285470.002	1449150.005	0.598
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285500.002	1449150.005	0.670
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285530.002	1449150.005	0.800
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285560.002	1449150.005	0.800
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285590.002	1449150.005	0.794
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285770.002	1449150.005	0.762
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285800.002	1449150.005	0.782
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285830.002	1449150.005	0.777
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285860.002	1449150.005	0.731
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285890.002	1449150.005	0.716
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285920.002	1449150.005	0.768
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1449150.005	0.865
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287780.002	1449150.005	0.684
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287810.002	1449150.005	0.682
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287840.002	1449150.005	0.680
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285440.002	1449120.005	0.564
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285470.002	1449120.005	0.693
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285500.002	1449120.005	0.769
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285530.002	1449120.005	0.801
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285800.002	1449120.005	0.888
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285830.002	1449120.005	0.782

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286070.002	1449120.005	0.810
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1449120.005	0.865
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287690.002	1449120.005	0.870
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287720.002	1449120.005	0.795
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287750.002	1449120.005	0.779
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287780.002	1449120.005	0.688
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285440.002	1449090.005	0.730
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285470.002	1449090.005	0.788
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285500.002	1449090.005	0.780
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286070.002	1449090.005	0.797
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286910.002	1449090.005	0.825
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1449090.005	0.723
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286970.002	1449090.005	0.772
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287510.002	1449090.005	0.741
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287540.002	1449090.005	0.771
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287570.002	1449090.005	0.863
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287600.002	1449090.005	0.864
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287630.002	1449090.005	0.867
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287660.002	1449090.005	0.830
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287690.002	1449090.005	0.749
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287720.002	1449090.005	0.749
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287750.002	1449090.005	0.745
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287780.002	1449090.005	0.688
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285290.002	1449060.005	0.823
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285320.002	1449060.005	0.769
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285440.002	1449060.005	0.800
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285470.002	1449060.005	0.745
21300	Hexastylis naniflora	149	Dwarf-flowered Heartleaf	2012-05-15	2012-05-15	2001	Current	A	2-High	100	2000	NC	1286070.002	1449060.005	0.831
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286910.002	1449060.005	0.866
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1449060.005	0.723
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286970.002	1449060.005	0.830
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287480.002	1449060.005	0.867
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285290.002	1449030.005	0.748
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285320.002	1449030.005	0.801
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285350.002	1449030.005	0.855
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285410.002	1449030.005	0.836
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285440.002	1449030.005	0.763
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285470.002	1449030.005	0.739
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1449030.005	0.726
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287360.002	1449030.005	0.742
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287390.002	1449030.005	0.874
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287420.002	1449030.005	0.868
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287450.002	1449030.005	0.869
20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	247	2000	NC	1271400.002	1449000.005	0.744
20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	247	2000	NC	1271430.002	1449000.005	0.756
20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	247	2000	NC	1271460.002	1449000.005	0.754
20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	247	2000	NC	1271490.002	1449000.005	0.704
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285350.002	1449000.005	0.810
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285380.002	1449000.005	0.836
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285410.002	1449000.005	0.840
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285440.002	1449000.005	0.758
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1285980.002	1449000.005	0.798

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1286010.002	1449000.005	0.733
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286910.002	1449000.005	0.727
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1449000.005	0.722
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287300.002	1449000.005	0.797
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287330.002	1449000.005	0.724
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287360.002	1449000.005	0.708
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287390.002	1449000.005	0.706
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287420.002	1449000.005	0.837
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287450.002	1449000.005	0.866
20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	247	2000	NC	1271370.002	1448970.005	0.750
20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	247	2000	NC	1271400.002	1448970.005	0.710
20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	247	2000	NC	1271430.002	1448970.005	0.584
20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	247	2000	NC	1271460.002	1448970.005	0.570
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285350.002	1448970.005	0.860
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285380.002	1448970.005	0.837
18850	Hexastylis naniflora	14	Dwarf-flowered Heartleaf	2009-06	2009-06	1981-05	Current	C?	3-Medium	100	2000	NC	1285410.002	1448970.005	0.756
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1285950.002	1448970.005	0.759
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1285980.002	1448970.005	0.758
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1286010.002	1448970.005	0.795
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1286040.002	1448970.005	0.759
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286910.002	1448970.005	0.723
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287270.002	1448970.005	0.838
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287300.002	1448970.005	0.729
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287330.002	1448970.005	0.704
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287360.002	1448970.005	0.699
20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	247	2000	NC	1271400.002	1448940.005	0.582
20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	247	2000	NC	1271430.002	1448940.005	0.520
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1285980.002	1448940.005	0.759
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1286010.002	1448940.005	0.764
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1286040.002	1448940.005	0.760
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1286070.002	1448940.005	0.737
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286910.002	1448940.005	0.720
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287240.002	1448940.005	0.732
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287270.002	1448940.005	0.724
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287300.002	1448940.005	0.699
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1286040.002	1448910.005	0.756
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1286070.002	1448910.005	0.812
22385	Hexastylis naniflora	237	Dwarf-flowered Heartleaf	2012-03-15	2012-03-15	1981-05	Current	E	3-Medium	100	2000	NC	1286100.002	1448910.005	0.740
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286910.002	1448910.005	0.691
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1448910.005	0.867
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287210.002	1448910.005	0.880
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287240.002	1448910.005	0.782
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287390.002	1448910.005	0.753
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287420.002	1448910.005	0.772
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286910.002	1448880.005	0.691
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1448880.005	0.869
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287180.002	1448880.005	0.876
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287210.002	1448880.005	0.796
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287390.002	1448880.005	0.582
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287420.002	1448880.005	0.679
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1448850.005	0.862
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287150.002	1448850.005	0.915

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287180.002	1448850.005	0.875
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286910.002	1448820.005	0.647
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1448820.005	0.862
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286970.002	1448820.005	0.830
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1448820.005	0.695
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287030.002	1448820.005	0.743
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287060.002	1448820.005	0.915
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287090.002	1448820.005	0.915
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287120.002	1448820.005	0.852
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287150.002	1448820.005	0.885
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287180.002	1448820.005	0.839
20334	Hexastylis naniflora	115	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-05	Current	C	2-High	247	2000	NC	1271100.002	1448790.005	0.767
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1448790.005	0.830
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286970.002	1448790.005	0.695
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1448790.005	0.747
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287030.002	1448790.005	0.841
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287060.002	1448790.005	0.834
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287090.002	1448790.005	0.806
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287120.002	1448790.005	0.854
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287150.002	1448790.005	0.838
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286910.002	1448760.005	0.650
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1448760.005	0.687
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286970.002	1448760.005	0.717
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1448760.005	0.798
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287030.002	1448760.005	0.834
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287060.002	1448760.005	0.825
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287120.002	1448760.005	0.909
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286910.002	1448730.005	0.667
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1448730.005	0.698
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286970.002	1448730.005	0.744
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1448730.005	0.720
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286970.002	1448700.005	0.727
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1287000.002	1448700.005	0.721
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286970.002	1448670.005	0.787
20243	Hexastylis naniflora	80	Dwarf-flowered Heartleaf	2012-07	2012-07	2003-03-13	Current	D	2-High	247	2000	NC	1270800.002	1448640.005	0.755
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286790.002	1448640.005	0.619
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286820.002	1448640.005	0.633
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286970.002	1448640.005	0.788
20243	Hexastylis naniflora	80	Dwarf-flowered Heartleaf	2012-07	2012-07	2003-03-13	Current	D	2-High	247	2000	NC	1270800.002	1448610.005	0.754
22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	100	2000	NC	1285200.002	1448610.005	0.798
22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	100	2000	NC	1285230.002	1448610.005	0.870
22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	100	2000	NC	1285260.002	1448610.005	0.885
22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	100	2000	NC	1285290.002	1448610.005	0.806
22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	100	2000	NC	1285320.002	1448610.005	0.862
22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	100	2000	NC	1285350.002	1448610.005	0.806
22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	100	2000	NC	1285380.002	1448610.005	0.850
22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	100	2000	NC	1285410.002	1448610.005	0.685
1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	100	2000	NC	1286100.002	1448610.005	0.705
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286850.002	1448610.005	0.839
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286880.002	1448610.005	0.840
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286910.002	1448610.005	0.795
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1448610.005	0.794

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	247	2000	NC	1271790.002	1448580.005	0.279
21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	247	2000	NC	1271820.002	1448580.005	0.683
21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	247	2000	NC	1271850.002	1448580.005	0.673
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281270.002	1448580.005	0.740
22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	100	2000	NC	1285200.002	1448580.005	0.877
22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	100	2000	NC	1285230.002	1448580.005	0.881
22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	100	2000	NC	1285380.002	1448580.005	0.806
22384	Hexastylis naniflora	236	Dwarf-flowered Heartleaf	2001	2001	2001	Current	C	3-Medium	100	2000	NC	1285410.002	1448580.005	0.777
1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	100	2000	NC	1286100.002	1448580.005	0.790
1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	100	2000	NC	1286130.002	1448580.005	0.674
1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	100	2000	NC	1286160.002	1448580.005	0.619
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286820.002	1448580.005	0.777
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286850.002	1448580.005	0.728
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286880.002	1448580.005	0.739
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286910.002	1448580.005	0.741
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1448580.005	0.414
20243	Hexastylis naniflora	80	Dwarf-flowered Heartleaf	2012-07	2012-07	2003-03-13	Current	D	2-High	247	2000	NC	1270530.002	1448550.005	0.777
21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	247	2000	NC	1271790.002	1448550.005	0.768
21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	247	2000	NC	1271820.002	1448550.005	0.641
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281270.002	1448550.005	0.831
1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	100	2000	NC	1286130.002	1448550.005	0.790
1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	100	2000	NC	1286220.002	1448550.005	0.652
1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	100	2000	NC	1286250.002	1448550.005	0.697
1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	100	2000	NC	1286370.002	1448550.005	0.505
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286820.002	1448550.005	0.757
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286850.002	1448550.005	0.751
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286880.002	1448550.005	0.752
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286940.002	1448550.005	0.769
20243	Hexastylis naniflora	80	Dwarf-flowered Heartleaf	2012-07	2012-07	2003-03-13	Current	D	2-High	247	2000	NC	1270560.002	1448520.005	0.669
21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	247	2000	NC	1271760.002	1448520.005	0.773
21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	247	2000	NC	1271790.002	1448520.005	0.771
21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	247	2000	NC	1271820.002	1448520.005	0.378
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281210.002	1448520.005	0.542
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281240.002	1448520.005	0.831
1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	100	2000	NC	1286250.002	1448520.005	0.793
1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	100	2000	NC	1286280.002	1448520.005	0.668
1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	100	2000	NC	1286310.002	1448520.005	0.733
1667	Hexastylis naniflora	74	Dwarf-flowered Heartleaf	2012-04-12	2012-04-12	2001-03-05	Current	B	2-High	100	2000	NC	1286340.002	1448520.005	0.746
12161	Hexastylis naniflora	51	Dwarf-flowered Heartleaf	2012-04-11	2012-04-11	2001-02-06	Current	A	2-High	100	2000	NC	1286820.002	1448520.005	0.804
21404	Hexastylis naniflora	173	Dwarf-flowered Heartleaf	2005-04	2005-04	2003-05-04	Current	D	2-High	247	2000	NC	1271790.002	1448490.005	0.739
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281180.002	1448490.005	0.544
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281210.002	1448490.005	0.834
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281180.002	1448460.005	0.843
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281210.002	1448460.005	0.746
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281150.002	1448430.005	0.846
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281180.002	1448430.005	0.805
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281120.002	1448400.005	0.851
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281150.002	1448400.005	0.846
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281090.002	1448370.005	0.857
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281120.002	1448370.005	0.858
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281150.002	1448370.005	0.807
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281060.002	1448340.005	0.859

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281090.002	1448340.005	0.859
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281120.002	1448340.005	0.840
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281150.002	1448340.005	0.800
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281180.002	1448340.005	0.797
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281210.002	1448340.005	0.386
22387	Hexastylis naniflora	239	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001	Current	D	2-High	100	2000	NC	1286220.002	1448340.005	0.746
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281030.002	1448310.005	0.861
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281060.002	1448310.005	0.856
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281090.002	1448310.005	0.849
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281120.002	1448310.005	0.826
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281150.002	1448310.005	0.716
22414	Hexastylis naniflora	246	Dwarf-flowered Heartleaf	2001	2001	2001	Current	D	2-High	100	2000	NC	1285920.002	1448310.005	0.647
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287750.002	1448310.005	0.826
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281030.002	1448280.005	0.852
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281060.002	1448280.005	0.814
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281090.002	1448280.005	0.710
22414	Hexastylis naniflora	246	Dwarf-flowered Heartleaf	2001	2001	2001	Current	D	2-High	100	2000	NC	1285830.002	1448280.005	0.620
22414	Hexastylis naniflora	246	Dwarf-flowered Heartleaf	2001	2001	2001	Current	D	2-High	100	2000	NC	1285860.002	1448280.005	0.816
22414	Hexastylis naniflora	246	Dwarf-flowered Heartleaf	2001	2001	2001	Current	D	2-High	100	2000	NC	1285890.002	1448280.005	0.828
22414	Hexastylis naniflora	246	Dwarf-flowered Heartleaf	2001	2001	2001	Current	D	2-High	100	2000	NC	1285920.002	1448280.005	0.797
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287750.002	1448280.005	0.831
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281000.002	1448250.005	0.824
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281030.002	1448250.005	0.761
22414	Hexastylis naniflora	246	Dwarf-flowered Heartleaf	2001	2001	2001	Current	D	2-High	100	2000	NC	1285860.002	1448250.005	0.774
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287750.002	1448250.005	0.891
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287780.002	1448250.005	0.840
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287870.002	1448250.005	0.827
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287900.002	1448250.005	0.823
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280970.002	1448220.005	0.824
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287750.002	1448220.005	0.890
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287780.002	1448220.005	0.888
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287810.002	1448220.005	0.876
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287840.002	1448220.005	0.877
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287870.002	1448220.005	0.876
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287900.002	1448220.005	0.822
18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	100	2000	NC	1286550.002	1448190.005	0.811
18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	100	2000	NC	1286580.002	1448190.005	0.815
18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	100	2000	NC	1286610.002	1448190.005	0.809
18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	100	2000	NC	1286640.002	1448190.005	0.807
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287720.002	1448190.005	0.879
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287750.002	1448190.005	0.846
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287780.002	1448190.005	0.795
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287810.002	1448190.005	0.794
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287840.002	1448190.005	0.791
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287870.002	1448190.005	0.728
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287900.002	1448190.005	0.702
18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	100	2000	NC	1286520.002	1448160.005	0.812
18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	100	2000	NC	1286550.002	1448160.005	0.809
18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	100	2000	NC	1286580.002	1448160.005	0.803
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287690.002	1448160.005	0.886
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287720.002	1448160.005	0.869
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287750.002	1448160.005	0.694

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287780.002	1448160.005	0.690
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287810.002	1448160.005	0.631
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287840.002	1448160.005	0.609
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287690.002	1448130.005	0.882
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287720.002	1448130.005	0.790
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287750.002	1448130.005	0.671
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287780.002	1448130.005	0.607
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287810.002	1448130.005	0.685
22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	100	2000	NC	1283880.002	1448100.005	0.857
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287660.002	1448100.005	0.875
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1287690.002	1448100.005	0.766
22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	100	2000	NC	1283820.002	1448070.005	0.854
22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	100	2000	NC	1283850.002	1448070.005	0.761
22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	100	2000	NC	1283880.002	1448070.005	0.775
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280820.002	1448040.005	0.654
22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	100	2000	NC	1283790.002	1448040.005	0.849
22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	100	2000	NC	1283820.002	1448040.005	0.792
18569	Hexastylis naniflora	49	Dwarf-flowered Heartleaf	2012-03-28	2012-03-28	2001-02-04	Current	A	3-Medium	100	2000	NC	1286310.002	1448040.005	0.714
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280700.002	1448010.005	0.749
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280970.002	1448010.005	0.803
22383	Hexastylis naniflora	235	Dwarf-flowered Heartleaf	2001	2001	2001	Current	CD	2-High	100	2000	NC	1283790.002	1448010.005	0.859
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288290.002	1448010.005	0.876
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280760.002	1447980.005	0.772
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280880.002	1447980.005	0.865
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280910.002	1447980.005	0.865
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288260.002	1447980.005	0.721
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288410.002	1447980.005	0.865
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288440.002	1447980.005	0.864
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288350.002	1447950.005	0.844
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288380.002	1447950.005	0.779
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288410.002	1447950.005	0.770
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288440.002	1447950.005	0.699
24748	Hexastylis naniflora	267	Dwarf-flowered Heartleaf	2006-07-06	2006-07-06	2006-07-06	Current	CD	2-High	99	2000	NC	1267650.002	1447920.005	0.800
24748	Hexastylis naniflora	267	Dwarf-flowered Heartleaf	2006-07-06	2006-07-06	2006-07-06	Current	CD	2-High	99	2000	NC	1267680.002	1447920.005	0.842
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280640.002	1447920.005	0.684
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280730.002	1447920.005	0.687
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288320.002	1447920.005	0.784
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288350.002	1447920.005	0.780
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280550.002	1447890.005	0.710
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280580.002	1447890.005	0.749
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280610.002	1447890.005	0.646
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280700.002	1447890.005	0.678
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288560.002	1447890.005	0.820
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288590.002	1447890.005	0.815
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280520.002	1447860.005	0.529
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280550.002	1447860.005	0.648
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288500.002	1447860.005	0.831
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288530.002	1447860.005	0.739
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288560.002	1447860.005	0.734
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288590.002	1447860.005	0.625
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288620.002	1447860.005	0.693
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288380.002	1447740.005	0.661

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288410.002	1447740.005	0.810
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288380.002	1447650.005	0.713
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1279590.002	1447560.005	0.807
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1279620.002	1447560.005	0.811
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1279590.002	1447530.005	0.758
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288380.002	1447530.005	0.740
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281660.002	1447500.005	0.366
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281690.002	1447500.005	0.780
24749	Hexastylis naniflora	268	Dwarf-flowered Heartleaf	2006-07-06	2006-07-06	2006-07-06	Current	D	2-High	99	2000	NC	1267380.002	1447470.005	0.318
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281450.002	1447470.005	0.621
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281360.002	1447440.005	0.529
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281390.002	1447440.005	0.734
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281420.002	1447440.005	0.791
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288380.002	1447440.005	0.661
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288410.002	1447440.005	0.762
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288440.002	1447440.005	0.749
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288470.002	1447440.005	0.772
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288500.002	1447440.005	0.719
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288530.002	1447440.005	0.824
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288650.002	1447440.005	0.782
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281300.002	1447410.005	0.529
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281330.002	1447410.005	0.589
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281360.002	1447410.005	0.793
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288410.002	1447410.005	0.638
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288440.002	1447410.005	0.663
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288620.002	1447410.005	0.813
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288650.002	1447410.005	0.780
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291020.002	1447410.005	0.760
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281150.002	1447380.005	0.229
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281180.002	1447380.005	0.574
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281210.002	1447380.005	0.569
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281240.002	1447380.005	0.589
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281270.002	1447380.005	0.720
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288590.002	1447380.005	0.755
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288620.002	1447380.005	0.733
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291020.002	1447380.005	0.755
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291050.002	1447350.005	0.743
17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	99	2000	NC	1268220.002	1447320.005	0.671
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291050.002	1447320.005	0.748
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291080.002	1447320.005	0.750
17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	99	2000	NC	1268160.002	1447290.005	0.687
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291050.002	1447290.005	0.807
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291170.002	1447290.005	0.736
17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	99	2000	NC	1267890.002	1447260.005	0.501
17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	99	2000	NC	1267920.002	1447260.005	0.526
17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	99	2000	NC	1267950.002	1447260.005	0.593
17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	99	2000	NC	1267980.002	1447260.005	0.635
17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	99	2000	NC	1268010.002	1447260.005	0.637
17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	99	2000	NC	1268040.002	1447260.005	0.635
17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	99	2000	NC	1268130.002	1447260.005	0.691
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291050.002	1447260.005	0.795
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291170.002	1447260.005	0.758

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291050.002	1447230.005	0.795
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291170.002	1447230.005	0.850
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291050.002	1447200.005	0.793
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291170.002	1447200.005	0.837
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281840.002	1447170.005	0.339
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291080.002	1447170.005	0.755
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291140.002	1447170.005	0.675
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281810.002	1447140.005	0.348
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281840.002	1447140.005	0.764
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281870.002	1447140.005	0.772
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291080.002	1447140.005	0.675
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291110.002	1447140.005	0.716
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291140.002	1447140.005	0.696
20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	99	2000	NC	1269030.002	1447110.005	0.547
20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	99	2000	NC	1269060.002	1447110.005	0.551
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281780.002	1447110.005	0.772
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281810.002	1447110.005	0.757
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291110.002	1447110.005	0.613
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291140.002	1447110.005	0.675
20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	99	2000	NC	1268970.002	1447080.005	0.664
20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	99	2000	NC	1269000.002	1447080.005	0.688
20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	99	2000	NC	1269030.002	1447080.005	0.761
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291140.002	1447080.005	0.675
20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	99	2000	NC	1268940.002	1447050.005	0.763
20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	99	2000	NC	1268970.002	1447050.005	0.768
20255	Hexastylis naniflora	90	Dwarf-flowered Heartleaf	2003-03-02	2003-03-02	2003-03-02	Current	D	2-High	99	2000	NC	1269000.002	1447050.005	0.757
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291140.002	1447050.005	0.593
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291140.002	1447020.005	0.593
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291170.002	1446990.005	0.738
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281690.002	1446960.005	0.485
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281720.002	1446960.005	0.594
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281750.002	1446960.005	0.730
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281780.002	1446960.005	0.802
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281810.002	1446960.005	0.580
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291170.002	1446960.005	0.698
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291200.002	1446960.005	0.743
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291230.002	1446960.005	0.796
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280820.002	1446930.005	0.900
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280850.002	1446930.005	0.896
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280880.002	1446930.005	0.891
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281690.002	1446930.005	0.659
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291170.002	1446930.005	0.678
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268460.002	1446900.005	0.635
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268490.002	1446900.005	0.623
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280820.002	1446900.005	0.896
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280850.002	1446900.005	0.898
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280880.002	1446900.005	0.894
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291140.002	1446900.005	0.572
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265430.002	1446870.005	0.766
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268460.002	1446870.005	0.637
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280850.002	1446870.005	0.891
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291140.002	1446870.005	0.552

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265430.002	1446840.005	0.759
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268430.002	1446840.005	0.641
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281720.002	1446840.005	0.317
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281750.002	1446840.005	0.802
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291140.002	1446840.005	0.512
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265430.002	1446810.005	0.768
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268400.002	1446810.005	0.643
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268430.002	1446810.005	0.591
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281690.002	1446810.005	0.123
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281720.002	1446810.005	0.753
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291140.002	1446810.005	0.512
25900	Hexastylis naniflora	274	Dwarf-flowered Heartleaf	2012-03-03	2012-03-03	2008-03-17	Current	A?	2-High	274	500	NC	1291170.002	1446810.005	0.661
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265400.002	1446780.005	0.789
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265430.002	1446780.005	0.773
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265460.002	1446780.005	0.759
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265490.002	1446780.005	0.761
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268370.002	1446780.005	0.643
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268400.002	1446780.005	0.639
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446750.005	0.805
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265400.002	1446750.005	0.791
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265430.002	1446750.005	0.781
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265460.002	1446750.005	0.770
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268310.002	1446750.005	0.588
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268340.002	1446750.005	0.592
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268370.002	1446750.005	0.641
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280880.002	1446750.005	0.715
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280910.002	1446750.005	0.715
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446720.005	0.811
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265430.002	1446720.005	0.777
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268280.002	1446720.005	0.667
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268310.002	1446720.005	0.586
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280910.002	1446720.005	0.710
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280940.002	1446720.005	0.768
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1280970.002	1446720.005	0.787
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281000.002	1446720.005	0.864
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446690.005	0.755
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265430.002	1446690.005	0.787
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268280.002	1446690.005	0.641
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281000.002	1446690.005	0.825
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281030.002	1446690.005	0.862
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281090.002	1446690.005	0.833
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446660.005	0.867
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446660.005	0.812
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265430.002	1446660.005	0.790
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265460.002	1446660.005	0.772
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268250.002	1446660.005	0.652
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281090.002	1446660.005	0.775
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281120.002	1446660.005	0.859
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281150.002	1446660.005	0.861
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446630.005	0.819
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446630.005	0.816
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265460.002	1446630.005	0.776

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265490.002	1446630.005	0.673
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268220.002	1446630.005	0.654
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281150.002	1446630.005	0.859
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281180.002	1446630.005	0.855
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446600.005	0.818
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265460.002	1446600.005	0.787
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265490.002	1446600.005	0.777
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265520.002	1446600.005	0.692
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281180.002	1446600.005	0.862
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281690.002	1446600.005	0.417
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281720.002	1446600.005	0.850
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1264980.002	1446570.005	0.865
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446570.005	0.818
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265460.002	1446570.005	0.802
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265490.002	1446570.005	0.802
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265520.002	1446570.005	0.788
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268190.002	1446570.005	0.609
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281210.002	1446570.005	0.854
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281630.002	1446570.005	0.662
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281660.002	1446570.005	0.347
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281690.002	1446570.005	0.741
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281720.002	1446570.005	0.737
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281750.002	1446570.005	0.837
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1264980.002	1446540.005	0.866
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446540.005	0.819
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265460.002	1446540.005	0.757
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265490.002	1446540.005	0.804
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265520.002	1446540.005	0.782
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268190.002	1446540.005	0.663
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281180.002	1446540.005	0.710
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281660.002	1446540.005	0.735
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281690.002	1446540.005	0.733
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281720.002	1446540.005	0.730
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281750.002	1446540.005	0.733
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281780.002	1446540.005	0.839
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281810.002	1446540.005	0.839
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281840.002	1446540.005	0.803
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281870.002	1446540.005	0.837
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281900.002	1446540.005	0.826
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281930.002	1446540.005	0.822
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281960.002	1446540.005	0.817
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1264980.002	1446510.005	0.818
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446510.005	0.862
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265490.002	1446510.005	0.808
22430	Hexastylis naniflora	251	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265520.002	1446510.005	0.791
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281150.002	1446510.005	0.708
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281750.002	1446510.005	0.699
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281780.002	1446510.005	0.847
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281810.002	1446510.005	0.831
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281900.002	1446510.005	0.821
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281930.002	1446510.005	0.745
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1264980.002	1446480.005	0.820

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446480.005	0.816
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281090.002	1446480.005	0.714
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281120.002	1446480.005	0.704
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1264980.002	1446450.005	0.820
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446450.005	0.791
21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	245	2000	NC	1273410.002	1446450.005	0.845
21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	245	2000	NC	1273440.002	1446450.005	0.840
21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	245	2000	NC	1273470.002	1446450.005	0.828
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281480.002	1446450.005	0.634
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1264980.002	1446420.005	0.821
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446420.005	0.822
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446420.005	0.776
21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	245	2000	NC	1273380.002	1446420.005	0.716
21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	245	2000	NC	1273410.002	1446420.005	0.834
21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	245	2000	NC	1273440.002	1446420.005	0.776
21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	245	2000	NC	1273470.002	1446420.005	0.683
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281060.002	1446420.005	0.699
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281480.002	1446420.005	0.634
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1264980.002	1446390.005	0.870
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446390.005	0.822
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446390.005	0.859
21406	Hexastylis naniflora	175	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-13	Current	C	2-High	245	2000	NC	1273380.002	1446390.005	0.598
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281480.002	1446390.005	0.640
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281510.002	1446390.005	0.675
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1264980.002	1446360.005	0.821
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446360.005	0.823
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446360.005	0.823
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265070.002	1446360.005	0.762
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268160.002	1446360.005	0.665
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273260.002	1446360.005	0.845
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273290.002	1446360.005	0.703
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281480.002	1446360.005	0.726
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281510.002	1446360.005	0.763
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1264980.002	1446330.005	0.872
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446330.005	0.824
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446330.005	0.826
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265070.002	1446330.005	0.709
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273230.002	1446330.005	0.854
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273260.002	1446330.005	0.840
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273290.002	1446330.005	0.610
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281450.002	1446330.005	0.726
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281480.002	1446330.005	0.643
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281510.002	1446330.005	0.763
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1264980.002	1446300.005	0.874
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446300.005	0.824
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446300.005	0.859
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268130.002	1446300.005	0.618
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268160.002	1446300.005	0.611
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273200.002	1446300.005	0.786
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273230.002	1446300.005	0.840
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273260.002	1446300.005	0.744
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273290.002	1446300.005	0.626

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281480.002	1446300.005	0.500
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281510.002	1446300.005	0.727
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446270.005	0.825
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446270.005	0.859
20354	Hexastylis naniflora	121	Dwarf-flowered Heartleaf	2004-05-15	2004-05-15	2004-05-15	Current	B	2-High	99	2000	NC	1267230.002	1446270.005	0.867
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273140.002	1446270.005	0.795
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273170.002	1446270.005	0.781
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281510.002	1446270.005	0.382
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265010.002	1446240.005	0.866
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446240.005	0.739
20354	Hexastylis naniflora	121	Dwarf-flowered Heartleaf	2004-05-15	2004-05-15	2004-05-15	Current	B	2-High	99	2000	NC	1267230.002	1446240.005	0.863
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273110.002	1446240.005	0.796
28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	287	500	NC	1246110.002	1446210.005	0.138
2113	Hexastylis naniflora	52	Dwarf-flowered Heartleaf	2005-03	2005-03	2001-04-06	Current	C	3-Medium	99	2000	NC	1265040.002	1446210.005	0.790
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273110.002	1446210.005	0.786
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281510.002	1446210.005	0.740
28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	287	500	NC	1246170.002	1446180.005	0.354
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273080.002	1446180.005	0.798
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281510.002	1446180.005	0.641
28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	287	500	NC	1246230.002	1446150.005	0.362
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273050.002	1446150.005	0.802
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281510.002	1446150.005	0.597
28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	287	500	NC	1246260.002	1446120.005	0.362
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273020.002	1446120.005	0.702
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273050.002	1446120.005	0.799
26982	Hexastylis naniflora	276	Dwarf-flowered Heartleaf	2016-06-20	2016-06-20	2007-08-10-Pre	Current	A	2-High	276	2000	NC	1281540.002	1446120.005	0.667
28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	287	500	NC	1246290.002	1446090.005	0.371
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273050.002	1446090.005	0.682
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273080.002	1446090.005	0.675
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273110.002	1446090.005	0.760
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273140.002	1446090.005	0.754
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273170.002	1446090.005	0.752
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273200.002	1446090.005	0.752
28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	287	500	NC	1246320.002	1446060.005	0.367
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273200.002	1446060.005	0.750
28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	287	500	NC	1246350.002	1446030.005	0.332
20332	Hexastylis naniflora	113	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-15	Current	C	3-Medium	245	2000	NC	1273230.002	1446030.005	0.788
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288316.727	1447836.831	0.708
22381	Hexastylis naniflora	233	Dwarf-flowered Heartleaf	2012-04-01	2012-04-01	2001	Current	A	2-High	100	2000	NC	1288320.584	1447847.387	0.744
21832	Hexastylis naniflora	181	Dwarf-flowered Heartleaf	2012-Spring	2012-Spring	2001-03-27	Current	AB	3-Medium	99	2000	NC	1268133.035	1446419.698	0.676
17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	99	2000	NC	1267511.796	1446916.712	0.569
17373	Hexastylis naniflora	10	Dwarf-flowered Heartleaf	2014-05-20	2014-05-20	1981-05	Current	A	2-High	99	2000	NC	1267734.371	1446995.529	0.640
20243	Hexastylis naniflora	80	Dwarf-flowered Heartleaf	2012-07	2012-07	2003-03-13	Current	D	2-High	247	2000	NC	1270737.027	1448589.652	0.752
21405	Hexastylis naniflora	174	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-03	Current	D	2-High	247	2000	NC	1270593.346	1448867.041	0.713
20333	Hexastylis naniflora	114	Dwarf-flowered Heartleaf	2010-01-27	2010-01-27	2003-05-03	Current	D	2-High	247	2000	NC	1270699.913	1448904.6	0.734
28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	287	500	NC	1246440.002	1445910.005	0.358
28582	Hexastylis naniflora	287	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2009-07-08	Current	AB	2-High	287	500	NC	1246470.002	1445880.005	0.348
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269720.002	1445820.005	0.189
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269750.002	1445820.005	0.192
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269780.002	1445820.005	0.417
22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265760.002	1445790.005	0.720
22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265790.002	1445790.005	0.716

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265820.002	1445790.005	0.784
22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265910.002	1445790.005	0.814
22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265940.002	1445790.005	0.774
22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265970.002	1445790.005	0.778
22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265820.002	1445760.005	0.770
22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265910.002	1445760.005	0.778
22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265940.002	1445760.005	0.767
22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265970.002	1445760.005	0.769
22428	Hexastylis naniflora	249	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	2-High	99	2000	NC	1265940.002	1445730.005	0.714
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264830.002	1445700.005	0.782
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264860.002	1445700.005	0.816
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264890.002	1445700.005	0.773
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269750.002	1445700.005	0.742
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264860.002	1445670.005	0.785
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264890.002	1445670.005	0.838
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445670.005	0.778
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445670.005	0.809
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269750.002	1445670.005	0.212
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269780.002	1445670.005	0.747
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264860.002	1445640.005	0.782
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264890.002	1445640.005	0.819
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265310.002	1445640.005	0.729
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265340.002	1445640.005	0.817
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265370.002	1445640.005	0.777
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445640.005	0.864
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445640.005	0.860
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445640.005	0.851
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445640.005	0.813
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445640.005	0.799
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269780.002	1445640.005	0.171
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269810.002	1445640.005	0.757
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264860.002	1445610.005	0.780
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264890.002	1445610.005	0.819
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265340.002	1445610.005	0.814
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265370.002	1445610.005	0.768
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445610.005	0.864
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445610.005	0.866
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445610.005	0.889
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445610.005	0.799
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445610.005	0.738
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269840.002	1445610.005	0.759
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264860.002	1445580.005	0.780
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264890.002	1445580.005	0.822
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264920.002	1445580.005	0.859
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265340.002	1445580.005	0.743
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265370.002	1445580.005	0.821
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445580.005	0.852
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445580.005	0.863
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445580.005	0.883
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445580.005	0.662
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445580.005	0.728
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269810.002	1445580.005	0.713

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269840.002	1445580.005	0.701
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264860.002	1445550.005	0.873
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264890.002	1445550.005	0.822
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264920.002	1445550.005	0.828
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265340.002	1445550.005	0.712
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265370.002	1445550.005	0.735
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445550.005	0.779
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445550.005	0.790
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445550.005	0.816
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445550.005	0.658
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445550.005	0.675
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269660.002	1445550.005	0.742
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269690.002	1445550.005	0.745
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269720.002	1445550.005	0.747
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269750.002	1445550.005	0.713
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269780.002	1445550.005	0.750
10378	Hexastylis naniflora	55	Dwarf-flowered Heartleaf	2016-05-25	2016-05-25	2001-04-01	Current	AB	2-High	99	2000	NC	1269810.002	1445550.005	0.583
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264860.002	1445520.005	0.820
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264890.002	1445520.005	0.819
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264920.002	1445520.005	0.801
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265340.002	1445520.005	0.706
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265370.002	1445520.005	0.727
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445520.005	0.795
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445520.005	0.837
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445520.005	0.814
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445520.005	0.614
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445520.005	0.671
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264860.002	1445490.005	0.819
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264890.002	1445490.005	0.742
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264920.002	1445490.005	0.732
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264950.002	1445490.005	0.751
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265370.002	1445490.005	0.718
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445490.005	0.737
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445490.005	0.829
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445490.005	0.761
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445490.005	0.596
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264890.002	1445460.005	0.751
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264920.002	1445460.005	0.734
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264950.002	1445460.005	0.754
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265370.002	1445460.005	0.714
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445460.005	0.729
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445460.005	0.828
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445460.005	0.759
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445460.005	0.592
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445460.005	0.580
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270320.002	1445460.005	0.589
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264890.002	1445430.005	0.748
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264920.002	1445430.005	0.744
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264950.002	1445430.005	0.784
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264980.002	1445430.005	0.689
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265370.002	1445430.005	0.714
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445430.005	0.731

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445430.005	0.821
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445430.005	0.759
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445430.005	0.660
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445430.005	0.578
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270380.002	1445430.005	0.741
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270410.002	1445430.005	0.820
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270470.002	1445430.005	0.808
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270500.002	1445430.005	0.819
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270530.002	1445430.005	0.710
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270560.002	1445430.005	0.800
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270650.002	1445430.005	0.807
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270680.002	1445430.005	0.805
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264890.002	1445400.005	0.795
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264920.002	1445400.005	0.745
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264950.002	1445400.005	0.732
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264980.002	1445400.005	0.747
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265370.002	1445400.005	0.577
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445400.005	0.779
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445400.005	0.820
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445400.005	0.759
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445400.005	0.751
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445400.005	0.578
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270470.002	1445400.005	0.817
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270590.002	1445400.005	0.718
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270620.002	1445400.005	0.709
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264920.002	1445370.005	0.701
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264950.002	1445370.005	0.747
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264980.002	1445370.005	0.726
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1265010.002	1445370.005	0.630
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265370.002	1445370.005	0.555
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445370.005	0.708
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445370.005	0.752
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445370.005	0.685
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445370.005	0.689
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445370.005	0.574
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266270.002	1445370.005	0.846
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270470.002	1445370.005	0.816
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264950.002	1445340.005	0.697
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264980.002	1445340.005	0.730
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1265010.002	1445340.005	0.687
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265370.002	1445340.005	0.562
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445340.005	0.702
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445340.005	0.746
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445340.005	0.740
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445340.005	0.685
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445340.005	0.612
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265550.002	1445340.005	0.588
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266240.002	1445340.005	0.794
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266270.002	1445340.005	0.838
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266300.002	1445340.005	0.800
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270500.002	1445340.005	0.805
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264980.002	1445310.005	0.745

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1265010.002	1445310.005	0.708
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1265040.002	1445310.005	0.630
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265370.002	1445310.005	0.560
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445310.005	0.684
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445310.005	0.735
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445310.005	0.735
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445310.005	0.739
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445310.005	0.616
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265550.002	1445310.005	0.590
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266180.002	1445310.005	0.704
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266210.002	1445310.005	0.770
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266240.002	1445310.005	0.850
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266270.002	1445310.005	0.823
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266300.002	1445310.005	0.790
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1264980.002	1445280.005	0.737
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1265010.002	1445280.005	0.801
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1265040.002	1445280.005	0.708
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265400.002	1445280.005	0.621
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445280.005	0.708
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445280.005	0.712
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445280.005	0.729
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445280.005	0.657
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265550.002	1445280.005	0.613
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266150.002	1445280.005	0.785
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266180.002	1445280.005	0.801
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266210.002	1445280.005	0.841
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266240.002	1445280.005	0.798
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270530.002	1445280.005	0.798
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1265040.002	1445250.005	0.742
17372	Hexastylis naniflora	9	Dwarf-flowered Heartleaf	2012	2005-03-05	1981	Current	AB	2-High	99	2000	NC	1265070.002	1445250.005	0.632
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265430.002	1445250.005	0.609
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265460.002	1445250.005	0.668
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265490.002	1445250.005	0.651
21834	Hexastylis naniflora	182	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	1996	Current	A?	3-Medium	99	2000	NC	1265520.002	1445250.005	0.645
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266060.002	1445250.005	0.657
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266090.002	1445250.005	0.732
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266120.002	1445250.005	0.824
22429	Hexastylis naniflora	250	Dwarf-flowered Heartleaf	2001-05-13	2001-05-13	2001-05-13	Current	A?	3-Medium	99	2000	NC	1266150.002	1445250.005	0.788
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270530.002	1445250.005	0.803
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270590.002	1445220.005	0.793
20242	Hexastylis naniflora	79	Dwarf-flowered Heartleaf	2012-05	2012-05	2001-04-01	Current	C	3-Medium	99	2000	NC	1270620.002	1445190.005	0.788
12925	Hexastylis naniflora	63	Dwarf-flowered Heartleaf	2001-07-31	2001-07-31	2001-07-31	Current	D	2-High	99	2000	NC	1269330.002	1445130.005	0.605
12925	Hexastylis naniflora	63	Dwarf-flowered Heartleaf	2001-07-31	2001-07-31	2001-07-31	Current	D	2-High	99	2000	NC	1269360.002	1445130.005	0.566
12925	Hexastylis naniflora	63	Dwarf-flowered Heartleaf	2001-07-31	2001-07-31	2001-07-31	Current	D	2-High	99	2000	NC	1269300.002	1445100.005	0.612
4172	Hexastylis naniflora	62	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2002-02-02	Current	C	2-High	99	2000	NC	1270380.002	1445100.005	0.788
4172	Hexastylis naniflora	62	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2002-02-02	Current	C	2-High	99	2000	NC	1270410.002	1445100.005	0.689
12925	Hexastylis naniflora	63	Dwarf-flowered Heartleaf	2001-07-31	2001-07-31	2001-07-31	Current	D	2-High	99	2000	NC	1269300.002	1445070.005	0.329
4172	Hexastylis naniflora	62	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2002-02-02	Current	C	2-High	99	2000	NC	1270230.002	1444980.005	0.814
4172	Hexastylis naniflora	62	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2002-02-02	Current	C	2-High	99	2000	NC	1270260.002	1444950.005	0.802
385	Hexastylis naniflora	23	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1992-1993	Current	A	2-High	23	2000	NC	1253130.002	1444920.005	0.613
385	Hexastylis naniflora	23	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1992-1993	Current	A	2-High	23	2000	NC	1253130.002	1444890.005	0.622
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1271040.002	1444890.005	0.789

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
385	Hexastylis naniflora	23	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1992-1993	Current	A	2-High	23	2000	NC	1253130.002	1444860.005	0.604
9779	Hexastylis naniflora	53	Dwarf-flowered Heartleaf	2003-05	2003-05	2001-04-02	Current	D	2-High	99	2000	NC	1268400.002	1444860.005	0.329
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1271010.002	1444860.005	0.685
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1271040.002	1444860.005	0.757
385	Hexastylis naniflora	23	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1992-1993	Current	A	2-High	23	2000	NC	1253130.002	1444830.005	0.608
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1271010.002	1444830.005	0.693
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1271040.002	1444830.005	0.695
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1271070.002	1444830.005	0.784
385	Hexastylis naniflora	23	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1992-1993	Current	A	2-High	23	2000	NC	1253130.002	1444800.005	0.622
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270980.002	1444800.005	0.691
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1271010.002	1444800.005	0.697
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1271040.002	1444800.005	0.791
385	Hexastylis naniflora	23	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1992-1993	Current	A	2-High	23	2000	NC	1253130.002	1444770.005	0.618
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270980.002	1444770.005	0.764
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1271010.002	1444770.005	0.788
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270920.002	1444740.005	0.766
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270950.002	1444740.005	0.802
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270890.002	1444710.005	0.757
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270920.002	1444710.005	0.800
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270890.002	1444680.005	0.755
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270860.002	1444650.005	0.763
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270860.002	1444620.005	0.712
7324	Hexastylis naniflora	37	Dwarf-flowered Heartleaf	2005	2005	1994-06	Current	C	2-High	99	2000	NC	1267050.002	1444590.005	0.879
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270860.002	1444590.005	0.775
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270860.002	1444560.005	0.810
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270860.002	1444530.005	0.807
7324	Hexastylis naniflora	37	Dwarf-flowered Heartleaf	2005	2005	1994-06	Current	C	2-High	99	2000	NC	1267020.002	1444500.005	0.870
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270830.002	1444500.005	0.717
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270860.002	1444500.005	0.804
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270830.002	1444470.005	0.719
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270830.002	1444440.005	0.719
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270800.002	1444410.005	0.720
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270830.002	1444410.005	0.811
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270800.002	1444380.005	0.721
16879	Hexastylis naniflora	61	Dwarf-flowered Heartleaf	2002-02-03	2002-02-03	2002-02-03	Current	B	3-Medium	99	2000	NC	1270800.002	1444350.005	0.814
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1273110.002	1444200.005	0.816
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1273080.002	1444170.005	0.783
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1273110.002	1444170.005	0.872
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1273140.002	1444170.005	0.856
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1273050.002	1444140.005	0.753
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1273140.002	1444140.005	0.857
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1273170.002	1444080.005	0.851
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1273170.002	1444050.005	0.855
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272630.002	1443990.005	0.828
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272660.002	1443990.005	0.827
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272660.002	1443960.005	0.772
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272360.002	1443930.005	0.818
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272690.002	1443930.005	0.780
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272390.002	1443900.005	0.827
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272420.002	1443900.005	0.746
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272690.002	1443900.005	0.782
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272420.002	1443870.005	0.825

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272720.002	1443870.005	0.832
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272750.002	1443870.005	0.771
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261260.002	1443840.005	0.661
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272420.002	1443840.005	0.837
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272750.002	1443840.005	0.819
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272780.002	1443840.005	0.769
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261050.002	1443810.005	0.735
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261080.002	1443810.005	0.727
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261110.002	1443810.005	0.742
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261140.002	1443810.005	0.742
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261170.002	1443810.005	0.659
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261200.002	1443810.005	0.659
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261230.002	1443810.005	0.649
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261260.002	1443810.005	0.651
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261290.002	1443810.005	0.663
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261320.002	1443810.005	0.663
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261350.002	1443810.005	0.664
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261380.002	1443810.005	0.664
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272450.002	1443810.005	0.794
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272810.002	1443810.005	0.860
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272840.002	1443810.005	0.874
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272870.002	1443810.005	0.865
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272900.002	1443810.005	0.857
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261050.002	1443780.005	0.725
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261320.002	1443780.005	0.652
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261350.002	1443780.005	0.652
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261380.002	1443780.005	0.263
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261410.002	1443780.005	0.257
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272870.002	1443780.005	0.865
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272900.002	1443780.005	0.870
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272930.002	1443780.005	0.861
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261050.002	1443750.005	0.649
21275	Hexastylis naniflora	125	Dwarf-flowered Heartleaf	2016-05-13	2016-05-13	1994	Current	A	3-Medium	125	2000	NC	1261470.002	1443750.005	0.322
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272480.002	1443720.005	0.815
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272480.002	1443690.005	0.811
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272510.002	1443630.005	0.758
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272510.002	1443600.005	0.779
4030	Hexastylis naniflora	54	Dwarf-flowered Heartleaf	2005-04-12	2014-05	2001-04-01	Current	D	2-High	248	500	NC	1266300.002	1443510.005	0.783
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272600.002	1443510.005	0.840
4030	Hexastylis naniflora	54	Dwarf-flowered Heartleaf	2005-04-12	2014-05	2001-04-01	Current	D	2-High	248	500	NC	1266300.002	1443480.005	0.679
4030	Hexastylis naniflora	54	Dwarf-flowered Heartleaf	2005-04-12	2014-05	2001-04-01	Current	D	2-High	248	500	NC	1266330.002	1443480.005	0.599
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272630.002	1443480.005	0.837
4030	Hexastylis naniflora	54	Dwarf-flowered Heartleaf	2005-04-12	2014-05	2001-04-01	Current	D	2-High	248	500	NC	1266330.002	1443450.005	0.679
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272720.002	1443420.005	0.838
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272750.002	1443390.005	0.819
14124	Hexastylis naniflora	75	Dwarf-flowered Heartleaf	2013-07-17	2013-07-17	2003-03-14	Current	A	3-Medium	99	2000	NC	1272810.002	1443360.005	0.822
3553	Hexastylis naniflora	76	Dwarf-flowered Heartleaf	2015-05-19	2015-05-19	2004-05-03	Current	BC	2-High	99	2000	NC	1273710.002	1443240.005	0.659
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267830.002	1442550.005	0.459
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267800.002	1442520.005	0.621
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267830.002	1442520.005	0.627
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267860.002	1442520.005	0.611
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267770.002	1442490.005	0.565

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267800.002	1442490.005	0.611
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267830.002	1442490.005	0.621
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267860.002	1442490.005	0.511
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267740.002	1442460.005	0.663
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267770.002	1442460.005	0.706
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267800.002	1442460.005	0.698
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267740.002	1442430.005	0.609
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267770.002	1442430.005	0.704
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267740.002	1442400.005	0.694
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267770.002	1442400.005	0.705
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267740.002	1442370.005	0.698
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267770.002	1442370.005	0.703
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267740.002	1442340.005	0.701
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267770.002	1442340.005	0.698
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267740.002	1442310.005	0.703
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267710.002	1442280.005	0.651
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267740.002	1442280.005	0.698
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267710.002	1442250.005	0.686
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267740.002	1442250.005	0.701
8494	Hexastylis naniflora	40	Dwarf-flowered Heartleaf	2005-04-12	2005-04-12	1994-06	Current	C	3-Medium	248	500	NC	1267710.002	1442220.005	0.696
4172	Hexastylis naniflora	62	Dwarf-flowered Heartleaf	2002-04-21	2002-04-21	2002-02-02	Current	C	2-High	99	2000	NC	1270171.343	1444998.916	0.823
3553	Hexastylis naniflora	76	Dwarf-flowered Heartleaf	2015-05-19	2015-05-19	2004-05-03	Current	BC	2-High	99	2000	NC	1273726.806	1443170.59	0.775
21403	Hexastylis naniflora	172	Dwarf-flowered Heartleaf	2012-03-12	2012-03-12	2003-05-14	Current	D	2-High	99	2000	NC	1273686.203	1442978.818	0.746
20256	Hexastylis naniflora	91	Dwarf-flowered Heartleaf	2012-07	2012-07	2003-03-13	Current	D	2-High	245	2000	NC	1272424.1	1445950.524	0.663
37915		319											1273499.852	1443293.951	0.836
36693	Hexastylis naniflora	311	Dwarf-flowered Heartleaf	2016-08-04	2016-08-04	2007-11-28	Current	A	2-High	311	500	NC	1251450.002	1441920.005	0.249
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277220.002	1437840.005	0.716
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277100.002	1437660.005	0.320
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277130.002	1437660.005	0.322
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277160.002	1437660.005	0.713
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277130.002	1437630.005	0.325
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1276680.002	1437240.005	0.687
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1276710.002	1437240.005	0.685
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1276740.002	1437240.005	0.659
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1276770.002	1437240.005	0.203
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1276680.002	1437210.005	0.697
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278240.002	1436670.005	0.726
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277340.002	1436640.005	0.710
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277370.002	1436640.005	0.712
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278210.002	1436640.005	0.719
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277430.002	1436610.005	0.699
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277460.002	1436610.005	0.716
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277490.002	1436610.005	0.720
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278210.002	1436610.005	0.726
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277610.002	1436580.005	0.720
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278180.002	1436580.005	0.719
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278150.002	1436550.005	0.728
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278180.002	1436550.005	0.493
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278150.002	1436520.005	0.718
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278150.002	1436490.005	0.484
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278120.002	1436460.005	0.491
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278150.002	1436460.005	0.482

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278120.002	1436430.005	0.486
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278150.002	1436430.005	0.403
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278090.002	1436400.005	0.497
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278120.002	1436400.005	0.486
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1278270.201	1436724.456	0.334
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277685.605	1436515.531	0.724
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1277721.636	1436459.279	0.722
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1276596.647	1437170.269	0.308
	Hexastylis naniflora		Dwarf-flowered Heartleaf							3	2000	SC	1276574.931	1437154.523	0.223
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1267590.002	1432770.005	0.703
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1267620.002	1432770.005	0.705
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1268640.002	1432710.005	0.533
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1267440.002	1432680.005	0.694
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1267350.002	1432620.005	0.692
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1268850.002	1432560.005	0.812
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1266840.002	1432500.005	0.329
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271700.002	1432410.005	0.685
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271700.002	1432380.005	0.597
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271790.002	1432260.005	0.624
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271820.002	1432260.005	0.547
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271400.002	1432200.005	0.421
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271430.002	1432200.005	0.410
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1269630.002	1432050.005	0.721
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271580.002	1432020.005	0.537
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271610.002	1431960.005	0.595
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271670.002	1431930.005	0.630
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271700.002	1431930.005	0.505
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1269090.002	1431900.005	0.390
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1269180.002	1431870.005	0.812
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1269150.002	1431840.005	0.713
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1269270.002	1431840.005	0.729
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1269270.002	1431810.005	0.802
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1270290.002	1431630.005	0.321
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1270290.002	1431600.005	0.319
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271070.002	1431270.005	0.615
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271140.904	1431243.357	0.515
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271839.979	1431852.731	0.393
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1270216.76	1432005.233	0.461
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1268998.768	1431858.019	0.423
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1269732.547	1432051.766	0.630
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1269564.774	1432059.834	0.730
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1269481.884	1432095.536	0.703
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271264.686	1432760.98	0.764
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1266022.481	1431931.821	0.724
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1268915.107	1432552.503	0.780
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271107.627	1432924.401	0.733
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271031.368	1432948.706	0.643
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1268683.268	1432764.414	0.608
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1266565.594	1432449.253	0.645
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1266608.648	1432473.057	0.641
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1268021.215	1432781.926	0.690
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1267887.858	1432778.852	0.701

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1273980.002	1428660.005	0.612
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1274100.002	1428660.005	0.608
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1273980.002	1428630.005	0.627
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1274010.002	1428630.005	0.613
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1274070.002	1428630.005	0.614
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1274100.002	1428630.005	0.608
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1273980.002	1428600.005	0.624
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1274070.002	1428570.005	0.581
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1273590.002	1427520.005	0.794
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1273632.548	1427581.4	0.818
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1274067.796	1428432.046	0.575
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1272673.576	1428410.354	0.734
	Hexastylis naniflora		Dwarf-flowered Heartleaf							1	2000	SC	1271866.924	1429582.397	0.660
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274700.002	1421520.005	0.397
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274700.002	1421490.005	0.298
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274670.002	1421430.005	0.368
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274460.002	1421340.005	0.301
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274460.002	1421310.005	0.215
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274460.002	1421280.005	0.268
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274940.002	1421280.005	0.616
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1275000.002	1421280.005	0.647
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1275030.002	1421280.005	0.633
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1275060.002	1421280.005	0.581
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1275090.002	1421280.005	0.521
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274490.002	1421250.005	0.318
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274850.002	1421250.005	0.602
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274880.002	1421250.005	0.703
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274910.002	1421250.005	0.709
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274970.002	1421250.005	0.611
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1275000.002	1421250.005	0.609
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274520.002	1421220.005	0.603
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274550.002	1421220.005	0.610
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274580.002	1421220.005	0.321
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274610.002	1421220.005	0.321
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274820.002	1421220.005	0.263
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274850.002	1421220.005	0.587
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274880.002	1421220.005	0.611
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274910.002	1421220.005	0.634
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274520.002	1421190.005	0.293
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274550.002	1421190.005	0.603
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274580.002	1421190.005	0.620
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274610.002	1421190.005	0.314
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274640.002	1421190.005	0.313
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274670.002	1421190.005	0.299
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274820.002	1421190.005	0.305
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274670.002	1421160.005	0.620
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274700.002	1421160.005	0.623
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274730.002	1421160.005	0.326
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274760.002	1421160.005	0.653
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274790.002	1421160.005	0.675
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274820.002	1421160.005	0.610
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274730.002	1421130.005	0.666

EO_ID	SCI_NAME	EO_NUM	COM_NAME	SURVEYDATE	LAST_OBS	FIRST_OBS	EO_STATUS	EO_RANK	ACCURACY	PopNumber	EstPlantsMax	State	X	Y	Maxent Score
	Hexastylis naniflora		Dwarf-flowered Heartleaf							2	2000	SC	1274760.002	1421130.005	0.675
													1240369.49	1419083.964	0.005
													1240676.032	1419026.488	0.006
													1225042.373	1411324.612	0.003

Appendix 1

Populations of *Hexastylis naniflora* estimated to contain over 1,000 rosettes in 2010, with updated information in 2016[1], and protection measures for these populations.

Populations known to be afforded some protection are indicated in **bold**.[2]

USFWS population number	State	County	NHP EO numbers (2016)[3]	NHP EO rank (2016)[4,5]	Site	Latest estimate of population size (year)	Estimate of plants on-site protection (year)	Protection comments
1	NC	Burke	029	A	Island Creek Heath Bluff (Lovelady Sites)	50,000+ (2016)	0	Not protected.
2	NC	Burke	178.159-178.161 178.254-178.256 178.280-178.282	A	Catawba River: Love Lady (Hoyle and Micol Creek)	~6,738 (2008-2011)	Awaiting data from NCDOT.	Possible NCDOT protected R-O-W, protection unconfirmed. In early 2016, the Town of Valdese applied to CWMTF to acquire part of this population.
3	**NC**	**Caldwell**	**227**	**A**	**Peaked Top Rare Plant Site (Foothills Landfill)**	**16,463 (2014)**	**16,463 (2014)**	**Conservation Easement (Foothills Conservancy of NC).**
4	**NC**	**Caldwell**	**044**	**AB**	**Little Gunpowder Creek Rare Plant Site 1**	**2,707 (2015)**	**2,424 (2015)**	**DOT mitigation site.**
5	NC	Catawba	158	D	South Fork Catawba River: Jacob Fork, Camp Creek	123 (2016)	27 (2015)	Some plants occur within an undetermined acreage within NCDOT R-O-W (Bassette 2016). Protection unconfirmed.
6	**NC**	**Catawba**	**243.012,** 243.242 243.269, **243.270**	**A**	**Catawba Wildlife Club**	**1,000-1300 (1995-2007)**	**>1,000 (1995-2007)**	**Catawba County Wildlife Club Registered Heritage Area (EO 12) The Nature Conservancy Conservation Easement (EO 270).**
7	NC	Catawba	031	C?	US 321, southeast Hickory	1,202 (2010)	161 (2010)	161 plants within NCDOT R-O-W (Bassette 2016).
8	**NC**	**Catawba**	**96.184,** 96.038 96.039	**A**	**Murrays Mill/Upper Balls Creek**	**~9,150 (2005)**	**11,860 (2013)**	**Fee title by NCDOT (~34 acres).**
9	**NC**	**Cleveland**	100.014, **100.049, 100.050, 100.051, 100.073, 100.074 100.149, 100.233**	**A**	**Broad River/Sandy Run Natural Areas (aka "Broad River Tract")**	**~33,500 (2001-2015)**	**32,702 (2015)**	**Fee title by Broad River Greenway (1,000 acres).**

USFWS population number	State	County	NHP EO numbers (2016)[3]	NHP EO rank (2016)[4,5]	Site	Latest estimate of population size (year)	Estimate of plants on-site protection (year)	Protection comments
			100.236, 100.237 **100.238, 100.239 100.240, 100.241,** 100.246					
10	NC	Cleveland	208	A?	Buffalo Creek: Potts Creek	3,572 (2007)		Awaiting verification that plants are protected in NCDOT R-O-W. Protection unconfirmed.
11	NC	Cleveland	211.072, 211.194		First Broad River: Hop-Hornbeam Natural Area	1,965 (2000)		Awaiting verification that plants are protected in NCDOT R-O-W. Protection unconfirmed.
12	NC	Cleveland	214.201, **214.202, 214.203,** 214.204, **214.205, 214.209,** 214.212, **214.213,**	A	Buffalo Creek: tributaries north and south of SR2047	6,447 (200-2007)		Awaiting verification that plants are protected in NCDOT in R-O-W, bold in EO column. Protection unconfirmed (EO 202, 203, 205, 209, 213).
13	NC	Cleveland	216.028, 216.196, 216.197, 216.198, **216.199, 216.200**	A	Buffalo Creek: Kings Mountain Reservoir	3,310 (200-2016)	~500? (2000-2007) (awaiting updates)	Awaiting verification that plants are protected in NCDOT in R-O-W, bold in EO column. Protection unconfirmed (EO 199, 200).
14	NC	Cleveland	157	AB	First Broad River: Crooked Run Creek	330 (2010)		None of the population is protected within NCDOT R-O-W, determined too far away from roadside, DOT stopped monitoring in 2010 (Bassette 2016).
15	**NC**	**Cleveland/ Rutherford**	**276**	**A**	**Cliffside Steam Station**	**39,545 (2016)**	**~39,545 (2016)**	**Voluntary agreement with Duke Energy; protected acreage unknown.**
16	NC	Lincoln	261.252, 261.259, 261.263	B	Lincoln County Airport and Leepers Creek	7,032 (2005-2006)		Not protected.
17	NC	Polk	023	A	Mills Creek Forest and Seep	1,459 (2016)		Not protected.

USFWS population number	State	County	NHP EO numbers (2016)[3]	NHP EO rank (2016)[4,5]	Site	Latest estimate of population size (year)	Estimate of plants on-site protection (year)	Protection comments
18	**NC**	**Polk**	**125**	**A**	**Broad River: New Hope Springhead Swamp**	**12,235 (2016)**	**1,000-3,000 estimated (2016)**	**New Hope Springhead Swamp Registered Heritage Area (voluntary conservation agreement).**
19	**NC**	**Rutherford**	**154**	**C**	**Second Broad River (Forest City Industrial Complex)**	**2,576 (2016)**	**2478 (2008)**	**Deed restrictions (12 acres). Significant threats from industrial development, invasive exotics, erosion, sedimentation in a fragmented landscape.**
20	**NC**	**Rutherford**	99.009, 99.010, 99.037, 99.052, 99.053, 99.055, 99.061, 99.063, 99.075, **99.076,** 99.079, 99.090, 99.121, **99.172,** 99.181, 99.182, 99.249-.251, 99.267, 99.268	**A**	**Broad River: Hensons Creek Ravine, Brice Rare Plant Site, Sandy Mush Outcrop**	**106,940 (2016)**	**~200-250 (2007-2012)**	**Parris Heartleaf Registered Heritage Area (voluntary conservation agreement on subEO 076 and 172).**
21	NC	Rutherford	176.167-176.170	A	Broad River: Cleghorn Creek Tributary/US221	6,750 (2016)		Not protected.
22	NC	Rutherford	177.016, 177.107, 177.122, 177.063, 177.164, 177.165, 177.166	A	Broad River: Floyds Creek, Long Branch	12,687 (2008-2016)		Not protected.
23	**NC**	**Rutherford**	247.013, 247.056, 247.080, **247.106,** 247.114, 247.115, 247.173, 247.174, **247.286**	**A**	**Broad River: Floyds Creek (aka New Bethel Rare Plant Site)**	**~5,480 (2003-2015)**	**4,873 (2015)**	**Tate Conservation Easement (8 acres) (SubEOs 106 and 286).**
24	**SC**	**Cherokee**	**016, 017, 018**	**BC**	**Cowpens Battlefield**	**2,823 (2016)**	**2,823? (2016)**	**National Park Service, National Battlefield.**

USFWS population number	State	County	NHP EO numbers (2016)[3]	NHP EO rank (2016)[4,5]	Site	Latest estimate of population size (year)	Estimate of plants on-site protection (year)	Protection comments
25	SC	Greenville /Spartanburg	002, 004, 024, 032, 033, 036, 038, 039, 040, 041, 042, 049, 050, 054	Various AB-BD	South Pacolet River and tributaries	5,205 (1991-1998)		Not protected.
26	**SC**	**Spartanburg**	**011, 014, 026--028, 047, 048, 057**	**Various AB-BD**	**Peters Creek Heritage Preserve**	**3,306 (2016)**	**3,306 (2016)**	**State Heritage Preserve (194 acres).**
27	**SC**	**Spartanburg**	**007, 029**	**BD, H?**	**Blalock Reservoir**	**3,505 (2016)**	**3,505? (2016)**	**Restrictive covenants (protected acreage unknown); significant threats to remaining population.**
28[6]	**NC**	**Lincoln**	302.046, **302.262**	**A**	**Rhyne Preserve**	**19,880 (2016)**	**19,873 (2016)**	**Rhyne Preserve (fee title by Catawba Lands Conservancy).**

[1]This table was replicated in the same format and populations as Table B.2 from the most recent USFWS five-year Review of *Hexastylis naniflora* (USFWS 2010) for comparison of changes since the time of the five-year review. Populations that are not believed to contain over 1,000 rosettes but were included in the original Table B.2 are included here, but the "NHP EO rank" and in the "Latest estimate of population size" reflects the smaller size.

[2] In the case of partially protected populations, the column "NHP EO numbers" indicates the specific portions of the population afforded protection in bold font.

[3]NHP EO numbers use the following format: Principal EO.SubEO. Only one number is listed if it is a stand-alone principal EO.

[4]NHP EO rank specifications are defined in Appendix B2. In cases involving principal/sub EOs, only the rank for the principal EO is given.

[5] EO ranks with two letters indicate a degree of uncertainty within the range provided (e.g. a rank of "AB" indicates possibly excellent to good viability).

[6]Population that is currently estimated to have over 1,000 rosettes that was not known to be large populations in 2010 have been added to this table.

Appendix 2

NC Natural Heritage Program (NCNHP) Element Occurrence Rank Specifications for *Hexastylis naniflora*

"A" Rank Specifications (excellent viability)
An A-ranked population of *Hexastylis naniflora* should have more than 500 clumps (rosettes) occurring in greater than one acre of high quality forest such as Dry-Mesic Oak Hickory Forest or Mesic Mixed Hardwood Forest.

“B” Rank Specifications (good viability)
A B-ranked population of *Hexastylis naniflora* should have 200-500 clumps (rosettes) occurring in greater than one acre of high quality forest such as Dry-Mesic Oak Hickory Forest or Mesic Mixed Hardwood Forest - OR - more than 500 clumps occurring in less than one acre of high quality forest or on land impacted by human disturbance such as logging, grazing, mowing, etc.

"C" Rank Specifications (fair viability)
A C-ranked population of *Hexastylis naniflora* should have 100-200 clumps (rosettes) occurring in greater than one acre of high quality forest such as Dry-Mesic Oak Hickory Forest or Mesic Mixed Hardwood Forest - OR - 200- 500 clumps occurring in less than one acre of high quality forest or on land impacted by human disturbance such as logging, grazing, mowing, etc.

"D" Rank Specifications (poor viability)
A D-ranked population of *Hexastylis naniflora* should have fewer than 100 clumps (rosettes) occurring in greater than one acre of high quality forest such as Dry-Mesic Oak Hickory Forest or Mesic Mixed Hardwood Forest - OR - less than 200 clumps occurring in less than one acre of high quality forest or on land impacted by human disturbance such as logging, grazing, mowing, etc.

“E” Rank Specifications (extant)
An E-ranked population of *Hexastylis naniflora* is an occurrence that has recently been verified as still existing, but sufficient information for the factors used to estimate viability has not yet been obtained.

“H” Rank Specification (historical)
An H-ranked population of *Hexastylis naniflora* lacks recent field information verifying the continued existence of the occurrence. In the absence of known disturbance and with the habitat still extant, H is generally recommended for occurrences that have not been reconfirmed for approximately 30 or more years.

“F” Rank Specification (failed to find)
An F-ranked population of *Hexastylis naniflora* has not been found despite a search by an experienced observer at a time and under conditions appropriate for the Element at a location where it was previously reported, but the occurrence still might be confirmed to exist at that location with additional field survey efforts. For occurrences with vague locational information, the search must include areas of appropriate habitat within the range of locational uncertainty.

“X” Rank Specification (failed to find)
An X-ranked population of *Hexastylis naniflora* is considered destroyed based on adequate surveys by one or more experienced observers at times and under conditions appropriate for the species at the occurrence location, or other persuasive evidence indicates that the species no longer exists there or that the habitat has been destroyed to such an extent that it can no longer support the species.

“U” Rank Specification (failed to find)
A U-ranked population of *Hexastylis naniflora* cannot be assigned a rank due to lack of sufficient information on the occurrence or the species identification has not been confirmed.

Rank Specifications Justification
The unit of measurement for population size in this species is "clump" (rosette). EO size (as quantified by number of clumps or rosettes) is the primary rank factor. Condition of habitat (vegetation community and structure) and Landscape context (extent of suitable habitat and physical factors) are also incorporated secondarily. The species thrives most in undisturbed habitat. However, disturbed lands, that have been logged, grazed, mown, or converted to pasture, orchards, or tree plantations have been found to support remnant patches of *Hexastylis naniflora*. The extent to which this species can withstand disturbance is unknown. Populations in disturbed habitat are considered at risk, with relatively poor viability (C or D). Care should be taken when estimating population size, as population estimates have been found to vary widely from the number counted in population censuses. Specifications are based on largest known populations and expert opinion (including James Padgett, Carolyn Wells, Misty Buchanan (formerly Franklin), and Brenda Wichmann).

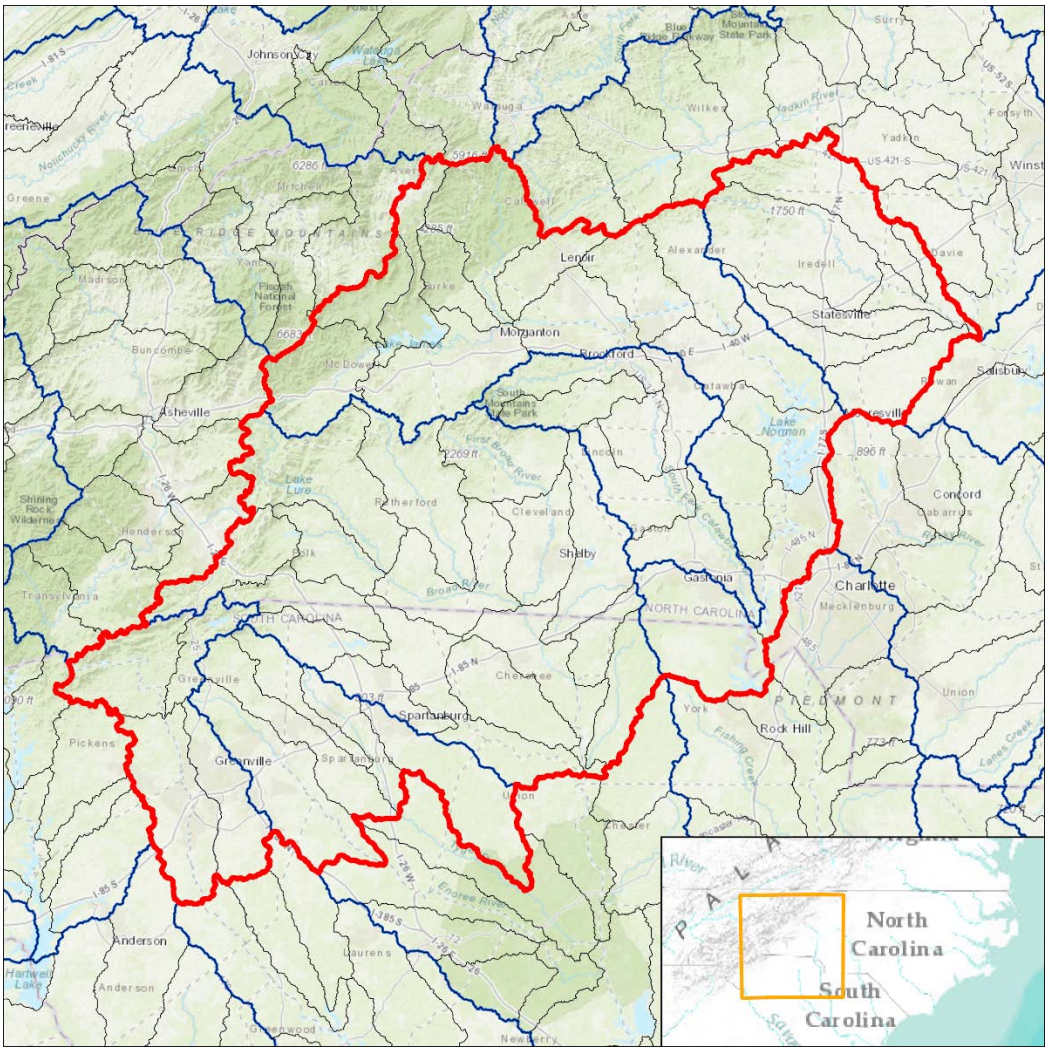
Appendix 3

Maxent Model Methodology

Study Extent, Coordinate System, and Cell Size

Fifty three 10-digit hydrologic units (HUC) comprise the analysis extent (Figure 1). In North Carolina it includes all 10-digit HUC that fall within the boundaries of 8-digit HUC with known occurrence of Hexastylis. In South Carolina we also included all 10-digit HUC that fell within the boundaries of 8-digit HUC with known occurrence of Hexastylis, but excluded the southern portions of the HUC-8 areas due to the boundaries being exceedingly large and far away from any known occurrences.

Figure 1. Analysis extent. Red line indicates Maxent analysis extent, blue lines are 8-digit HUC boundaries, black lines are 10-digit HUC boundaries. The orange line in the inset map indicates where the analysis extent is situated in North and South Carolina



Coordinate System: USA Contiguous Albers Equal Area Conic USGS version

Cell Size: 30 x 30 meters derived from the USGS National GAP Landcover

Source Element Occurrence Data

Hexastylis naniflora element occurrence data was obtained from the North and South Carolina Natural Heritage Programs. These data were in polygon format and digitized at scale that accurately identified the boundaries of the individual population areas. Current populations of Hexastylis naniflora were identified by reviewing the last observed data in the database and excluding all populations that have not been observed in the last 10 years (2007). To represent these current population areas in Maxent, a raster cell center was retained for every 30 x 30 meter pixel that was situated within the current element occurrence data polygons.

Source Datasets Used:

USGS National GAP Landcover - The GAP National Terrestrial Ecosystems – Ver 3.0 is a 2011 update of the National Gap Analysis Program Land Cover Data – Version 2.2 for the conterminous U.S. The GAP National Terrestrial Ecosystems – Version 3.0 represents a highly thematically detailed land cover map of the U.S at a 30 x 30 meter pixel resolution. The map legend includes types described by NatureServe's Ecological Systems Classification (Comer et al. 2002) as well as land use classes described in the National Land Cover Dataset 2011 (Homer et al. 2015). These data cover the entire continental U.S. and are a continuous data layer. The land cover map identifies 49 different land cover types within the range of Hexastylis Naniflora.

LandFire - Landscape Fire and Resource Management Planning Tools, is a shared program between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior, providing landscape scale geo-spatial products to support cross-boundary planning, management, and operations.

SSURGO Soils - The SSURGO database contains information about soil as collected by the National Cooperative Soil Survey over the course of a century. The information was gathered by walking over the land and observing the soil. Many soil samples were analyzed in laboratories. The maps outline areas called map units. The map units describe soils and other components that have unique properties, interpretations, and productivity. The information was collected at scales ranging from 1:12,000 to 1:63,360.

National Elevation Dataset - The NED is a seamless dataset with the best available raster elevation data of the conterminous United States, Alaska, Hawaii, and territorial islands. The NED is derived from diverse source data that are processed to a common coordinate system and unit of vertical measure. NED data are available nationally (except for Alaska) at resolutions of 1 arc-second (about 30 meters) and 1/3 arc-second (about 10 meters), and in limited areas at 1/9 arc-second (about 3 meters). The 1/3 arc-second database was used for HENA modelling purposes.

PRISM Climate Data - The PRISM Climate Group gathers climate observations from a wide range of monitoring networks, applies sophisticated quality control measures, and develops spatial climate datasets to reveal short- and long-term climate patterns. The resulting datasets incorporate a variety of modeling techniques and are available at multiple spatial/temporal resolutions, covering the period from 1895 to the present.

Model Variables Created:

Landcover – Landcover represented by the default landcover classification (Table 1).

Landcover Hexastylis Grouping – Landcover represented by a grouping of landcover types. For the purposes of discussing Hexastylis naniflora habitat, many of the default landcover classifications are similar and could be grouped together. The definition of each landcover classification was reviewed and categorized using a much broader habitat definition (Table 1).

Table 1. Landcover classification

Default Landcover Classification	Hexastylis Grouping
Southern Piedmont Glade and Barrens	Barren
Southern Ridge and Valley / Cumberland Dry Calcareous Forest	Barren
Undifferentiated Barren Land	Barren
Cultivated Cropland	Disturbed
Deciduous Plantations	Disturbed
Developed, High Intensity	Disturbed
Developed, Low Intensity	Disturbed
Developed, Medium Intensity	Disturbed
Developed, Open Space	Disturbed
Disturbed/Successional - Grass/Forb Regeneration	Disturbed
Disturbed/Successional - Shrub Regeneration	Disturbed
Evergreen Plantation or Managed Pine	Disturbed
Harvested Forest - Grass/Forb Regeneration	Disturbed
Harvested Forest-Shrub Regeneration	Disturbed
Introduced Upland Vegetation - Annual Grassland	Disturbed
Introduced Upland Vegetation - Shrub	Disturbed
Introduced Upland Vegetation - Treed	Disturbed
Pasture/Hay	Disturbed
Quarries, Mines, Gravel Pits and Oil Wells	Disturbed
Ruderal forest	Disturbed
Southern Appalachian Low Mountain Pine Forest	Evergreen
Southern Appalachian Montane Pine Forest and Woodland	Evergreen
Southern and Central Appalachian Cove Forest	Hardwood
Southern and Central Appalachian Oak Forest	Hardwood
Southern and Central Appalachian Oak Forest - Xeric	Hardwood
Southern Piedmont Mesic Forest	Hardwood

Central and Southern Appalachian Montane Oak Forest	High Elevation
Central and Southern Appalachian Northern Hardwood Forest	High Elevation
Central and Southern Appalachian Spruce-Fir Forest	High Elevation
Southern Appalachian Grass and Shrub Bald	High Elevation
Southern Appalachian Grass and Shrub Bald - Shrub Modifier	High Elevation
Appalachian Hemlock-Hardwood Forest	Mixed
Southern Piedmont Dry Oak-(Pine) Forest - Hardwood Modifier	Mixed
Southern Piedmont Dry Oak-(Pine) Forest - Loblolly Pine Modifier	Mixed
Southern Piedmont Dry Oak-(Pine) Forest - Mixed Modifier	Mixed
Southern Ridge and Valley Dry Calcareous Forest	Mixed
Southern Ridge and Valley Dry Calcareous Forest - Pine modifier	Mixed
Open Water (Fresh)	Open Water/Wetland
Southern and Central Appalachian Bog and Fen	Open Water/Wetland
Southern Piedmont/Ridge and Valley Upland Depression Swamp	Open Water/Wetland
Southern Appalachian Granitic Dome	Outcrop
Southern Appalachian Montane Cliff	Outcrop
Southern Appalachian Rocky Summit	Outcrop
Southern Piedmont Cliff	Outcrop
Southern Piedmont Granite Flatrock	Outcrop
South-Central Interior Large Floodplain - Forest Modifier	Riparian
South-Central Interior Small Stream and Riparian	Riparian
Southern Piedmont Large Floodplain Forest - Forest Modifier	Riparian
Southern Piedmont Small Floodplain and Riparian Forest	Riparian

Landcover Diversity – Identifies the number of landcover classes (default classification) within a 10-cell radius (300 meters) of an individual pixel.

Landcover Majority – Identifies the dominant landcover class (default classification) within a 10-cell radius (300 meters) of an individual pixel.

Landfire Canopy Height – Represents the vertically projected percent cover of the live vegetation canopy.

Landfire Canopy Cover – Represents the average height of the dominant vegetation across the landscape.

SSURGO mukey – SSURGO soils dataset represented by the Map Unit Key (mukey)

SSURGO Drainage Class – SSURGO soils dataset represented by wettest drainage class. Drainage class refers to the frequency and duration of wet periods in conditions similar to those under which the soil formed.

SSURGO Hydrologic Group – SSURGO soils dataset represented by hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

Elevation – National elevation dataset elevation values. This 10-meter dataset was reclassified to 30-meters.

Aspect 9-class – Using the national elevation dataset, the aspect was derived and categorized into the following classes: Flat, North, Northeast, East, Southeast, South, Southwest, West, and Northwest.

Aspect 5-class – Using the national elevation dataset, the aspect was derived and categorized into the following classes: Flat, North, East, South, and West.

Slope – The national elevation dataset represented by degree of slope.

Geomorphons – A pattern recognition analysis that converts a digital elevation dataset into 10 common landform elements: flat, peak, ridge, shoulder, spur, slope, pit, valley, footslope, and hollow. The national elevation dataset was used as the source elevation for the analysis.

Solar Radiation – An analysis of the amount of solar radiation (radiant energy) reaching the earth's surface using the national elevation dataset as the elevation model. The output solar model is reported in watt hours per square meter (WH/m^2)

Average Annual Precipitation – Climate dataset of average annual precipitation according to a model using point precipitation and elevation data for the 30-year period of 1971-2000.

Maximum Average Annual Temperature – Climate dataset of average annual maximum temperature according to a model using point temperature data for the 30-year period of 1981-2010.

Minimum Average Annual Temperature – Climate dataset of average annual minimum temperature according to a model using point temperature data for the 30-year period of 1981-2010.

Maxent Model Development

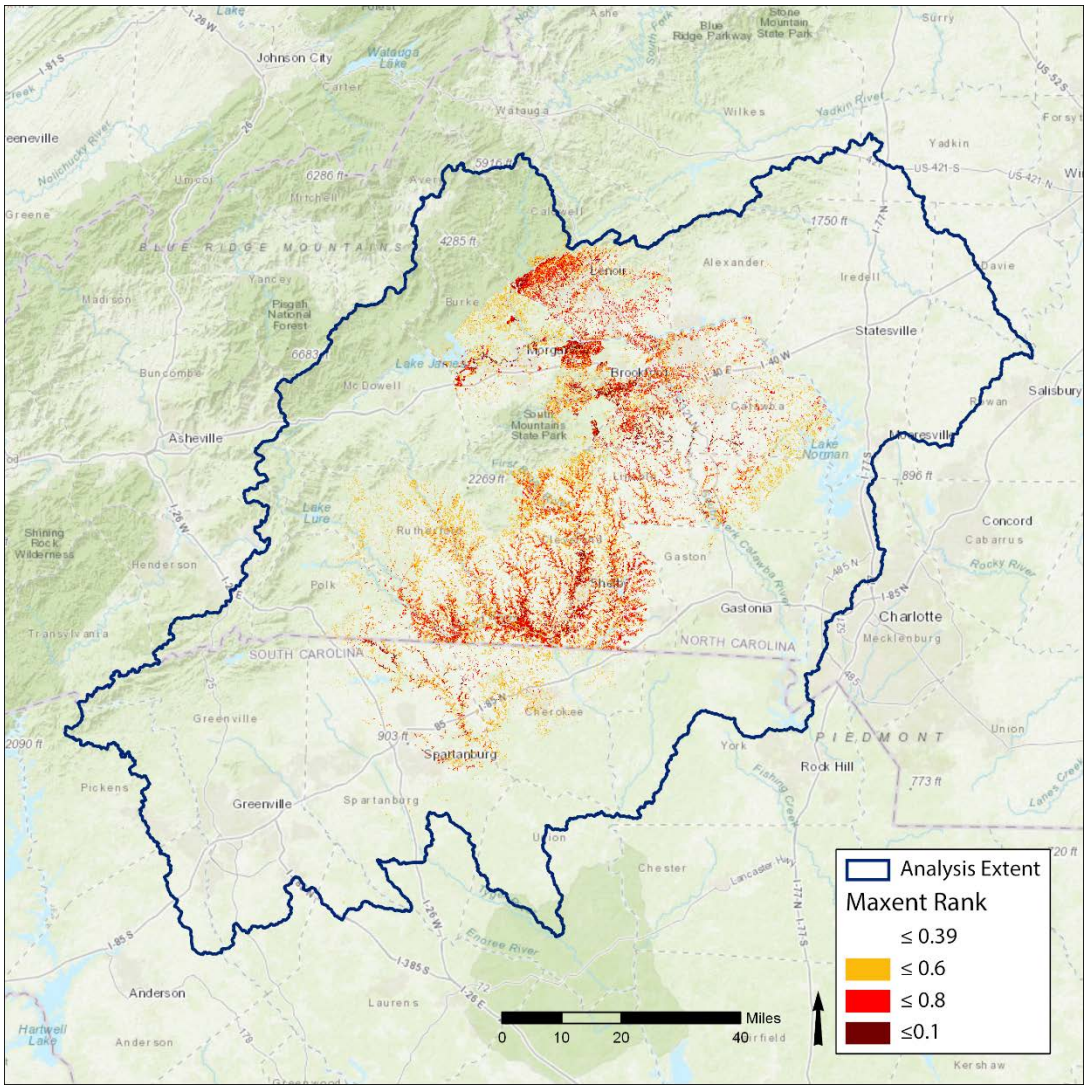
Maxent software for species habitat modeling (version 3.4.1) was used (Philips et al., 2018).

An initial single model Maxent run was done to determine which variables could be excluded due to limited percent contribution to the model. Any variable that contributed less than 1% to the single model run results was excluded in the final model. The following variables were excluded:

landcover diversity, canopy height, SSURGO drainage class, SSURGO hydrologic group, aspect 9-class, aspect 5-class, slope, solar radiation, and maximum annual temperature.

For the final model a 10-run replicate Maxent model was created using crossvalidation. For replicate models, the occurrence data is randomly split into a number of equal-sized groups called "folds", and separate models are created leaving out each fold in turn. The individual model runs are then averaged together to derive the final model. Cloglog output format was used. Cloglog output gives an estimate between 0 and 1 of probability of presence assuming an appropriate sampling design.

Figure 2. Maxent model output map.



Results

Figure 2 shows the model output. The minimum cutoff value (to determine if an area is considered potential habitat for a species) of 0.39 was determined by using the average 10th percentile training presence. The 10th percentile training presence uses the suitability threshold associated with the presence record that occurs at the 10th percentile of presence records (Phillips 2018). This value excludes some of the outlier population areas in the Maxent predictions to focus on the typical habitat conditions for this species. The total area ranked greater than 0.39 in the Maxent model was just 6.0% of the total analysis area (Table 1).

Table 1. Area estimates of the Maxent model

Maxent Score	Acres	Square Miles	Percent of Total
0.406 and greater	302,834.13	473.18	6.02%
0.6 and greater	128,273.52	200.43	2.55%
0.8 and greater	22,115.97	34.56	0.44%

The average area-under-curve (AUC) score for the replicate Maxent model is 0.86. The AUC is calculated from the receiver operating characteristic (ROC) plot. This value has a range of 0 – 1 and may be interpreted as a single test statistic that assesses model performance, indicating the ability of the model to correctly classify the occurrence data used. AUC values close to 0.50 indicate a model fit no better than random, values less than 0.5 indicate a model fit worse than random, a value of 1.0 indicate a perfect fit (Baldwin 2009). A value of 0.86 is a good fitting model.

The Maxent output supplies estimates of the relative contributions of the environmental variables to the Maxent model (Table 2.)

Table 2. Percent contribution of the environmental variables

Environmental Variable	Percent Contribution
SSURGO mukey	23.5%
Minimum Annual Temperature	17.8%
Average Annual Precipitation	15.7%
Landcover	12.9%
Landcover Majority	12.0%
Landcover Hexastylis Grouping	5.4%
Geomorphons	4.9%
Elevation	4.6%
Canopy Cover	3.2%

SSURGO mukey is the top contributing variable. 135 different individual soil types are present within the polygon boundaries of the Hexastylis element occurrences. Many of these individual soil types are part of soil complexes and are separated by things such as percent slope, erosion, how stony/rocky, and amount of clay. The most common individual soil type was Meadowfield-Rhodhiss complex, 25 to 60 percent slopes, very stony (14.1% of total). However, collectively the Meadowfield soils only comprised 14.3% of all soils). The individual Pacolet soil types were very common and collectively comprise 32.2% of all soil types present. Woolwine, Rion, and Fairview

soils were also collectively common, comprising 10.4%, 9.7%, and 8.8% of all soils present respectively.

The minimum annual average temperature range in the analysis extent is 39 – 51 degrees Fahrenheit. The majority of the Hexastylis element occurrences (89%) are found at the 47 and 48 degrees. The Average annual precipitation range in the analysis extent is 42 – 81 inches per year. The majority of the Hexastylis element occurrences (82%) are found in the 47 – 49 inches per year range.

Piedmont forested landcover habitats dominate the land area of the element occurrences. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier (53%), Southern Piedmont Mesic Forest (9%), Southern Piedmont Dry Oak-Pine Forest (5.2%), Southern Piedmont Small Floodplain and Riparian Forest (4.4%), and collectively comprise 71% of the element occurrences area. Unfortunately, non-native habitats are also present. Evergreen Plantation or Managed Pine (9%), Harvested Forest (7.2%), Developed, Open Space (5%), Pasture/Hay (2.1%) collectively comprise 22% of the total element occurrence area. The Remaining 6 percent of element occurrence area is comprised of a mix of 14 other natural and disturbed landcover classes, but each at small percentages.

The landcover majority classification scheme reduces the total number of landcover classes present in the analysis extent from 23 to 11. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier is still the dominant landcover class (58%). However disturbed categories are increased in area (sum total of 35%). Evergreen plantation or managed pine (12%) and Pasture/Hay (12%) are the only other categories that have at least 10% or greater area. The increase in disturbed landcover area representation in the landcover majority layer suggests that many Hexastylis population areas are situated in areas impacted by disturbed landcover. This is likely due to urban encroachment and increasing fragmentation of habitats.

The landcover Hexastylis grouping reveals the amount of disturbance present in Hexastylis population areas. Landcover classes grouped as disturbed comprises 27% of the total area. Mixed forest (deciduous and evergreen) comprises 58%, pasture/hay 12%, and hardwood forest 2%,

Geomorphons revealed that the majority of Hexastylis element occurrence areas are situated in concave landforms. Geomorphon categories hollow (13%), valley (46%), and depression (10%) collectively comprise 69% of all Hexastylis population areas. Flat landforms comprise 15.5% of the area and convex landforms the remaining 15.5%.

Within the analysis extent, the range of elevation present is 335 – 5,265 feet. For Hexastylis, the prime elevation range is from 666 – 908 feet (53% of total element occurrence area). A lesser elevation range is present from 935 – 1,184 (37% of total element occurrence area).

Canopy cover for the Hexastylis populations are dominated by Tree Cover 70-80% (20.2%) and Tree Cover 80-90% (63.9%). The rest of the canopy cover categories are 2% or less.

Citations

Baldwin, R.A. 2009. Use of maximum entropy modeling in wildlife research. Entropy. 11:854-866.

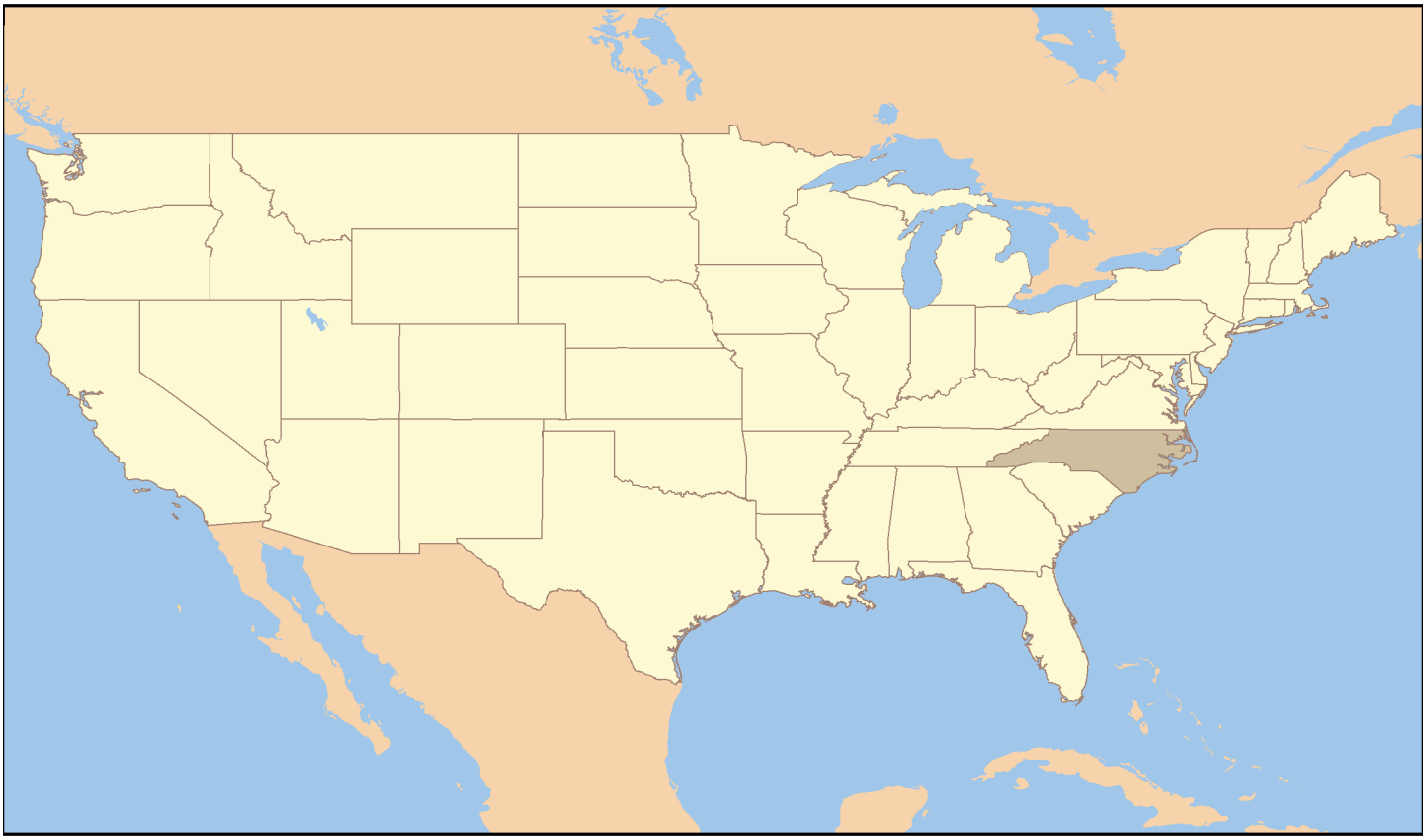
Phillips, S. J. 2018. A Brief Tutorial on Maxent. Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-02/21.

Steven J. Phillips, Miroslav Dudík, Robert E. Schapire. [Internet] Maxent software for modeling species niches and distributions (Version 3.4.1). Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-2-20.

Appendix 4a

U.S. Geological Survey - National Climate Change Viewer

Summary of North Carolina



December 1, 2016

1 Maximum 2-m Air Temperature

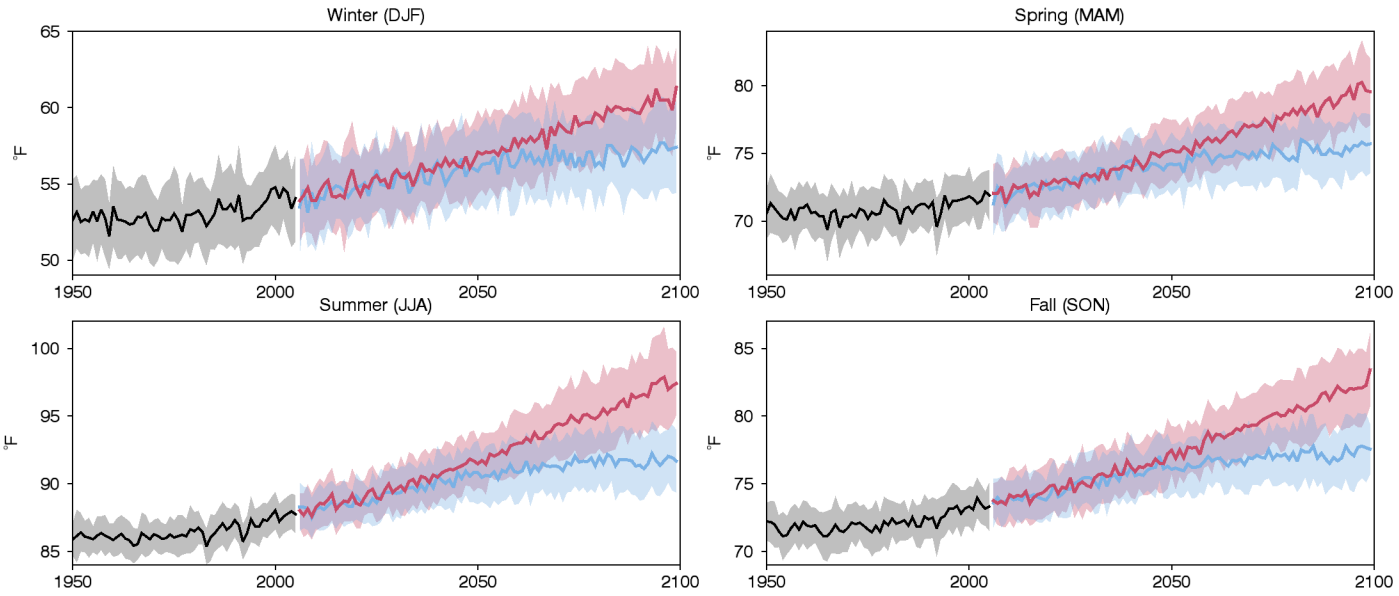


Figure 1: Seasonal average time series of maximum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

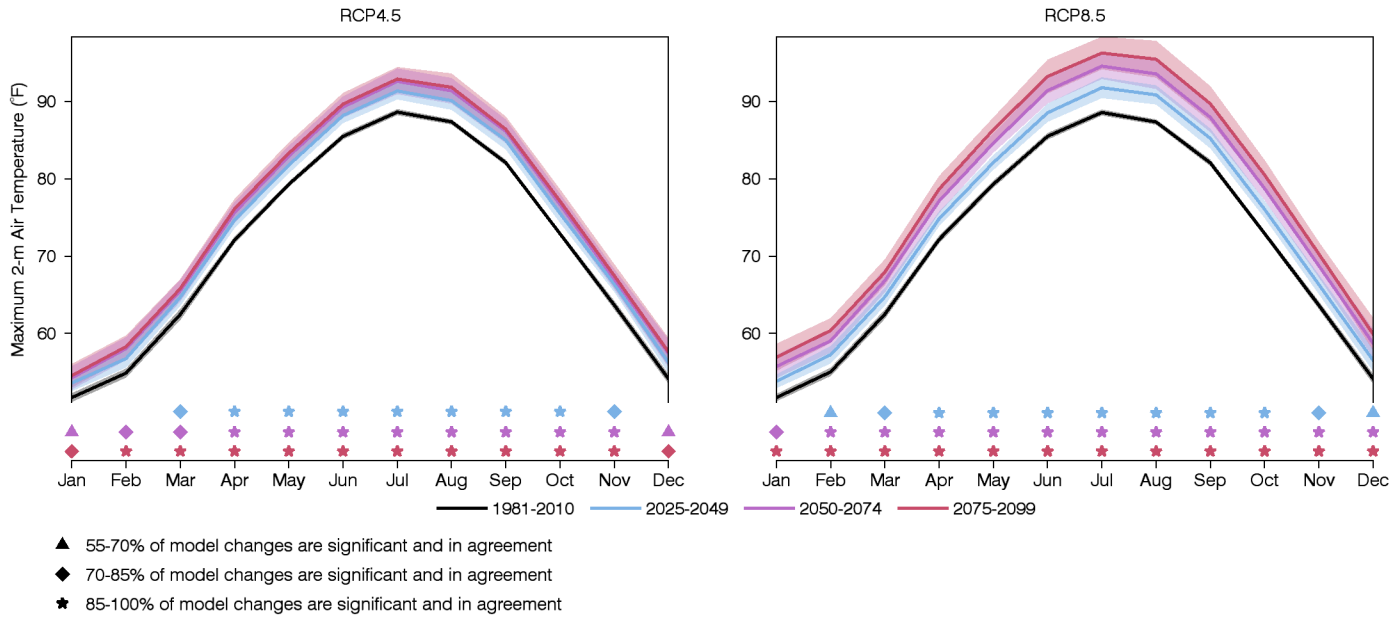


Figure 2: Monthly averages of maximum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

2 Minimum 2-m Air Temperature

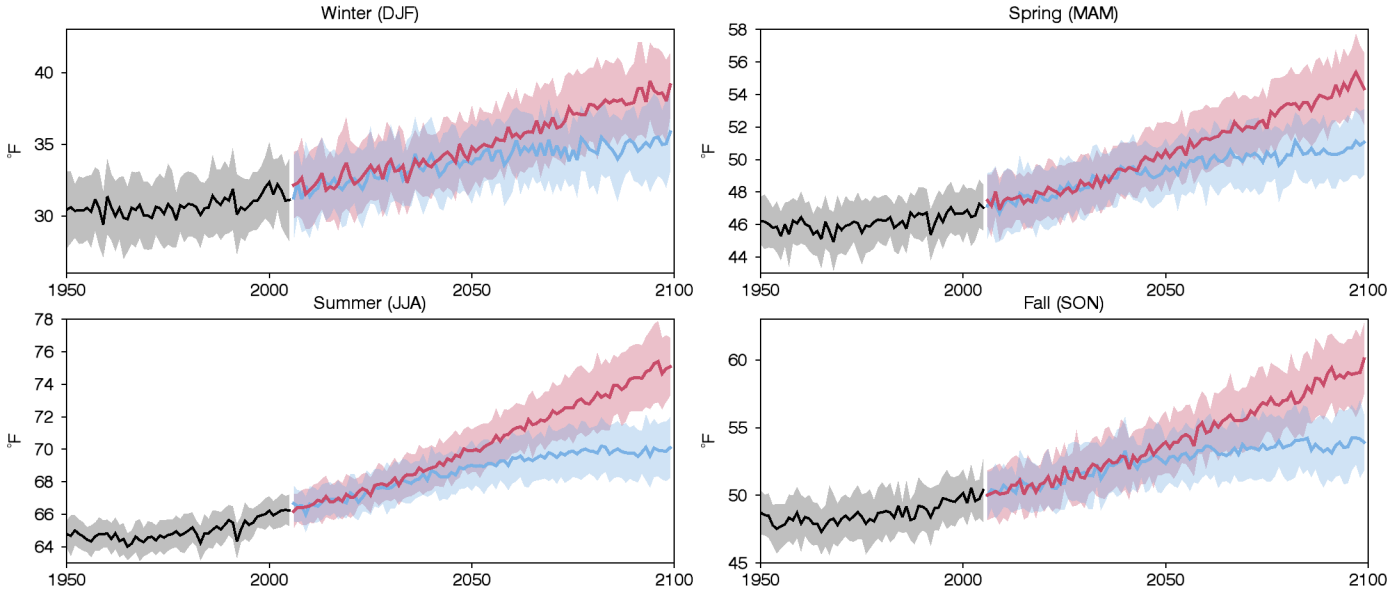


Figure 3: Seasonal average time series of minimum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

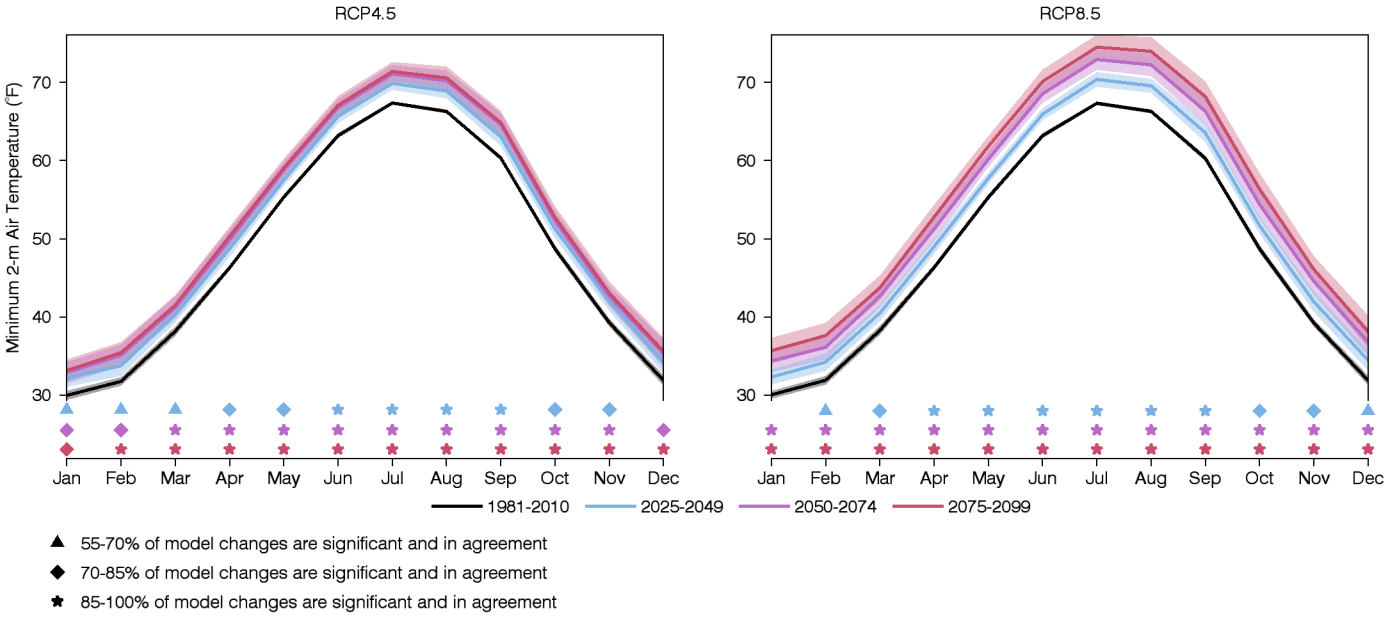


Figure 4: Monthly averages of minimum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

3 Precipitation

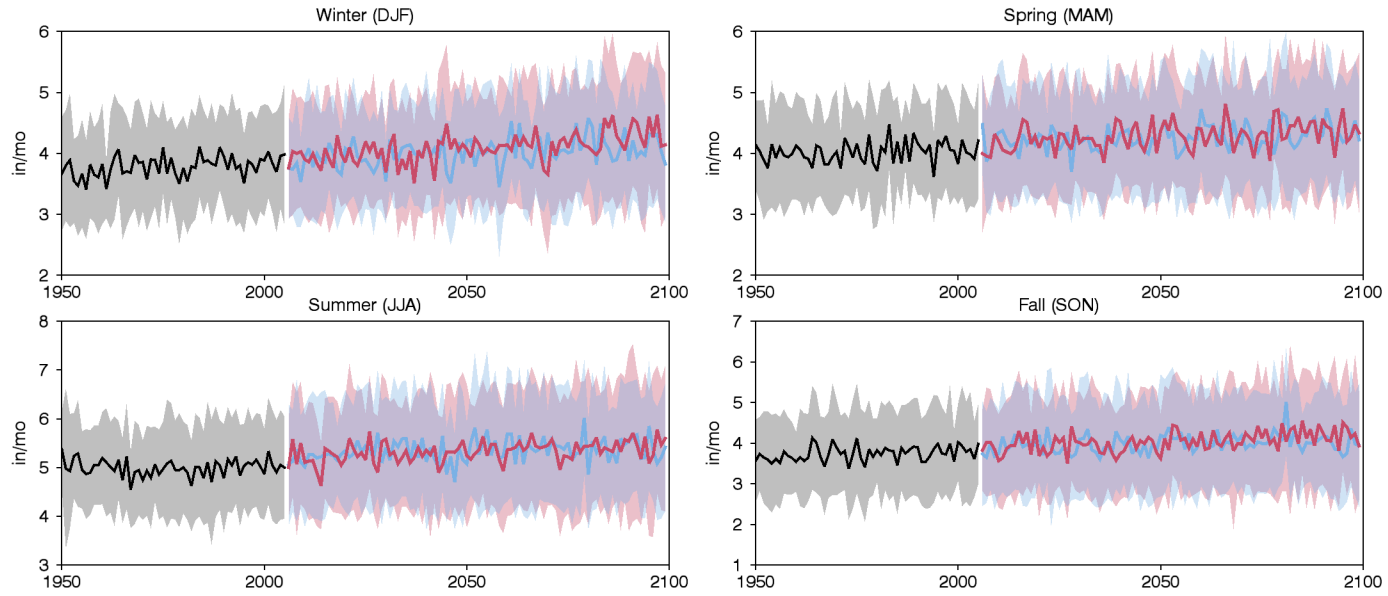


Figure 5: Seasonal average time series of precipitation for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

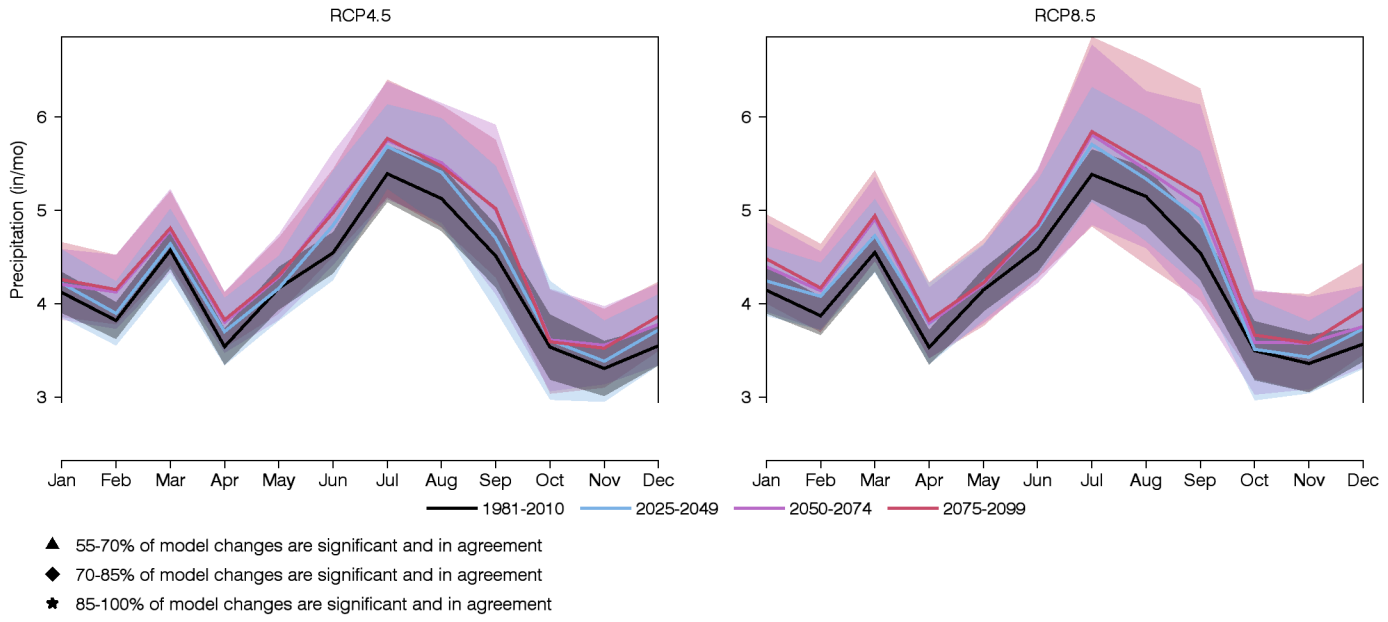


Figure 6: Monthly averages of precipitation for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

4 Snow Water Equivalent

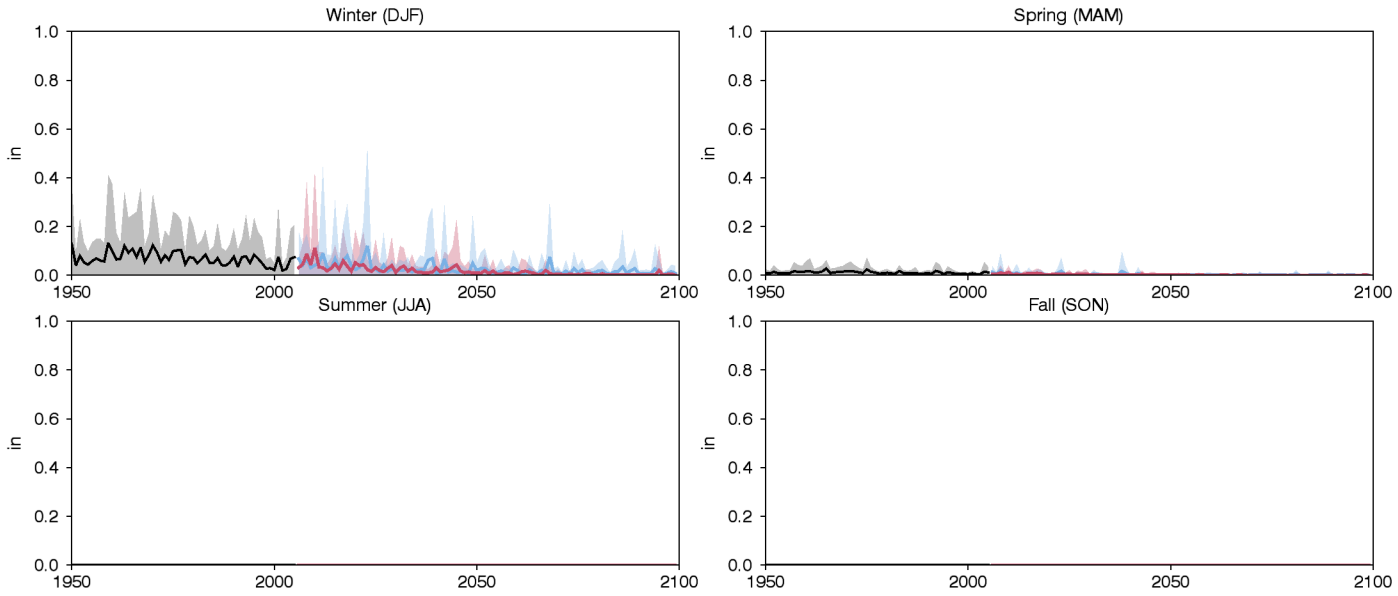


Figure 7: Seasonal average time series of snow water equivalent for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

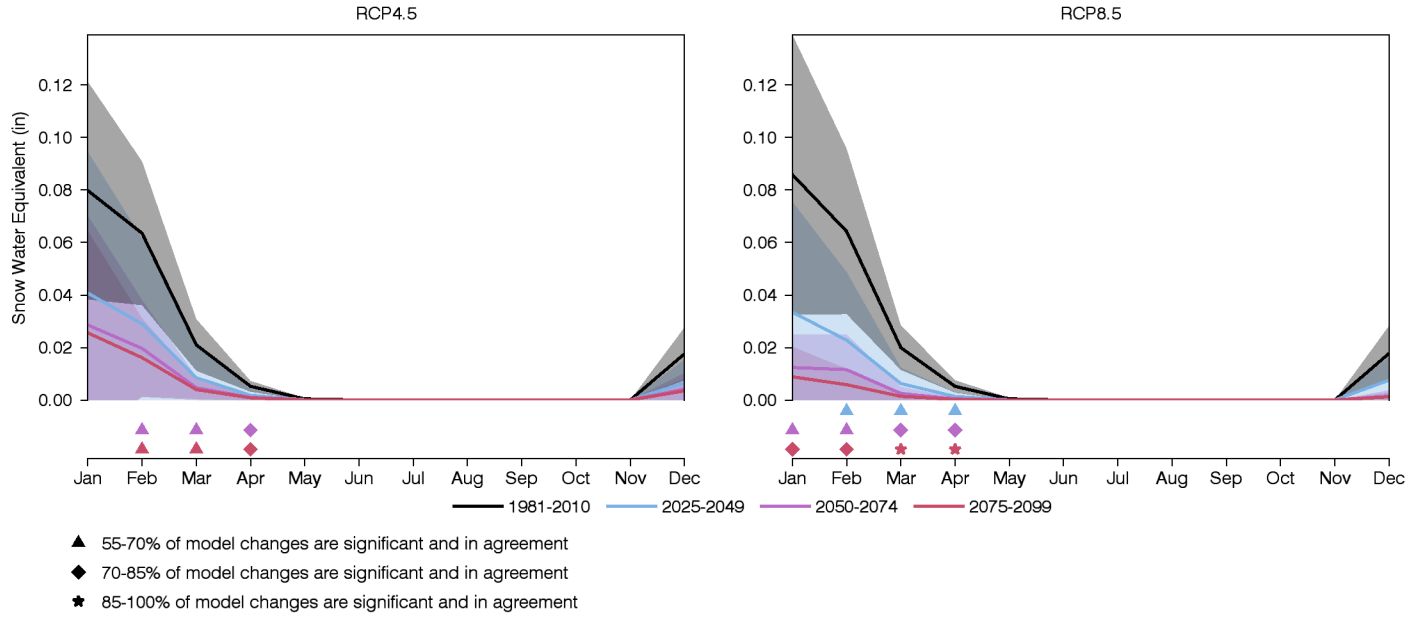


Figure 8: Monthly averages of snow water equivalent for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

5 Runoff

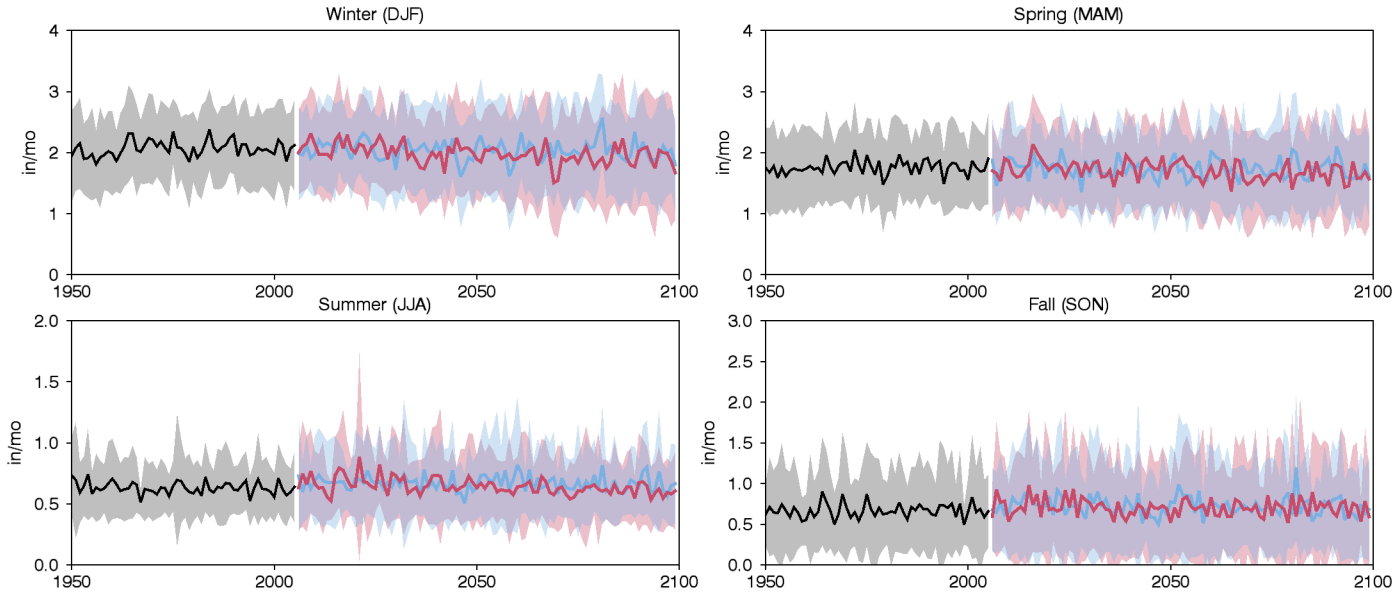


Figure 9: Seasonal average time series of runoff for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

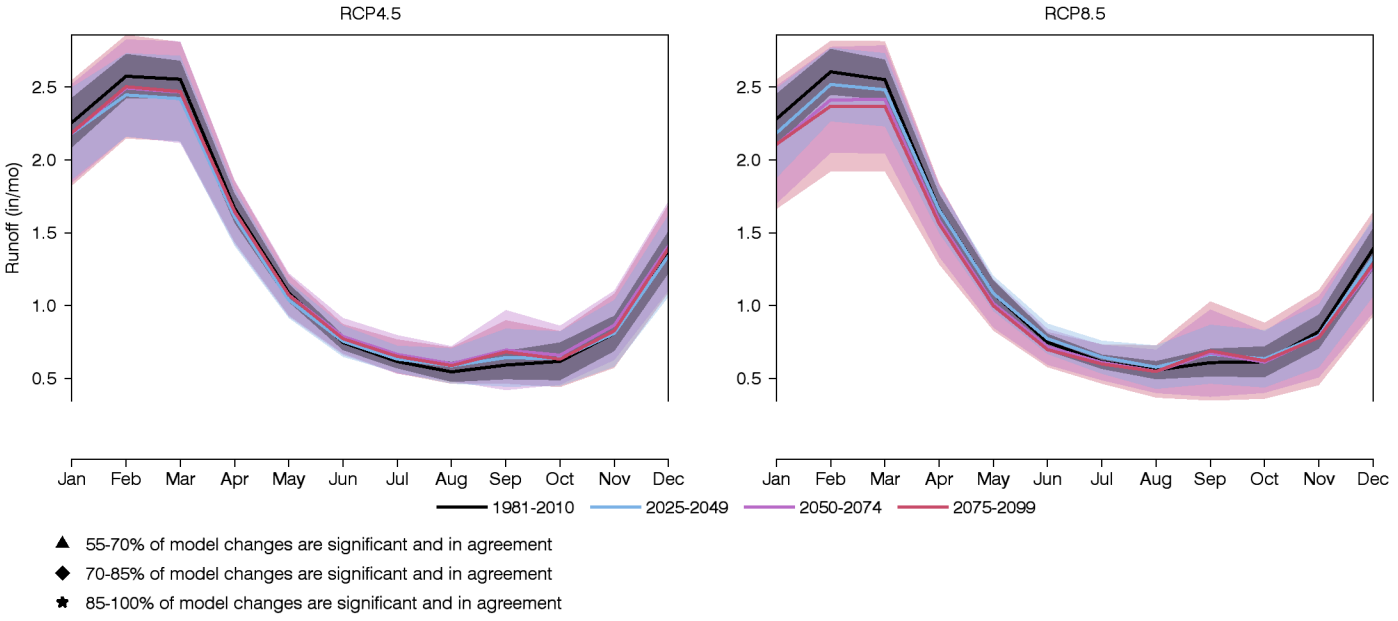


Figure 10: Monthly averages of runoff for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

6 Soil Water Storage

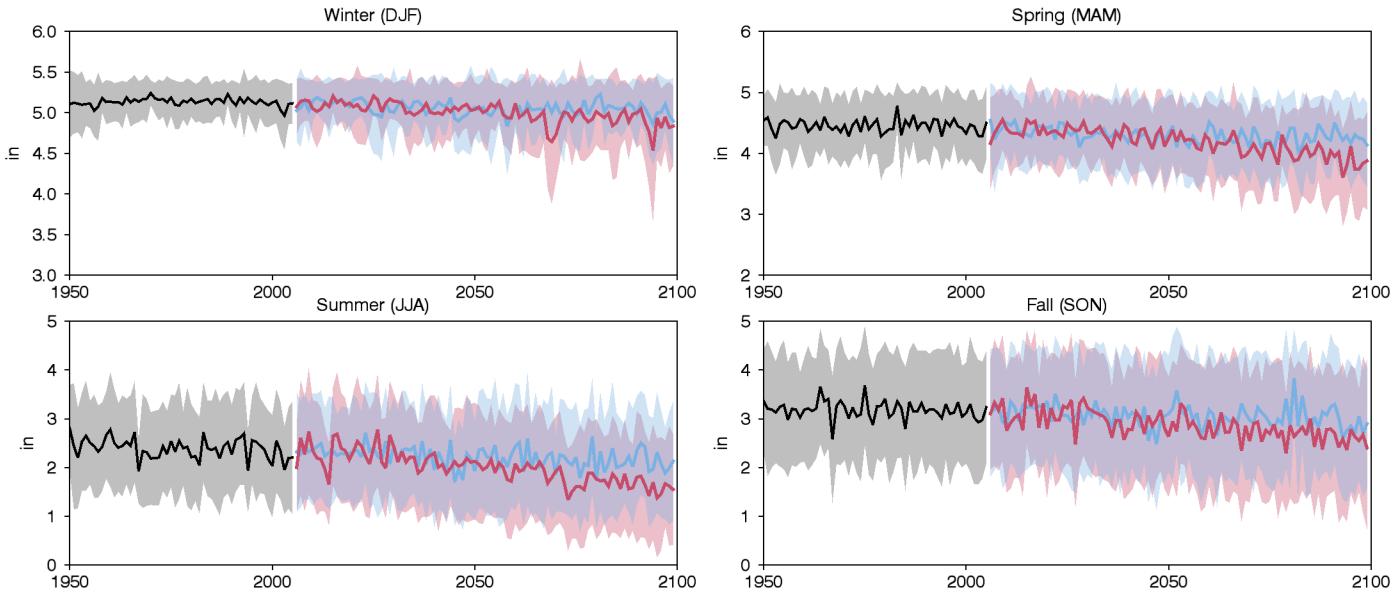


Figure 11: Seasonal average time series of soil water storage for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

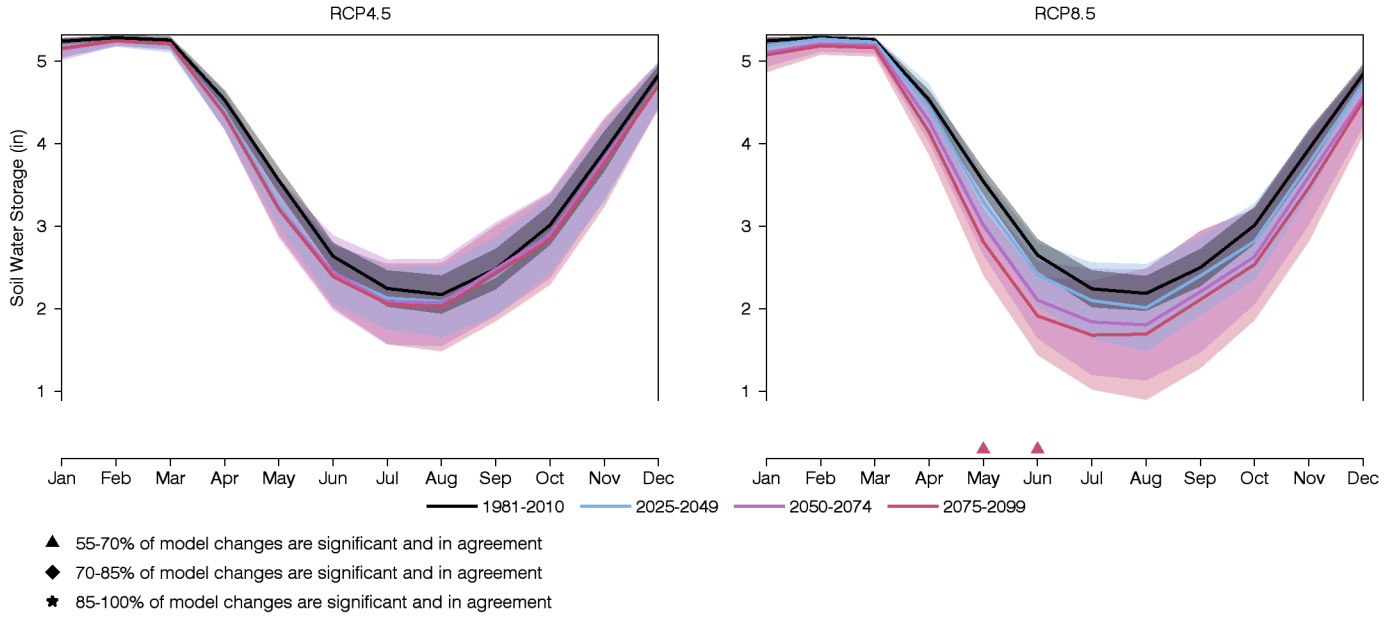


Figure 12: Monthly averages of soil water storage for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

7 Evaporative Deficit

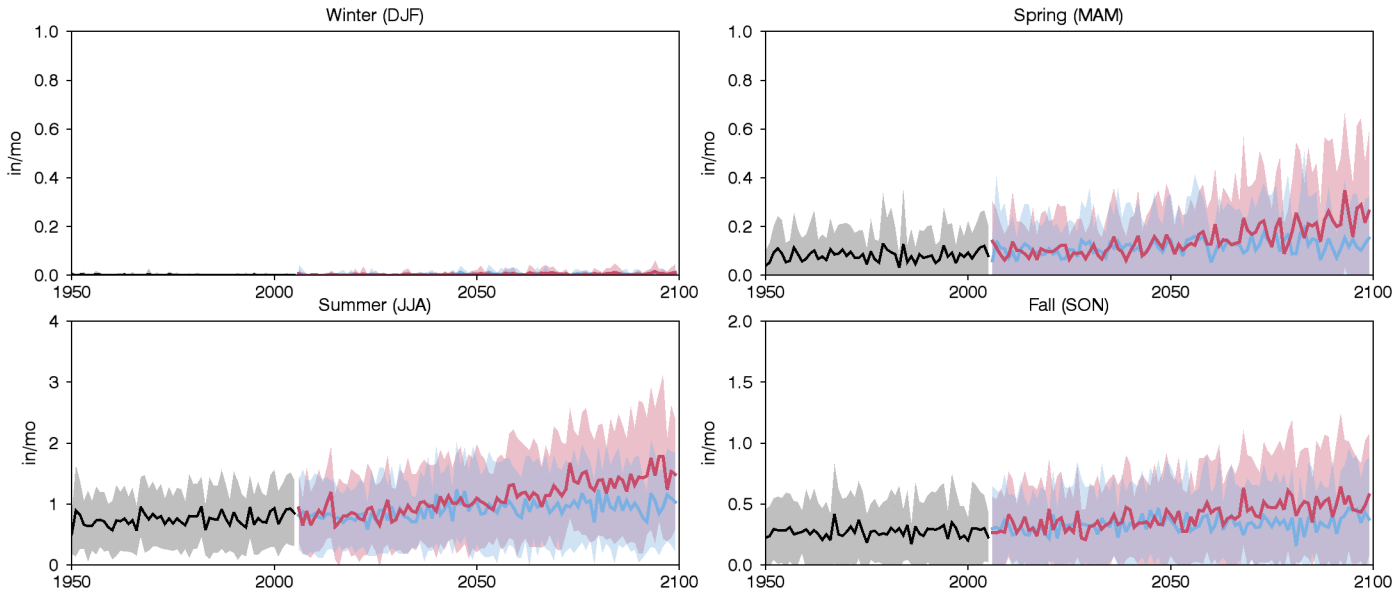


Figure 13: Seasonal average time series of evaporative deficit for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

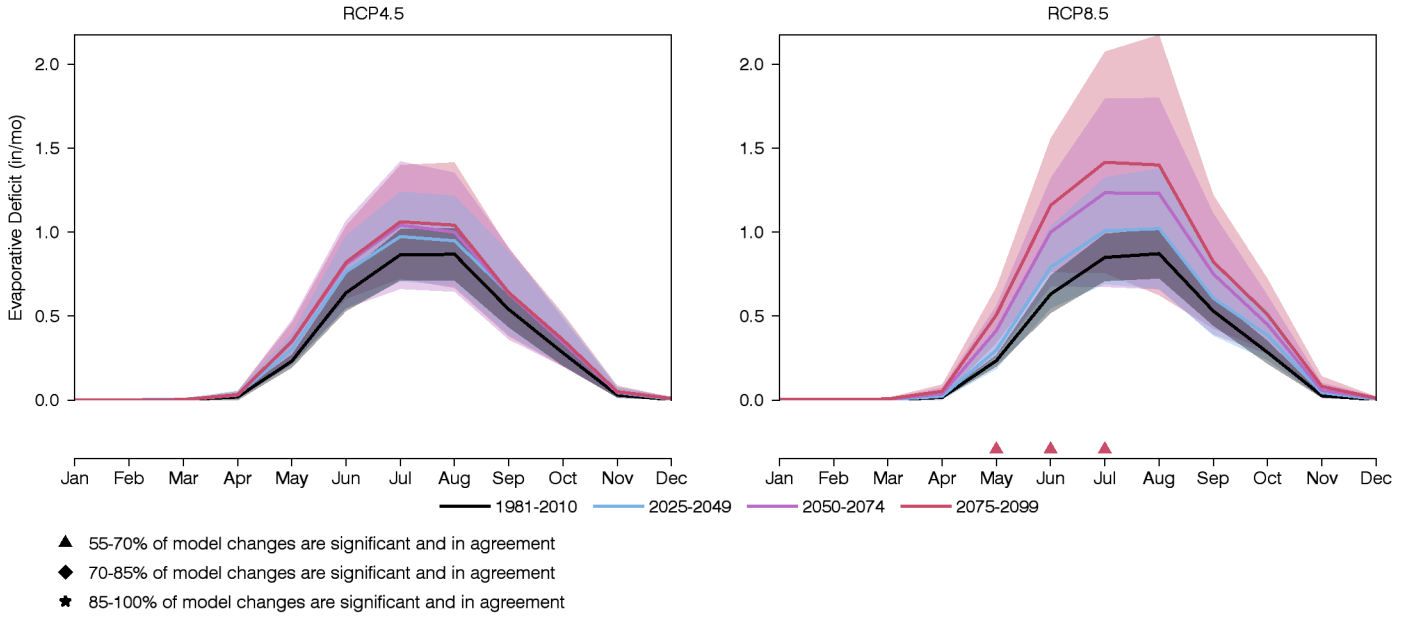


Figure 14: Monthly averages of evaporative deficit for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

8 Data

The temperature and precipitation summaries are created by spatially averaging the NASA NEX-DCP30 data set (Thrasher et al., 2013). The water-balance variables snow water equivalent, runoff, soil water storage and evaporative deficit are simulated by using the NEX-DCP30 temperature and precipitation as input to a simple model (McCabe and Wolock, 2007). The water-balance model accounts for the partitioning of water through the various components of the hydrologic system, but does not account for groundwater, diversions or regulation by impoundments.

9 Models

ACCESS1-0	bcc-csm1-1	bcc-csm1-1-m	BNU-ESM	CanESM2	CCSM4
CESM1-BGC	CMCC-CM	CNRM-CM5	CSIRO-Mk3-6-0	FGOALS-g2	FIO-ESM
GFDL-CM3	GFDL-ESM2G	GFDL-ESM2M	GISS-E2-R	HadGEM2-AO	HadGEM2-CC
HadGEM2-ES	inmcm4	IPSL-CM5A-LR	IPSL-CM5A-MR	IPSL-CM5B-LR	MIROC5
MIROC-ESM	MIROC-ESM-CHEM	MPI-ESM-LR	MPI-ESM-MR	MRI-CGCM3	NorESM1-M

10 Citation Information

Alder, J. R. and S. W. Hostetler, 2013. USGS National Climate Change Viewer. US Geological Survey `http://www.usgs.gov/climate_landuse/clu_rd/nccv.asp` doi:10.5066/F7W9575T.

Hostetler, S.W. and Alder, J.R., 2016. Implementation and evaluation of a monthly water balance model over the U.S. on an 800 m grid. Water Resources Research, 52, doi:10.1002/2016WR018665.

Thrasher, B., J. Xiong, W. Wang, F. Melton, A. Michaelis, and R. Nemani, 2013. New downscaled climate projections suitable for resource management in the U.S. Eos, Transactions American Geophysical Union 94, 321-323, doi:10.1002/2013EO370002.

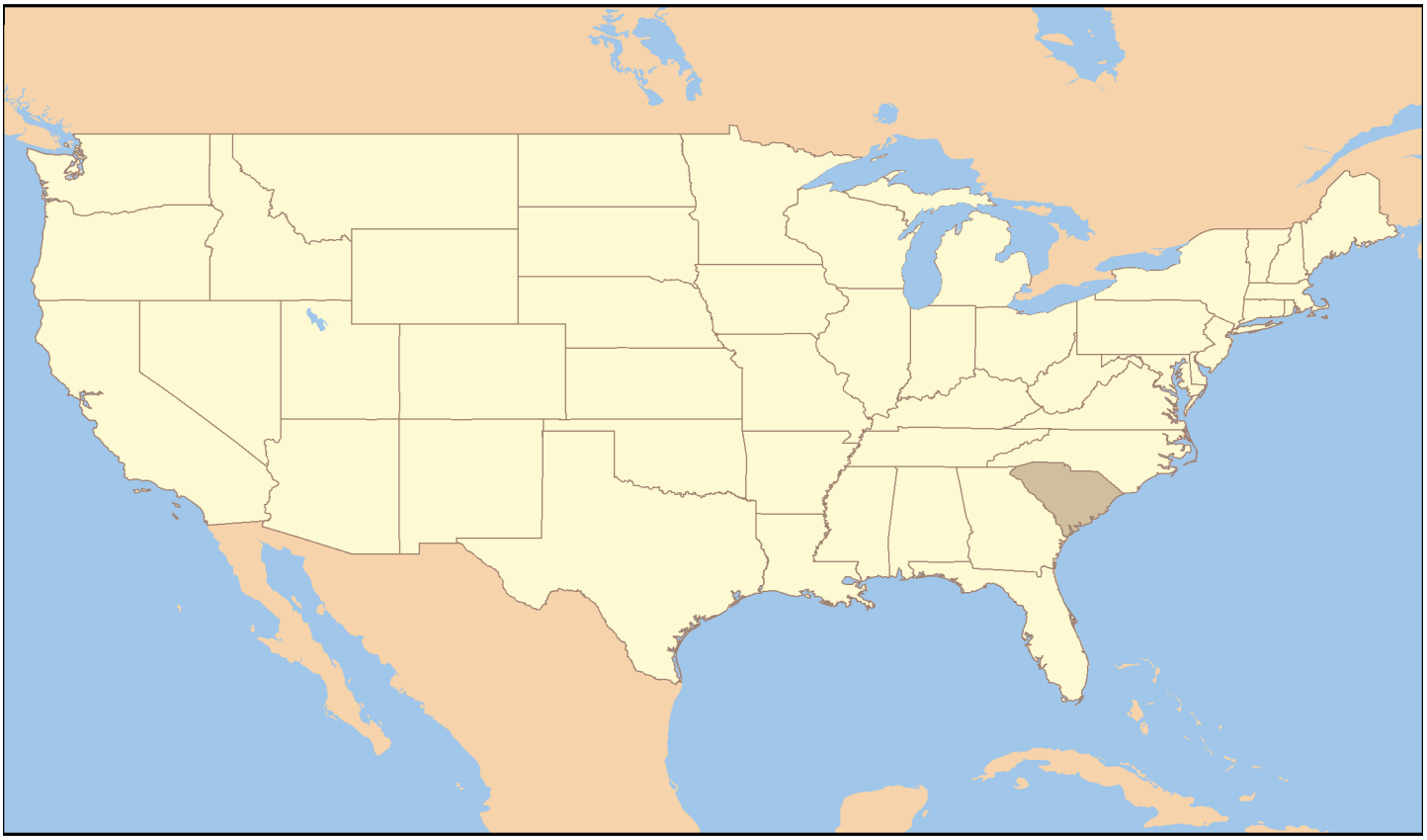
11 Disclaimer

These freely available, derived data sets were produced by J. Alder and S. Hostetler, US Geological Survey (USGS). The original climate data are from the NEX-DCP30 dataset, which was prepared by the Climate Analytics Group and NASA Ames Research Center using the NASA Earth Exchange, and is distributed by the NASA Center for Climate Simulation. No warranty expressed or implied is made by the USGS regarding the display or utility of the derived data on any other system, or for general or scientific purposes, nor shall the act of distribution constitute any such warranty. The USGS shall not be held liable for improper or incorrect use of the data described and/or contained herein.

Appendix 4b

U.S. Geological Survey - National Climate Change Viewer

Summary of South Carolina



December 1, 2016

1 Maximum 2-m Air Temperature

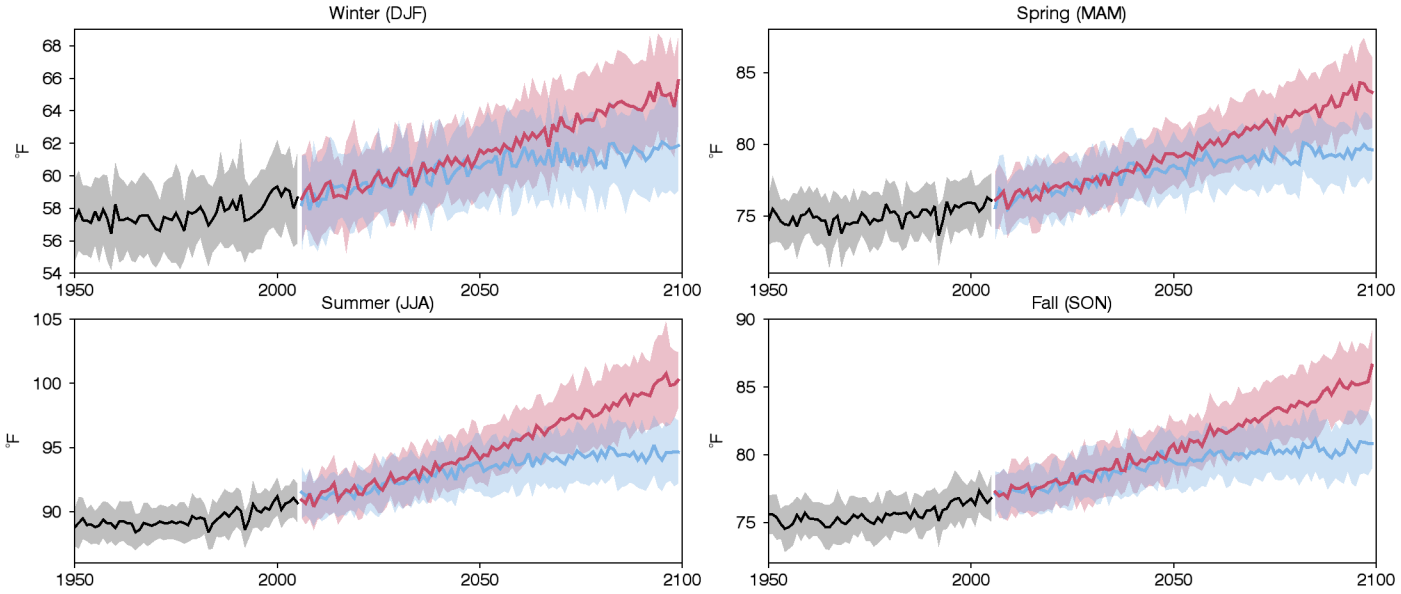


Figure 1: Seasonal average time series of maximum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

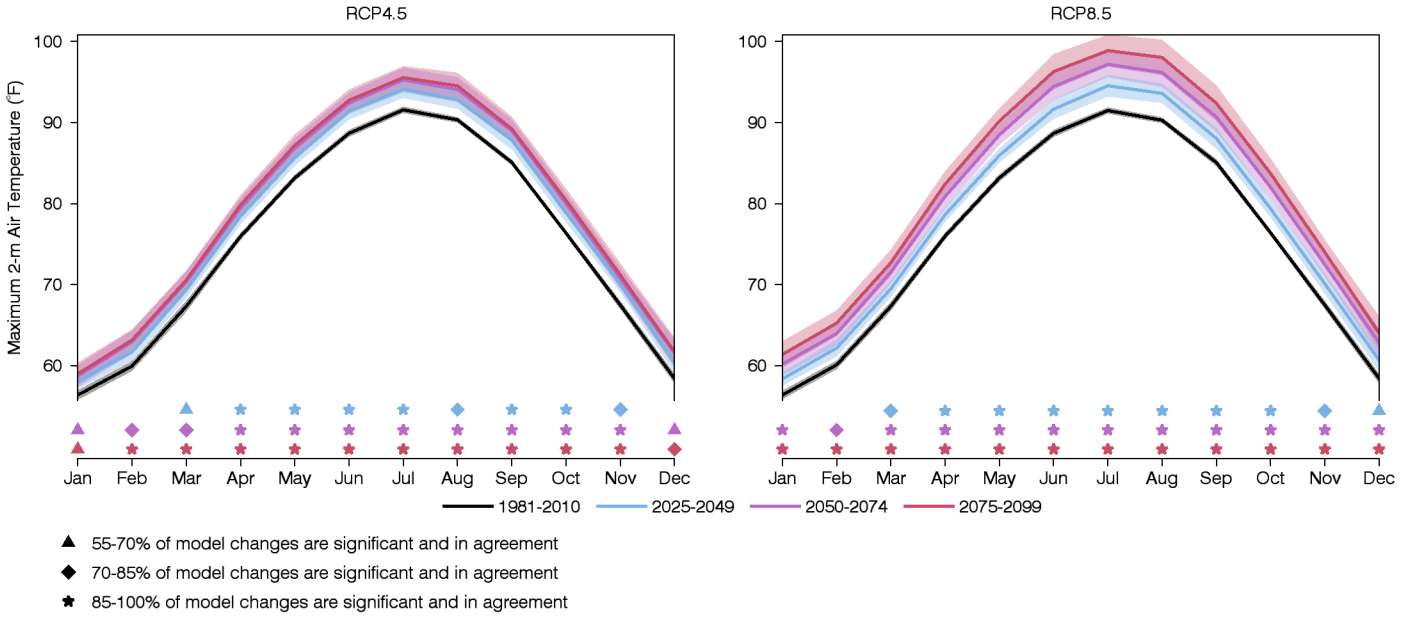


Figure 2: Monthly averages of maximum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

2 Minimum 2-m Air Temperature

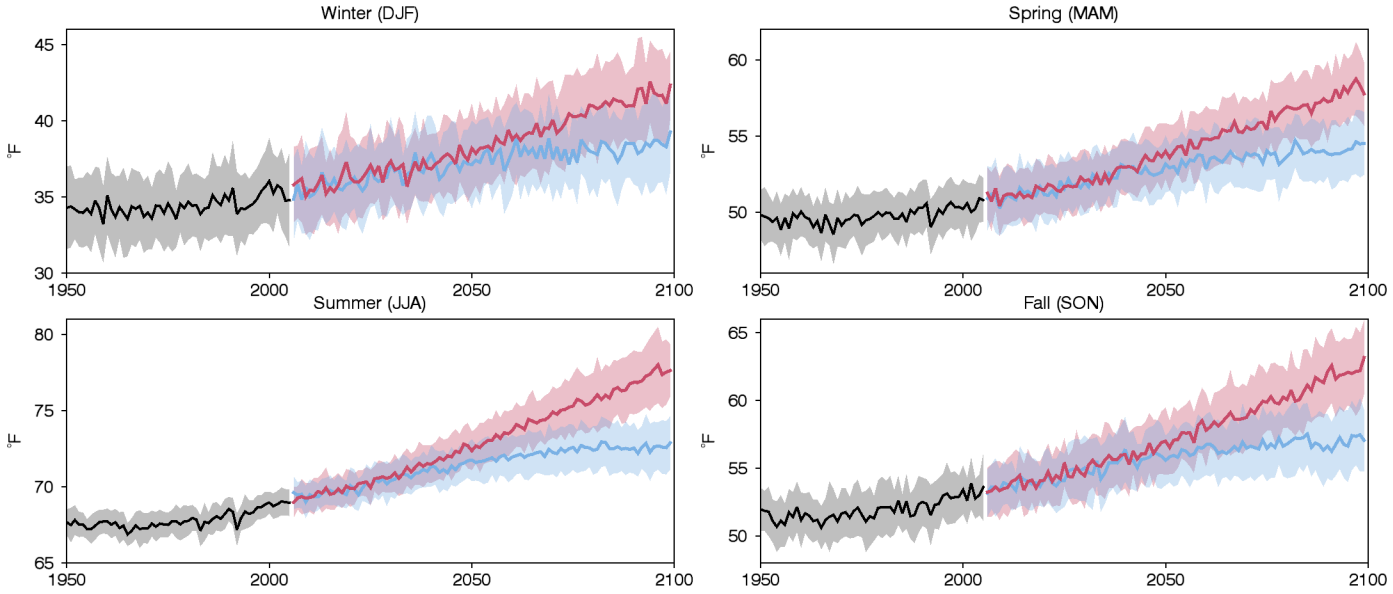


Figure 3: Seasonal average time series of minimum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

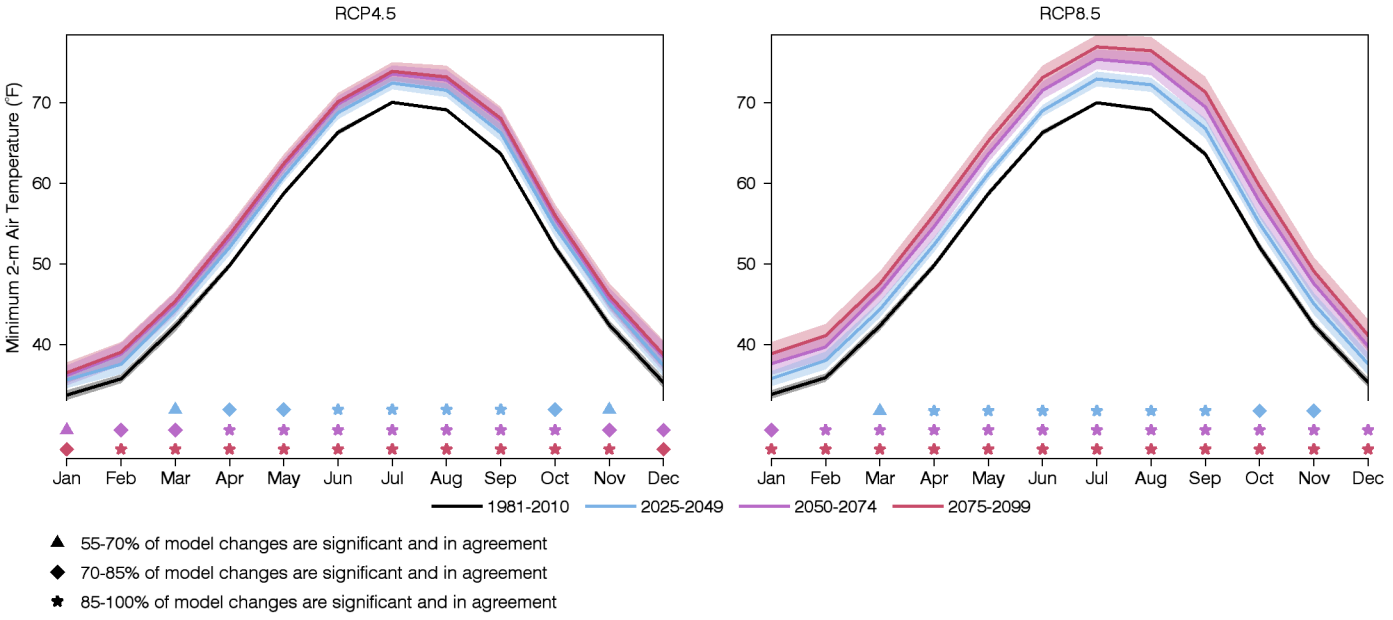


Figure 4: Monthly averages of minimum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

3 Precipitation

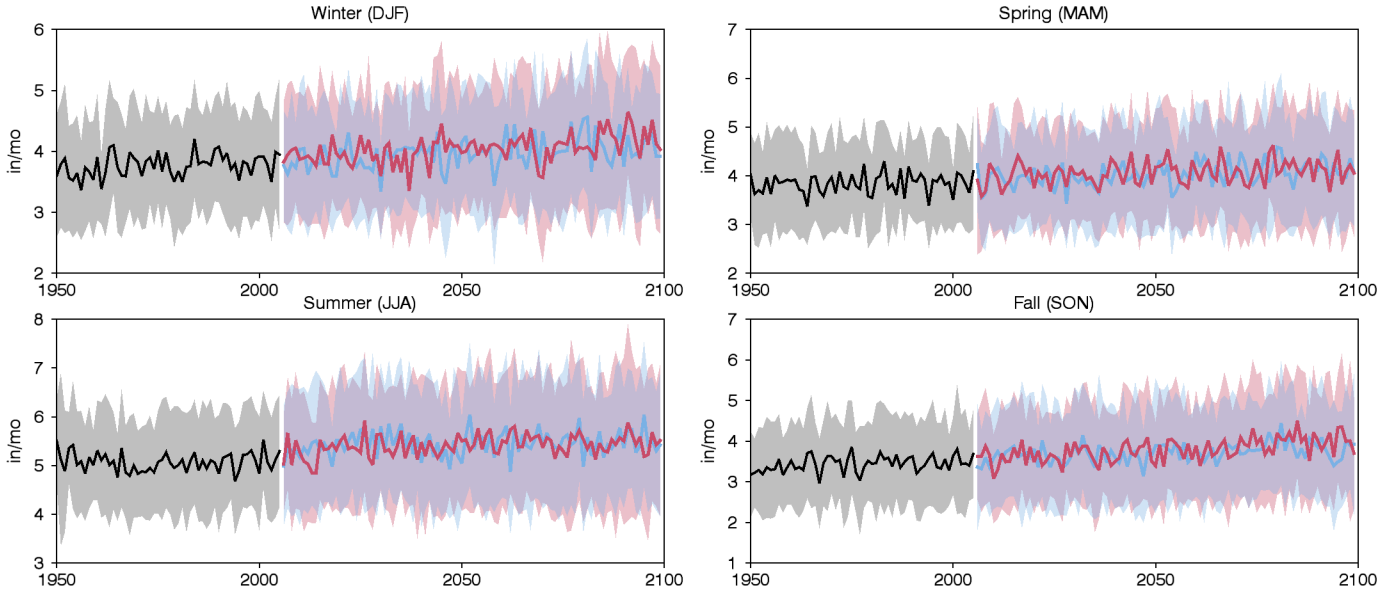


Figure 5: Seasonal average time series of precipitation for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

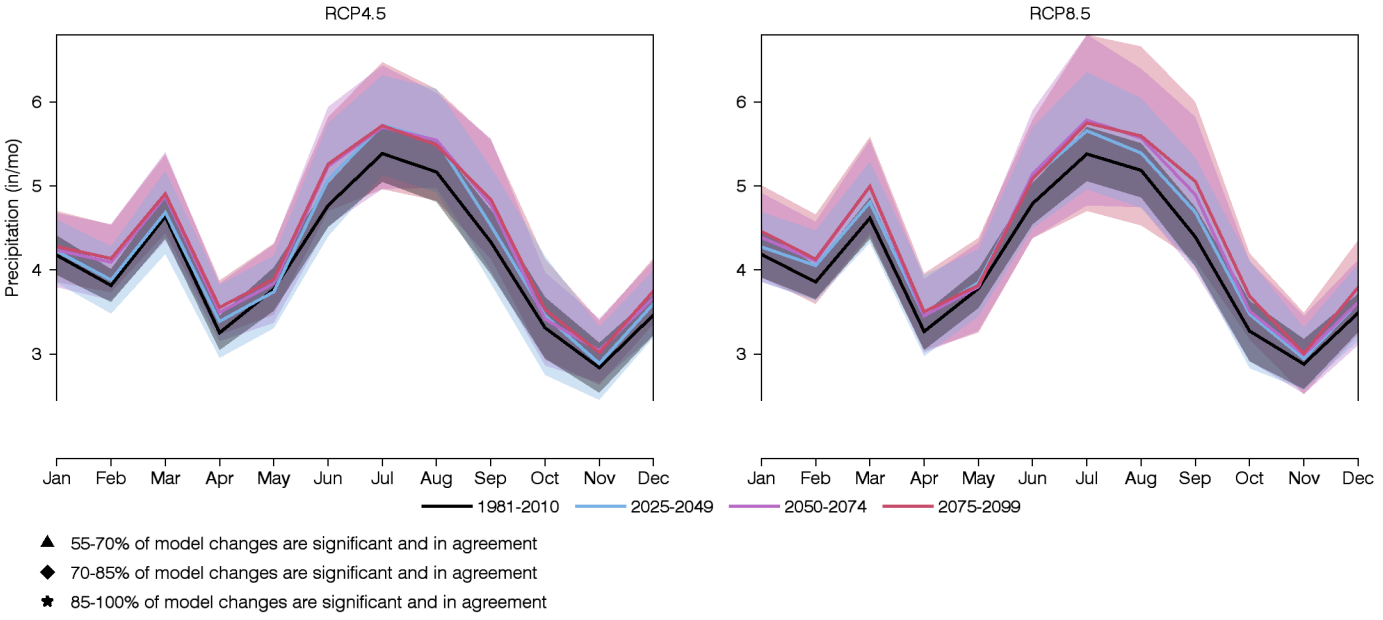


Figure 6: Monthly averages of precipitation for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

4 Snow Water Equivalent

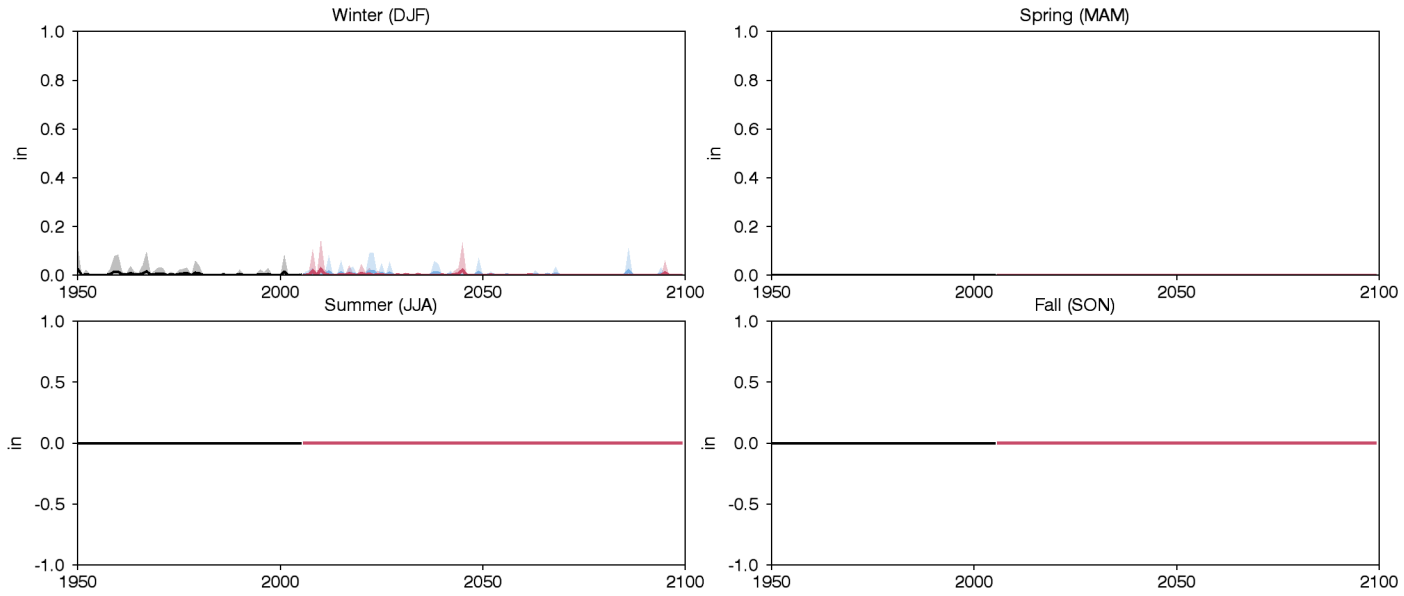


Figure 7: Seasonal average time series of snow water equivalent for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

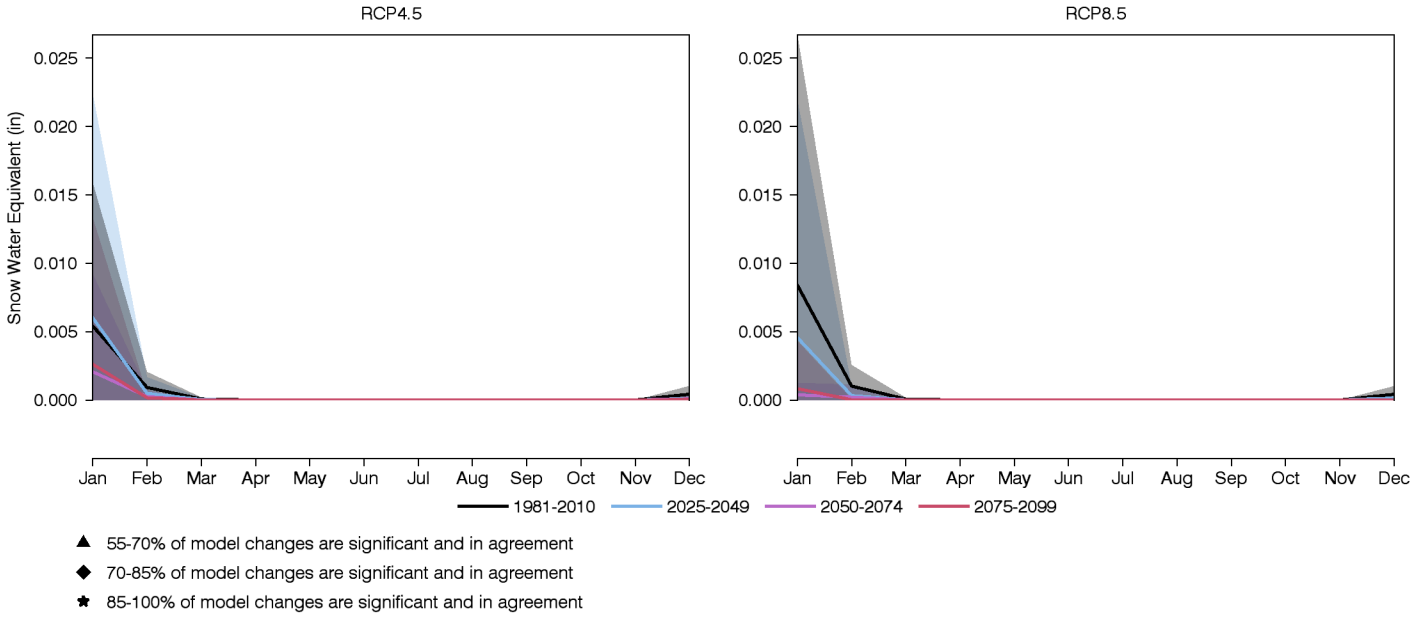


Figure 8: Monthly averages of snow water equivalent for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

5 Runoff

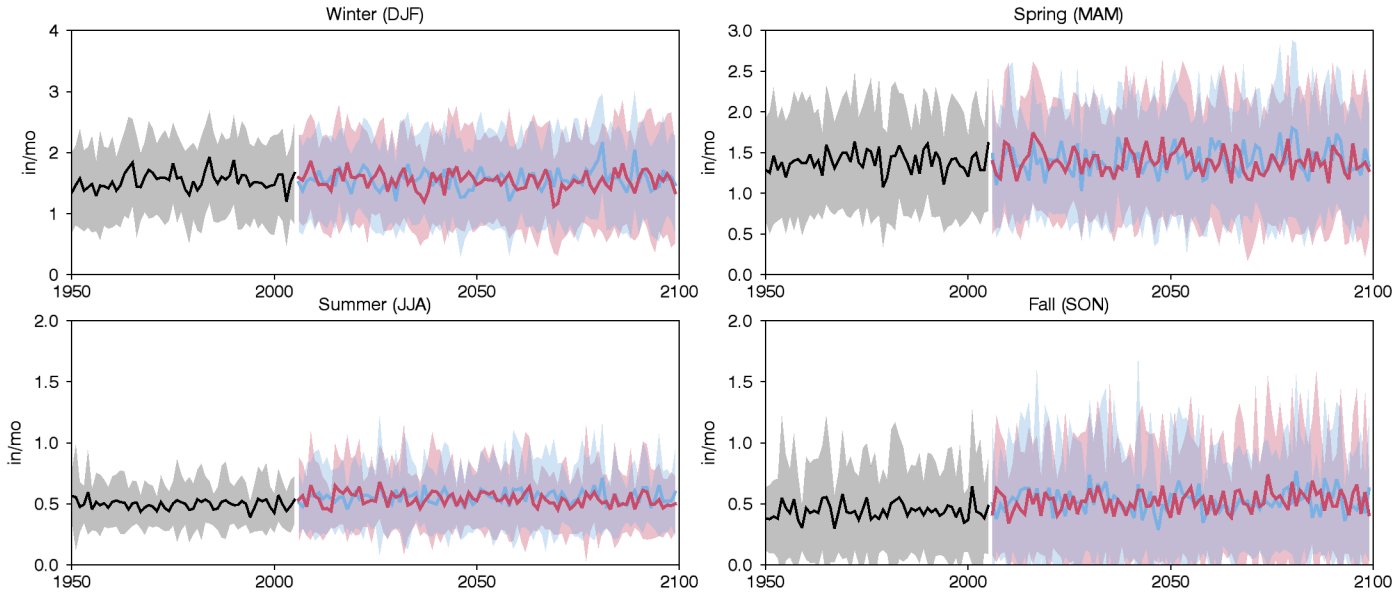


Figure 9: Seasonal average time series of runoff for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

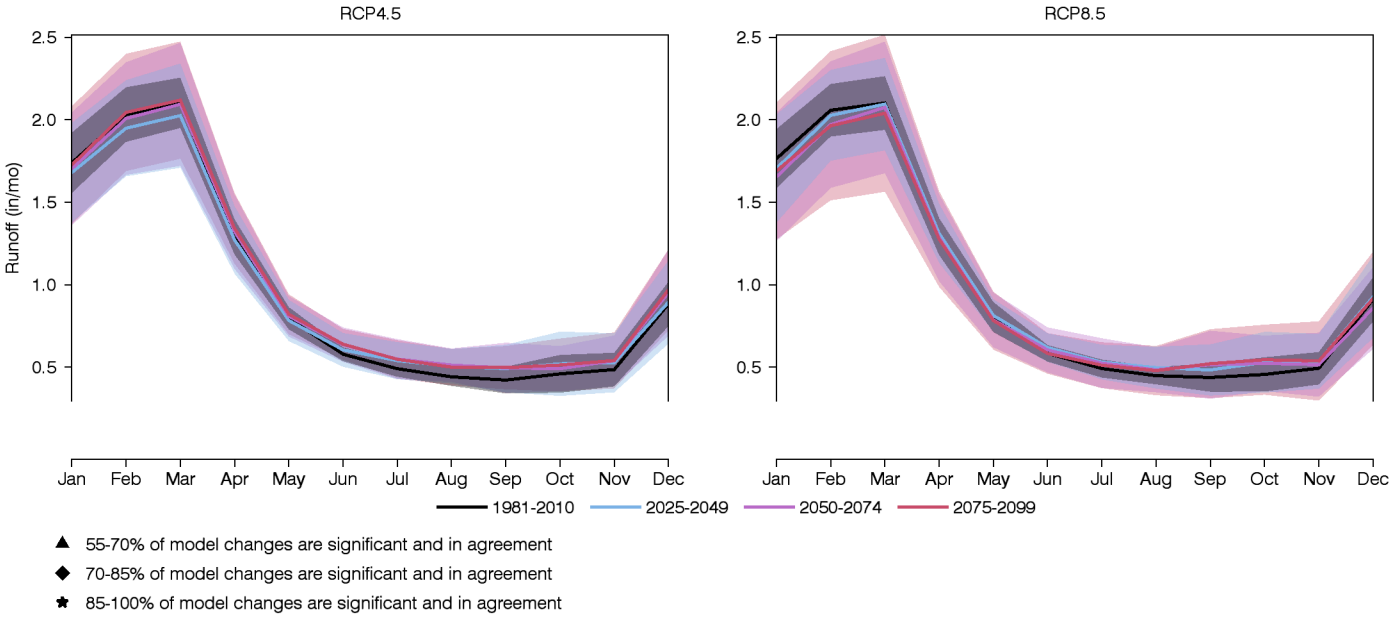


Figure 10: Monthly averages of runoff for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

6 Soil Water Storage

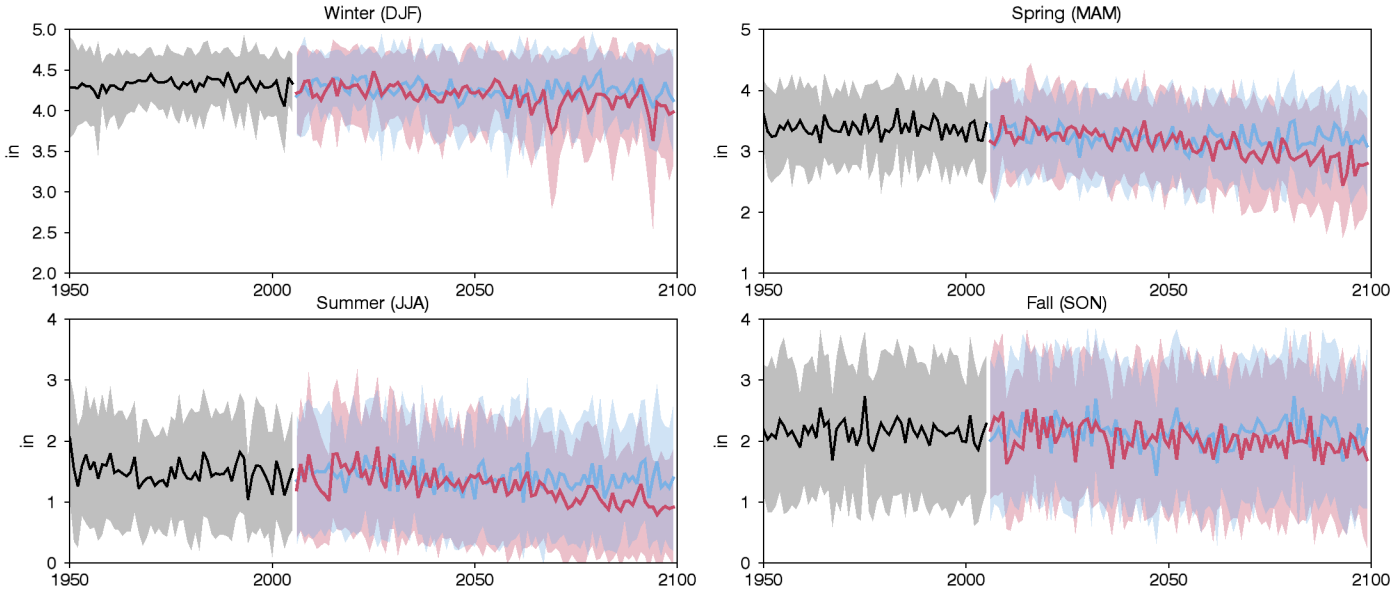


Figure 11: Seasonal average time series of soil water storage for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

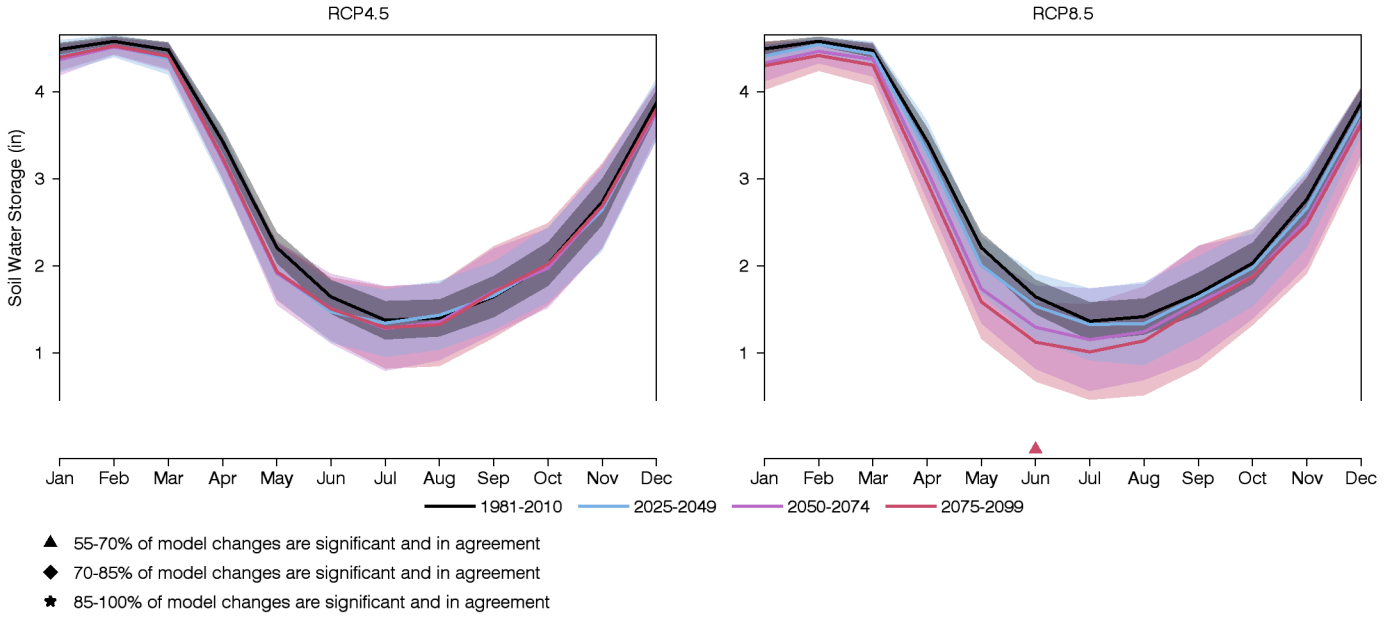


Figure 12: Monthly averages of soil water storage for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

7 Evaporative Deficit

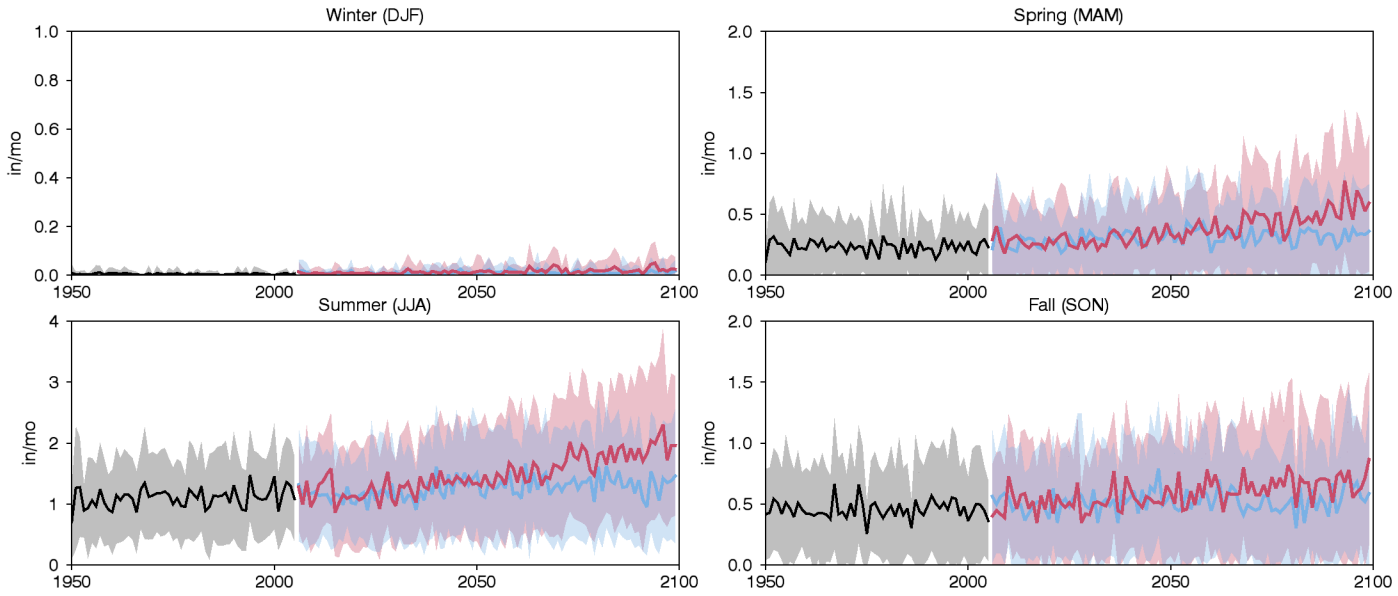


Figure 13: Seasonal average time series of evaporative deficit for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

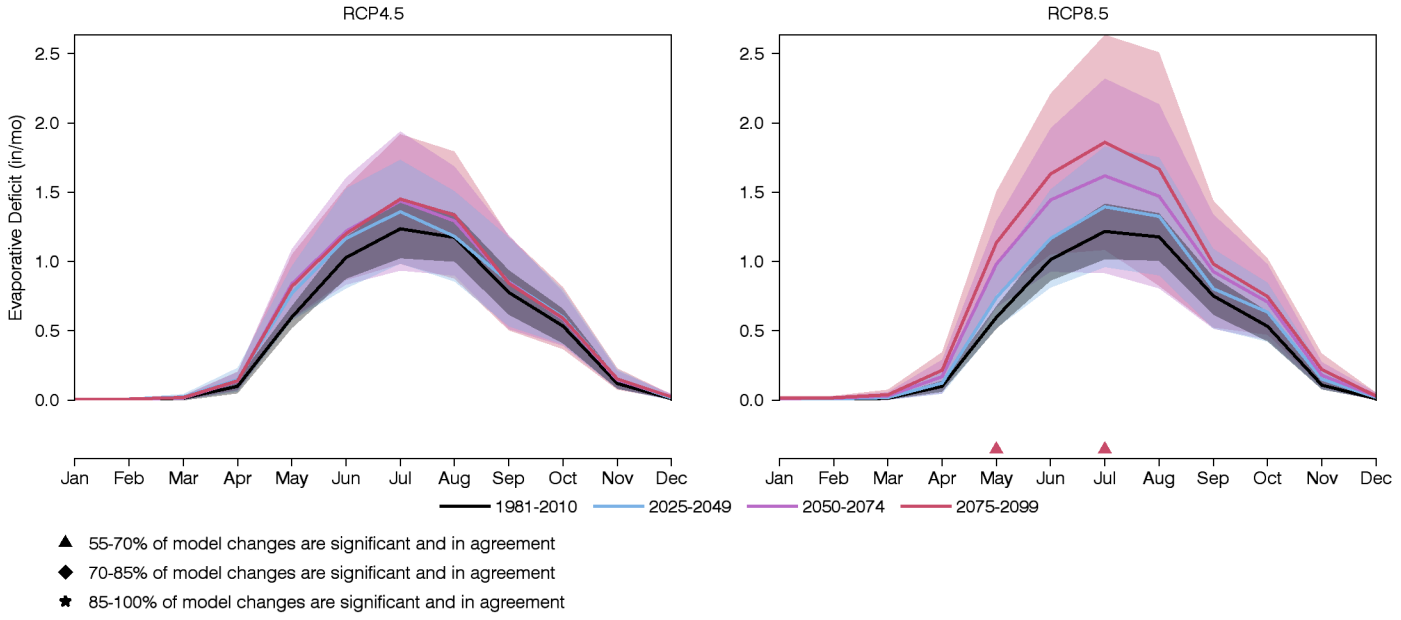


Figure 14: Monthly averages of evaporative deficit for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

8 Data

The temperature and precipitation summaries are created by spatially averaging the NASA NEX-DCP30 data set (Thrasher et al., 2013). The water-balance variables snow water equivalent, runoff, soil water storage and evaporative deficit are simulated by using the NEX-DCP30 temperature and precipitation as input to a simple model (McCabe and Wolock, 2007). The water-balance model accounts for the partitioning of water through the various components of the hydrologic system, but does not account for groundwater, diversions or regulation by impoundments.

9 Models

ACCESS1-0	bcc-csm1-1	bcc-csm1-1-m	BNU-ESM	CanESM2	CCSM4
CESM1-BGC	CMCC-CM	CNRM-CM5	CSIRO-Mk3-6-0	FGOALS-g2	FIO-ESM
GFDL-CM3	GFDL-ESM2G	GFDL-ESM2M	GISS-E2-R	HadGEM2-AO	HadGEM2-CC
HadGEM2-ES	inmcm4	IPSL-CM5A-LR	IPSL-CM5A-MR	IPSL-CM5B-LR	MIROC5
MIROC-ESM	MIROC-ESM-CHEM	MPI-ESM-LR	MPI-ESM-MR	MRI-CGCM3	NorESM1-M

10 Citation Information

Alder, J. R. and S. W. Hostetler, 2013. USGS National Climate Change Viewer. US Geological Survey `http://www.usgs.gov/climate_landuse/clu_rd/nccv.asp` doi:10.5066/F7W9575T.

Hostetler, S.W. and Alder, J.R., 2016. Implementation and evaluation of a monthly water balance model over the U.S. on an 800 m grid. Water Resources Research, 52, doi:10.1002/2016WR018665.

Thrasher, B., J. Xiong, W. Wang, F. Melton, A. Michaelis, and R. Nemani, 2013. New downscaled climate projections suitable for resource management in the U.S. Eos, Transactions American Geophysical Union 94, 321-323, doi:10.1002/2013EO370002.

11 Disclaimer

These freely available, derived data sets were produced by J. Alder and S. Hostetler, US Geological Survey (USGS). The original climate data are from the NEX-DCP30 dataset, which was prepared by the Climate Analytics Group and NASA Ames Research Center using the NASA Earth Exchange, and is distributed by the NASA Center for Climate Simulation. No warranty expressed or implied is made by the USGS regarding the display or utility of the derived data on any other system, or for general or scientific purposes, nor shall the act of distribution constitute any such warranty. The USGS shall not be held liable for improper or incorrect use of the data described and/or contained herein.

Appendix 5

Protected status of current populations throughout the range of the dwarf-flowered heartleaf. Protected status is as follows: 1-protected in perpetuity; 2-protected, but not in perpetuity; 3-not protected.

Population Number	Protection Status
1	1
2	1
3	1
4	1
5	3
2	2 (part)
23	3
29	3
31	2 (part)
44	1
59	2(part)
71	3
77	1
85	3
93	3
96	1 (part)
98	3
99	2 (part)
100	1 (part)
124	3
125	2
130	3
154	1
157	3
158	2/3
176	3
177	3
178	2
179	2(part)
183	1
195	3
206	3
208	2
214	2 (part)
216	2 (part)
217	1
219	3
226	1 (part)
227	1
229	1
232	3
243	1/2 (part)
245	2/3
247	1 (part)

248	3
252	?
261	3
271	1
272	3
274	3
275	3
276	2
279	3
287	1
291	2(part)
292	3
293	3
295	2 (part)
296	3
297	3
298	3
299	3
300	3
302	1 (part)
303	1/2
304	1
306	3
307	2(part)
308	2 (part)
309	3
311	1
312	1
316	?
317	3
318	2 (part)
320	3
321	3
Rock Barn Solar Farm	1

DRAFT Species Status Assessment Report

for

Dwarf-flowered Heartleaf (*Hexastylis naniflora*)

Version 1.0

xx-xx-201x (date)

U.S. Fish and Wildlife Service

Region 4

Atlanta, GA

ACKNOWLEDGEMENTS

This document was prepared by Michael Marshall (U.S. Fish and Wildlife Service [Service]-Texas A &M Natural Resource Institute [NRI]), Rebekah Reid (Service), Mark Endries (Service), and Stephanie DeMay (Texas A&M NRI). External species expertise, guidance, and document reviews were provided by technical team members Suzanne Mason (North Carolina Natural Heritage Program [NCNHP]), Jame Amoroso (NCNHP), Matt Estep (Appalachian State University), and Laura Robinson (NCNHP). Peer review was provided by _____.

Deleted: N

EXECUTIVE SUMMARY

The Species Status Assessment (SSA) reports the results of the comprehensive status review for the dwarf-flowered heartleaf (*Hexastylis naniflora*). For the purpose of this assessment, we generally define viability as the ability of the dwarf-flowered heartleaf to sustain resilient populations in the natural ecosystems within its range over time. Using the SSA framework, we consider what the species needs to maintain viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation (USFWS 2016, entire; Wolf et al. 2015, entire). This SSA provides a thorough assessment of biology and natural history and assesses demographic risks, stressors, and limiting factors in the context of determining the viability for the species. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time.

The dwarf-flowered heartleaf is a low growing herbaceous plant in the birthwort family (Aristolochiaceae) with a range currently restricted to 13 counties within the Upper Piedmont of South Carolina and North Carolina. The species appears to have a restricted range due to its habitat requirements, including soil type, moisture availability, and various other landform characteristics (Wagner 2013).

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect the species include habitat loss due to the conversion of land to residential, commercial, and industrial use. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of

ponds, impacts from grazing cattle, ORV damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or siltation (NCNHP 2016, Robinson and Padgett 2016). Climate change may exacerbate these risk factors through changes in temperature and precipitation.

For the purposes of this SSA, we use population size as the main driver of population resilience. The unit of measurement for population size in this species is a "clump" (rosette). We used Element Occurrence data from both North Carolina Natural Heritage Program and South Carolina Heritage Trust Program as a basis for delineating populations. Delineations were based off of NatureServe criteria such as EO separation distance and intervening landscape matrix. EO data included a wide range of years since the species was last observed at a given location (1964-2017), however, we only used EOs that were observed since 2005.

Deleted: Natural

Deleted: s

To determine overall resilience for populations, we used last known abundance estimates to bin population size classes into corresponding resilience categories. EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, given there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, depending on habitat conditions; poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016; Robinson and Padgett 2016) focus monitoring studies on populations with greater than 1,000 individuals, populations that are assumed to be very viable. We synthesized all of the above population size information and created four resilience categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.

- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.

- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.

- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

There are currently 78 populations of dwarf-flowered heartleaf that have been observed since 2005. The resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low).

Our analysis of future conditions focused on the potential negative impacts of urbanization, and potential positive effects of location or rediscovery of additional populations. Because the actual impacts of urbanization and probability of locating additional populations are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. A projection out to 2040 was based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape.

We used the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040. We used a habitat model and corresponding SMART methodology to assess the likelihood that the species would be found to persist on various sites.

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resilience and extirpation of a few populations is offset by the fact that several additional populations were found to persist in the Status Quo and Targeted Conservation scenarios. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resilience in several additional populations. Regardless of the scenario, the majority of the populations expected to persist on the landscape in 2040 are of at least moderate resilience.

Given the species' current condition and the impacts that the species is expected to experience under the future scenarios, some reductions in resilience are anticipated, but redundancy and representation are unaffected under all scenarios. The results of the SSA indicate the species has a low susceptibility to threats and a high degree of stability.

Table of Contents

INTRODUCTION **1**

SPECIES BIOLOGY **4**

Taxonomy and Species Description 4

Distribution 6

Life History 8

Demographics 8

Pollination and Dispersal 8

Habitat 9

Soils 11

Fire 12

Genetics 12

SPECIES NEEDS FOR VIABILITY **14**

Delineating Populations 14

Population Resiliency 15

Habitat Factors 16

Reproduction and Presence of Pollinators 17

Abundance 18

Population Trends 19

CURRENT CONDITION **21**

Current Population Resilience 22

Categorizing Resilience 22

Occupancy and Abundance 24

Population Trends 27

Habitat Factors 28

Source Data and Model Variables 28

Model Development 29

Results 30

Current Species Representation 35

Current Species Redundancy 35

INFLUENCES ON VIABILITY **37**

Human Population Change 37

Development 40

Invasive Species 42

Climate Change 43

Assessment of Current Threats 55

Conservation Measures in the Mill Creek Watershed 57

FUTURE CONDITIONS **45**

Future Considerations 45

Status Quo Scenario 53

High Development Scenario 53

Targeted Conservation Scenario 54

Future Resilience 55

Status Quo Scenario 56

High Development Scenario 59

Targeted Conservation Scenario 62

Viability Summary 65

Opportunities for Additional Conservation 66

LITERATURE CITED **69**

CURRENT CONDITIONS

Below we assess current resilience, representation, and redundancy as they relate to population and habitat factors known to be important for species viability. Based off of recent reports (NCNHP 2016a; NCNHP 2016b), the species consists of 113 populations distributed across 12 counties in North Carolina and South Carolina. Recent genetic research suggests that dwarf-flowered heartleaf, as originally described, is found in the southern portion of its presumed range based on current EO locations, and the northern portion could be a currently undescribed species. The genetic analysis to support this is complete, but a review of the morphology is ongoing and a new species has not yet been described (Estep pers. Comm. 2018). For the purpose of this SSA, we assume all EO detections are H. Naniflora, and represent the best currently available scientific data.

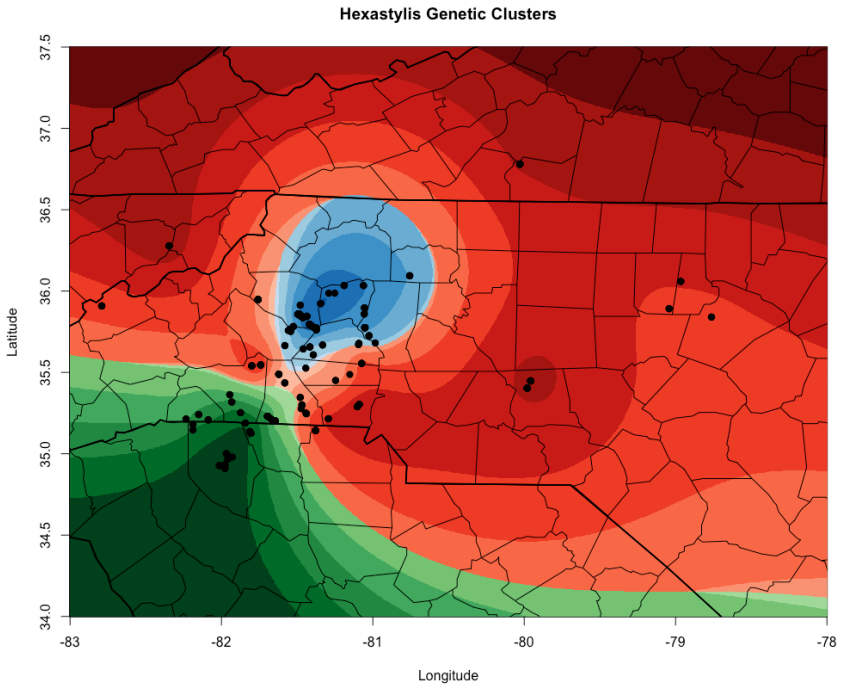


Figure 1-Recent genetic analyses detailing clustering of the genus Hexastylis. Green areas represent "true" H. naniflora; Blue represents a possible new species; Red represents other species in the genus (H. minor, H. heterophylla, etc.).

Current Population Resilience

Categorizing Resilience

For the purposes of this SSA, we use population size as the main driver of population resilience. The unit of measurement for population size in this species is a "clump" (rosette). As discussed previously, populations were delineated by NCNHP and SCNHP, and these delineations were based off of NatureServe criteria such as EO separation distance and intervening landscape matrix. EO data included a wide range of years since the species was last observed at a given location (1964-2017), so although recent reports suggest the species consists of 113 populations, some of that data is fairly outdated. For the purposes of this SSA, we only used EO that were last observed within the last 10 years (2007-2017). Based on that criteria, there are currently 68 populations distributed across the range of dwarf-flowered heartleaf, although this may be an underestimate as discussed in more detail in the habitat modelling section later.

To determine overall resilience for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resilience categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are also incorporated secondarily. Appendix 2 shows the NCNHP EO rank specifications for dwarf-flowered heartleaf. The EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, given there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, depending on habitat conditions; poor viability for populations consisting of less than 100 individuals. Recent reports (NCNHP 2016a; NCNHP 2016b) focus monitoring studies on populations with greater

than 1,000 individuals, populations that are assumed to be extremely viable. Because we do not have habitat level information for every population we assessed, we synthesized all of the above population size information and created four resilience categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence, and moderate-high probability of extirpation for 20-30 years at or above the current population size.

Occupancy and Abundance

There are 67 populations of dwarf-flowered heartleaf that have been observed within the last 10 years (Table ##), and resilience of these populations is as follows: 27 (very high); 5 (high); 20 (moderate); 15 (low).

Site Name	State	Last Observed	Total plants	Resilience
Mill Creek Forest and Seep	North Carolina	2016	>1000	very high
Island Creek Heath Bluff	North Carolina	2016	>1000	very high
NCDOT TIP: R-2824	North Carolina	2015	>1000	very high
Murrays Mill/Upper Balls Creek NA	North Carolina	2013	>1000	very high
Big Horse Creek Rare Plant Site	North Carolina	2015	>1000	very high
Broad River/Sandy Run NA	North Carolina	2012	>1000	very high
New Hope Springhead Swamp	North Carolina	2016	>1000	very high
Facebook Site	North Carolina	2016	>1000	very high
Davenport Road/Mountain View Rare Plant Site	North Carolina	2016	>1000	very high
Broad River: Floyds Creek	North Carolina	2016	>1000	very high

Catawba River: Hoyle Crk-Micol Crk	North Carolina	2013	>1000	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	North Carolina	2013	>1000	very high
Buffalo Creek: Tributaries N and S of SR 2047	North Carolina	2012	>1000	very high
Buffalo Creek: Kings Mountain Res	North Carolina	2016	>1000	very high
Broad River: Brushy Creek	North Carolina	2016	>1000	very high
Peaked Top Rare Plant Site/Foothills Landfill	North Carolina	2014	>1000	very high
Jacob Fork West Corridor	North Carolina	2012	>1000	very high
Floyds Creek Tributray Rare Plant Site	North Carolina	2012	>1000	very high
New Bethel Rare Plant Site	North Carolina	2015	>1000	very high
Cliffside Steam Station	North Carolina	2016	>1000	very high
Rhyne Conservation Preserve	North Carolina	2016	>1000	very high
Glade Creek, Alex County	North Carolina	2017	>1000	very high
Richardson Creek trib above Toms Lake	North Carolina	2016	>1000	very high
Gunpowder Creek: South of Hudson	North Carolina	2012	>1000	very high
Taylor Blalock Res	South Carolina	2016	>1000	very High
DNR Peters Creek Heritage Preserve	South Carolina	2016	>1000	very High
Cowpens NBF - Site 1	South Carolina	2016	>1000	very High
Little Gunpowder Creek Rare Plant Site 1	North Carolina	2015	500-1000	high
Little Gunpowder Creek Rare Plant Site 2	North Carolina	2015	500-1000	high
Buffalo Creek Rare Plant Site	North Carolina	2012	500-1000	high
Northern Catawba County	North Carolina	2017	500-1000	high
Rock Barn Solar Farm	South Carolina	2010-2011	500-1000	high
NCDOT TIP R-2824	North Carolina	2015	100-500	moderate
West Shelby Mesic Slope	North Carolina	2016	100-500	moderate
Cat Square Heartleaf Forest	North Carolina	2012	100-500	moderate
Jonas Road Rare Plant Site	North Carolina	2014	100-500	moderate
South Fork Catawba River, Henry Fork	North Carolina	2007	100-500	moderate
No Business Creek, Boyd Tract	North Carolina	2007	100-500	moderate
Broad River/Sandy Run NA	North Carolina	2012	100-500	moderate
Buffalo Shoals Creek	North Carolina	2014	100-500	moderate
Fox Knoll Farm	North Carolina	2016	100-500	moderate
Forest City: Adj to Isothermal CC	North Carolina	2010	100-500	moderate

Hickory Area	North Carolina	2016	100-500	moderate
UT of Kings Mountain Res	North Carolina	2012	100-500	moderate
Brushy Creek Headwaters	North Carolina	2014	100-500	moderate
Smith Cliff/Henry Fork River	North Carolina	2015	100-500	moderate
Simms Hill/Little River Uplands	North Carolina	2015	100-500	moderate
Collinsville (Hughes) Creek Slopes	North Carolina	2016	100-500	moderate
Burke County - Drowning Creek UT	North Carolina	2017	100-500	moderate
Third Creek Rare Plant Site	North Carolina	2010	100-500	moderate
First Broad River: Crooked Run Creek	North Carolina	2010	100-500	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	North Carolina	2016	100-500	moderate
Buffalo Creek: Ravine	North Carolina	2007	<100	low
Buffalo Creek: Potts Creek	North Carolina	2012	<100	low
Pott Creek	North Carolina	2012	<100	low
Northeast Lincolnton: UT Walker Branch	North Carolina	2009	<100	low
Gunpowder Creek	North Carolina	2012	<100	low
Lincoln County, SR-1314	North Carolina	2014	<100	low
Levan Family Farm	North Carolina	2013	<100	low
Fanjoy Road Site	North Carolina	2015	<100	low
South Mountains Pleasant Grove Uplands	North Carolina	2016	<100	low
NCDOT TIP R-3603A	North Carolina	2017	<100	low
Hickory Creek - UT (Shelby High School)	North Carolina	2016	<100	low
Boulder Creek Subdivision - Jordan Road	South Carolina	2016	<100	Low
Gateway Elementary School	South Carolina	2017	<100	Low
Killian Crossroads	North Carolina	2010	<100	Low
Beaverdam Crk at First Broad River	North Carolina	2011	<100	Low

Although we lack an adequate past time series of abundance data for all populations to estimate growth rates or population trends, NCNHP conducted surveys of thirteen of the largest populations across the range of the species from 2012-2016. Table ## shows the results of these surveys. Two populations show an increasing trend, nine show a stable trend, and two show a decreasing trend.

Table ##-Summary of population trends over 5 years of monitoring data for 13 of the largest populations of dwarf-flowered heartleaf across its range (from: NCNHP 2016).

Commented [MME1]: DOT data.....add here.

Trend	Site	2016 estimated number of plants (Rosettes)	2016 area occupied (Acres)
Increasing	Cliffside Steam Station (EO 276)	39,535	52
	Broad River: Floyds Creek, Long Branch (EO 177)	12,687	5.67
Stable	Island Creek Bluff/Love Lady Site (EO 029)	50,481	61.76
	Rhyne Preserve (EO 302)	19,873	22.43
	Mills Creek Forest and Seep (EO 023)	1,733	1.39
	New Hope Springhead Swamp (EO 125)	12,235	5.03
	Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop (EO 099)	106,940	83.39
	Broad River: Cleghorn Creek, US 221 (EO 176)	6,750	7.24
	Cowpens National Battlefield (SC EO 016, 017, 018)	2,823	6.05
	Peters Creek Preserve (SC EO 011)	3,306	8.98
	Blalock Reservoir (SC EO 007, 031)	3,505	7.59
Decreasing	Second Broad River (Forest City Industrial Complex) (EO 154)	2,576	4.74
	South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)	123	0.09

Habitat Factors: Slope, Aspect, Elevation, Soil, and Forest Type

This will be where we describe our population model….what covariates are used….what covariates best explain areas where HENA is highly resilient. I can envision a table that lists all of the populations, and columns describing habitat elements within each population. Also, we can describe how much potential habitat is out there based on the model (occupied and unoccupied)…this will set us up for scenarios in the future condition.

Resilience Summary

A narrative that summarizes how many populations are on the landscape and their associated resilience score.

Current Species Representation

Representation describes the ability of a species to adapt to changing environmental conditions. We lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species.

Current Species Redundancy

Redundancy describes the ability of a species to withstand catastrophic events. Measured by the number of populations, their resiliency, and their distribution (and connectivity), redundancy gauges the probability that the species has a margin of safety to withstand or can bounce back from catastrophic events (such as a rare destructive natural event or episode involving many populations). Redundancy for dwarf-flowered heartleaf is the total number and resilience of population segments and their distribution across the species range. As stated previously, there are 68 populations of dwarf-flowered heartleaf that have been observed within the last 10 years, and resilience of these populations is as follows: 27 (very high); 5 (high); 20 (moderate); 13 (low); 2 (unknown); 1 (possibly extirpated). The populations are spread across the range, although a majority occur in North Carolina. Although, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf, the species range is very small, making it potentially vulnerable to catastrophic events. Thus we classify redundancy as inherently low for the species.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Asheville Field Office
160 Zillicoa Street Suite #B
Asheville, North Carolina 28801

January 10, 2018

Dear Dwarf-flowered Heartleaf Partner:

The dwarf-flowered heartleaf (*Hexastylis naniflora*) is a threatened species that is endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. In 1989, the U.S. Department of Interior listed the dwarf-flowered heartleaf as a threatened species. A Recovery Plan for the species was never completed. However, over the last 29 years, the U.S. Fish and Wildlife Service (Service) has worked closely with partners to make significant progress toward recovery of the species. The Service is initiating a Species Status Assessment (SSA) to aid in determining the appropriateness of reclassifying the species. In the event that the SSA does not support reclassification, the SSA would be used to inform the development of a Recovery Plan.

The Service's new SSA framework is intended to generate a highly integrated, explicit, and scientifically based approach to evaluate the biological and conservation status of a species. The dwarf-flowered heartleaf SSA will begin with a compilation of the best available information on the species (taxonomy, life history, and habitat) and its ecological needs at the individual, population, and/or species levels. Next, the SSA will describe the current condition of dwarf-flowered heartleaf habitat and demographics, and the probable explanations for any past or ongoing changes in these parameters. Finally, the SSA forecasts the species response to probable future scenarios of environmental conditions and conservation efforts.

The SSA is intended to inform regulatory and policy decision, but be developed independently from any such decision. The Service will ultimately provide a public notification of the finding in the *Federal Register*. Any associated proposed rulemakings would include an opportunity for the public to review and comment.

The Service will accept new information throughout this process, although it would be most helpful if provided by February 10, 2018. Information should be submitted to:

Rebekah Reid
Asheville Ecological Services Field Office
U.S. Fish and Wildlife Service
160 Zillicoa Street, Suite B
Asheville, North Carolina 28801
Email and Phone: rebekah_reid@fws.gov, (828) 258-3939 x238

All data and information submitted to the Service, including names and addresses, will become part of the administrative record.

Thank you for your interest in the conservation of threatened and endangered species. Please do not hesitate to contact Rebekah Reid at the phone number or email listed above with any questions or if you would like additional information regarding dwarf-flowered heartleaf.

Sincerely,

Project Leader

Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2019–0081; FF09E22000 FXES11130900000 201

RIN 1018-BD95

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicate that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened species, and does not meet the definition of an endangered species, under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2019–0081, which is the docket number for this rulemaking. Then, click on the Search button. On the resulting page, in the Search panel on the left side of the screen, under the Document Type heading, check the Proposed Rule box to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail to: Public Comments Processing, Attn: FWS–R4–ES–2019–0081, U.S. Fish and Wildlife Service, MS: JAO/1N, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see **Information Requested**, below, for more information).

Document availability: The proposed rule, draft PDM plan, and supporting documents (including the species status assessment (SSA) report, references cited, and 5-year review) are available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and

Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC 28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from other concerned governmental agencies (including, but not limited to, State and Federal agencies and city or county governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. We particularly seek comments on:

(1) Information concerning the biology and ecology of dwarf-flowered heartleaf;

(2) Relevant data concerning any threats (or lack thereof) to dwarf-flowered heartleaf, particularly any data on the possible effects of climate change as it relates to habitat, as well as the extent of State protection and management that would be provided to this plant as a delisted species;

(3) Current or planned activities within the geographic range of dwarf-flowered heartleaf that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

Please note that submissions merely stating support for, or opposition to, the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or a threatened species must be made "solely on the basis of the best scientific and commercial data available."

You may submit your comments and materials concerning this proposed rule by one of the methods listed in **ADDRESSES**. We request that you send comments only by the methods described in **ADDRESSES**.

If you submit information via *http://www.regulations.gov*, your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on *http://www.regulations.gov*.

Comments and materials we receive, as well as supporting documentation used in preparing this proposed rule, will be available for public inspection on *http://www.regulations.gov*.

Public Hearing

Section 4(b)(5)(E) of the Act provides for a public hearing on this proposal, if requested. Requests must be received by the date specified in **DATES**. Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the *Federal Register* at least 15 days

before the hearing. For the immediate future, we will provide these public hearings using webinars that will be announced on the Service's website, in addition to the *Federal Register*. The use of these virtual public hearings is consistent with our regulation at 50 CFR 424.16(c)(3).

Peer Review

In accordance with our joint policy on peer review published in the *Federal Register* on July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we sought the expert opinions of seven appropriate specialists regarding the species status assessment (SSA) report, which informed this proposed rule. Out of the seven reviews requested, we received no responses. The purpose of peer review is to ensure our determination is based on scientifically sound data, assumptions, and analyses.

Because we will consider all comments and information received during the comment period, our final determinations may differ from this proposal. Based on the new information we receive (and any comments on that new information), we may conclude that the species is still in danger of extinction, either now or in the foreseeable future. Such final decisions would be a logical outgrowth of this proposal, as long as we: (a) base the decisions on the best scientific and commercial data available after considering all of the relevant factors; (2) do not rely on factors Congress has not intended us to consider; and (3) articulate a rational connection between the facts found and the conclusions made, including why we changed our conclusion.

Previous Federal Actions

On April 14, 1989, we listed dwarf-flowered heartleaf as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting, and cattle grazing (54 FR 14964). A recovery plan for the species was never completed. However,

over the last 30 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf SSA report to aid in determining the appropriateness of reclassifying the species.

Supporting Documents

A species status assessment team prepared an SSA report for the dwarf-flowered heartleaf. The SSA team was composed of Service biologists, in consultation with other species experts. The SSA report represents a compilation of the best scientific and commercial data available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the species.

Proposed Delisting Determination

Background

Dwarf-flowered heartleaf is a plant species endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It is a low-growing herbaceous plant in the birthwort family (Aristolochiaceae). Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (Service 2010, p. 15; North Carolina Natural Heritage Program (NCNHP) 2016, p. 4). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant populations (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. As of 2018, the distribution of this species consisted of 78 populations distributed across 13 counties in these two States. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Deleted: 119

Dwarf-flowered heartleaf is historically known to have a restricted range due to its

habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of any population.

Dwarf-flowered heartleaf occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, p. 114; Weakley 2015, p. 129; Service 2015, entire), or in moist soils adjacent to creeks or streamheads, or along lakes and rivers. Plants grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). A habitat suitability study was conducted to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used to help identify the species when not in flower (relative to other *Hexastylis* species' habitat preferences), find new populations, or identify suitable sites for transplants (Wagner 2013, pp. 30-32). The unit of measurement for population size in this species is a "clump" (rosette).

A thorough review of the taxonomy, life history, ecology, and overall viability of the dwarf-flowered heartleaf is presented in the SSA report (Service 2018, entire; available at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081).

Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an "endangered species" or a

"threatened species." The Act defines an endangered species as a species that is "in danger of extinction throughout all or a significant portion of its range," and a threatened species as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether any species is an "endangered species" or a "threatened species" because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future. These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term "threat" to refer, in general, to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term "threat" includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those

that affect individuals through alteration of their habitat or required resources (stressors). The term "threat" may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In determining whether a species meets either definition, we must evaluate all identified threats by considering the likely response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species, such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

Deleted: expected

Deleted: expected

The Act does not define the term "foreseeable future," which appears in the statutory definition of "threatened species." Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term "foreseeable future" extends only so far into the future as the Services can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. "Reliable" does not mean "certain"; it means sufficient to provide a reasonable degree of confidence in the

prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework

The SSA report documents the results of our comprehensive biological status review for dwarf-flowered heartleaf, including an assessment of the potential threats to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for removal from the List of Endangered and Threatened Plants (i.e., "delisting"). It does, however, provide the scientific basis that informs our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

Summary of SSA Analysis

To assess dwarf-flowered heartleaf viability, we used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 306–310). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years), redundancy supports

the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation supports the ability of the species to adapt over time to long-term changes in the environment (for example, climate changes causing earlier spring flowering). In general, the more resilient and redundant a species is and the more representation it has, the more likely it is to sustain populations over time, even under changing environmental conditions. Using these principles, we identified the species' ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species' viability.

Deleted:)

The SSA process can be categorized into three sequential stages. During the first stage, we evaluated the individual species' life-history needs. In the next stage, we assessed the historical and current condition of the species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize the species' viability (i.e., its ability to sustain populations in the wild over time). We used this information to inform this proposed rule.

Summary of Biological Status and Threats

In this discussion, we review the biological condition of the species and its resources, and the threats that influence the species' current and future condition, in order to assess the species' overall viability and the risks to that viability.

Current Condition

Resiliency

For dwarf-flowered heartleaf to maintain viability, its populations, or some portion thereof, must be resilient. Resiliency is assessed at the level of populations and reflects a species' ability to withstand stochastic events (events arising from random factors). Resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates and fecundity (demographic stochasticity), variations in rainfall (environmental stochasticity), and the effects of anthropogenic activities. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include habitat impacts, climate change, and exotic, invasive species. Factors influencing the resiliency of dwarf-flowered heartleaf populations include population size, available habitat, and elements of dwarf-flowered heartleaf ecology that determine whether populations can maximize habitat occupancy.

The Natural Heritage Programs (NHP) collect information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member NHPs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2004, n.p.). We regard the NHP database as the best repository for known locations of the dwarf-flowered heartleaf (Service 2010, p. 41). Populations are composed of both multiple sub-EOs and stand-alone EO records. For the purpose of assessing resiliency, 78 populations observed since 2005 were assessed due to the high confidence in their persistence. These new populations are results of additional survey efforts.

(b)(5) DPP & ACP

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

- Very high—populations with more than 1,000 individuals; very high probability of persistence for 20–30 years at or above the current population size.
- High—populations with 500 to 1,000 individuals; moderately high probability of persistence for 20–30 years at or above the current population size.
- Moderate—populations with 100 to 500 individuals; low probability of persistence for 20–30 years at or above the current population size.
- Low—populations with fewer than 100 individuals; low probability of persistence for 20–30 years at or above the current population size, and moderately high probability of extirpation.

Of the 78 populations assessed, 28 have very high resiliency, 5 have high resiliency, 26 have moderate resiliency, and 19 have low resiliency.

Redundancy

Redundancy is also assessed at the species level and reflects a species' ability to withstand catastrophic events (such as a rare destructive natural event or episode involving many populations) by spreading the risk of such an event across multiple, resilient populations. We measured redundancy for dwarf-flowered heartleaf by the number and distribution of resilient populations across the range of the species. It is important to note that dwarf-flowered heartleaf has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area. Redundancy for dwarf-flowered heartleaf is the total number and resiliency of population segments and their distribution across the species' range.

We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with devastating effects; however, they can occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbances. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long-term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions such as temperature and precipitation changes (DeWan et al. 2010, pp. 7–10).

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Representation

Because we lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf, we decided delineating representative units was not appropriate for this species. However, in the absence of species-specific genetic and ecological diversity information, we evaluated representation based on the extent and variability of habitat characteristics across the geographical range. Dwarf-flowered heartleaf occurs in two types of habitat throughout the range. Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (Padgett 2004, entire; Weakley 2015, entire; USFWS 2015, entire), or moist soils adjacent to creeks, streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats, demonstrating the species' ability to adapt to changing environmental conditions.

We note that, by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have not only analyzed individual effects on the species, but we have also analyzed their potential cumulative effects. We incorporate the cumulative effects into our SSA analysis when we characterize the current and future condition of the species. Our assessment of the current and future conditions encompasses and incorporates the threats individually and cumulatively. Our current and future condition assessment is iterative because it accumulates and evaluates the effects of all the factors that may be influencing the species, including threats and conservation efforts. Because the SSA framework considers not just the presence of the factors, but to what degree they collectively influence risk to the entire species, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative effects analysis.

Summary of Threats and Conservation Measures that Affect the Species

The NCNHP assessed threats in the populations they monitored from 2012 through 2016 (Robinson and Padgett 2016, pp. 7–8, 17–20). Threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on field observations of severity, scope, and immediacy. The rank (A through G) for each threat factor determined an overall value for each threat observed at each population. Threats observed during these years included development; incompatible forestry practices; agriculture; trampling; invasive, exotic species; sedimentation; erosion; and road construction. In this rule, we discuss the major threats affecting the species, which include development, climate change and invasive, exotic species.

Development

Dwarf-flowered heartleaf populations occur in rapidly growing urban areas within numerous counties in North and South Carolina. At the time of listing, the species was determined to be most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5).

The most recent 5-year review for the species identified the most recurrent source of habitat destruction as road and bridge improvement projects which is the most common trigger for consultations under section 7 of the Act involving dwarf-flowered heartleaf. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of section 7 consultations. Collectively, these projects have adversely impacted or were expected to impact approximately 22,135 rosettes (Service 2018, p. 31). In most cases, the section 7 process resulted

in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection. Significant portions of other populations have been purchased by the North Carolina Department of Transportation (NCDOT) as off-site conservation measures in association with these consultations. The purpose of this purchase is to protect the dwarf-flowered heartleaf. Other forms of economic development have also resulted in the destruction or modification of habitats occupied by dwarf-flowered heartleaf; in many cases, these activities have also required section 7 consultations with the Service. Examples include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities at a regional airport. Collectively, these activities involved the loss or relocation of several thousand rosettes.

Development was identified as a threat at five of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17–19). The five populations include two stand-alone EOs and three parent EOs with 18 sub-EOs. Of the two stand-alone EOs, one has a development threat rank of A (moderate to severe, imminent threat for most (more than 60 percent) of population, occurrences, or area) and one has a rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area). Of the 18 sub-EOs, nine have development identified as a threat. Of the nine sub-EOs, one has a development threat rank of A, one has a rank of B, one has a rank of E (moderate to severe threat for a small proportion of population, occurrences, or area), and six have a rank of F (low severity threat for most or a significant proportion of population, occurrences, or area). The two stand-alone EOs and two sub-EOs with the highest threat ranks (A and B) are located in four populations. Based on the most recent monitoring data, one is increasing, two are stable, and one

is decreasing (Robinson and Padgett 2016, p. 11). Even where development is ranked as a high threat, impacts to dwarf-flowered heartleaf are not a certain outcome.

Development was identified as a threat at one of three South Carolina populations monitored by NCNHP, and the population has a development threat rank of E (Robinson and Padgett 2016, p. 20). Based on the most recent monitoring data, the population is stable (Robinson and Padgett 2016, p. 11).

The data indicate that dwarf-flowered heartleaf populations can persist and increase in the presence of development. From 2012 to 2016, there were insignificant changes in the severity of the threat observed in the field from development (NCNHP 2016, p. 8).

The North Carolina Plant Protection and Conservation Act (North Carolina General Statutes, sections 106-202.12 et seq.) lists native plants as threatened, endangered, or species of concern, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. In North Carolina, the NCNHP designates "natural areas", which are sites with biological diversity significance due to the presence of rare species or unique natural communities. The NCNHP works with many conservation partners (state and federal agencies, conservation organization, land trusts, etc.) to implement voluntary protection. Through partnerships, the most important natural areas are purchased for permanent conservation. If a natural area is not available for purchase, ecological significance can be recognized by a voluntary registry agreement. Registry agreements consist of Registered Heritage Areas (RHAs), which are voluntary conservation agreements between the landowner and NCNHP to preserve the natural area and biological diversity of the property. The NCNHP has four registry agreements that include dwarf-flowered heartleaf. In South Carolina, plants are

protected only from disturbance where they occur on those properties owned by the State and specifically managed as South Carolina Heritage Preserves (South Carolina Code of State Regulations, chapter 123, sections 123-200 through 123-204). Heritage Preserves are protected areas that play a critical role in conserving rare species and natural habitats. There is one Heritage Preserve in South Carolina, which protects one population of the dwarf-flowered heartleaf.

The overwhelming majority of dwarf-flowered heartleaf populations have been discovered as a direct result of surveys conducted to ensure compliance with the Act. The majority of sites that have the potential to afford long-term protection to the species have been protected as a result of consultations under section 7 of the Act, which directs federal agencies to avoid and minimize adverse effects to federally listed species. Through section 7 and other voluntary conservation actions, approximately 24 (31%) of the 78 current populations are permanently protected, and another 18 populations (23%) are partially protected, greatly minimizing the likelihood of impacts due to development. Together, these two groups of populations make up over 50% of the areas under some form of protective mechanism in the absence of the ESA protections.

Invasive, Exotic Species

Invasive, exotic plant species occur across the range of this species. Plants such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and Japanese stiltgrass (*Microstegium vimineum*) are known at several sites that contain dwarf-flowered heartleaf (Service 2011, p. 15). Invasive, exotic species were identified as a threat at eight of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17–19). The eight populations include four stand-alone EOs and four parent

EOs with 19 sub-EOs. Of the four stand-alone EOs, one has an invasive threat rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area), two have a rank of F (low severity threat for most or a significant proportion of population, occurrences, or area), and one has a rank of G (low severity threat for a small proportion of population, occurrences, or area). Of the 19 sub-EOs, 9 have invasive, exotic species identified as a threat. Of the nine sub-EOs, one has an invasive threat rank of A (moderate to severe, imminent threat for most (more than 60 percent) of population, occurrences, or area), four have a rank of B, two have a rank of E (moderate to severe threat for a small proportion of population, occurrences, or area), and two have a rank of G. The one stand-alone EO and five sub-EOs with the highest threat ranks (A and B) are located in three populations. Based on the most recent monitoring data, one is increasing, one is stable, and one is decreasing (Robinson and Padgett 2016, p. 11). Even where nonnative species are ranked as a high threat, impact to dwarf-flowered heartleaf is not a certain outcome.

Invasive, exotic species were identified as a threat at all (three) South Carolina populations monitored by NCNHP, and all sites had an invasive threat rank of F (Robinson and Padgett 2016, p. 20). Based on the most recent monitoring data, all populations are stable (Robinson and Padgett 2016, p. 11).

In short, the data indicate that dwarf-flowered heartleaf populations can persist and increase in the presence of invasive, exotic species. Despite the long-term presence of invasive, exotic plants, from 2012 to 2016, there were no changes in the severity of threats observed in the field enough to elevate the threat ranks of dwarf-flowered heartleaf populations evaluated (NCNHP 2016, p. 8).

Climate Change

Accelerated climate change (changes in climate on a scale that exceeds historical rates of change) is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, entire). Increased frequency of severe storms could lead to impacts if flooding duration or intensity increase as a result. Increased flooding could decrease habitat suitability through scouring and changes in soil moisture or wash plants away. Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.), which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p. 7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages, resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p. 7). Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. In recent years, the Southeast has experienced moderate to severe droughts, which many observers have implicated in population declines and poor transplant survivorship (NCNHP 2010). A wildfire, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County, NC; Golder and Associates, 2009). However, observation suggests that the species was not appreciably harmed by this fire (Service 2011, p. 14). Additionally, the National Park Service (NPS) uses prescribed fire as a vegetation management tool at Cowpens National Battlefield. The NPS's prescribed burning activity includes the majority of the dwarf-flowered heartleaf population on site and burning appears to have had no adverse effects upon growth or flowering (Walker et al. 2009, p. 14).

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Moved (insertion) [1]

Future Condition

Our analysis of the past, current, and future influences on dwarf-flowered heartleaf revealed that there are several influences that may pose risks to the future viability of the species. These risks are primarily related to invasive species, changes in climate, and habitat changes from development. We consider "foreseeable future" as that period of time within which a reliable prediction can be made about the future status of a species. We consider 20 years to be a reasonable period of time within which reliable predictions can be made for dwarf-flowered heartleaf. This period of time aligns with the timeframes for predictions regarding development and growth (see *Development* below) and climate change (see *Climate Change* below). We discuss in greater detail how we define "foreseeable future" for this species below, under ***Determination***.

Deleted: change

Invasive, Exotic Species

As discussed above, invasive, exotic plants were identified as a threat at the time of listing; however, the threat may not be as significant as once thought. The NCNHP monitored 13 populations of dwarf-flowered heartleaf and assessed threats at each population. Of monitored sites, only 9 percent of populations (one of 11) where invasive, exotic species are present are also in decline, indicating the species has at least some capacity to withstand the presence of invasive, exotic species. The number of populations has increased dramatically since listing as a result of increased survey effort and the invasive, exotic plant threat posed at many of the largest populations is low (NCNHP 2016, pp. 8, 17–20). Additionally, and as noted above, the number of populations managed under conservation ownership has increased. Therefore, we do not believe that competition from invasive, exotic species will be a significant threat in the foreseeable future.

Climate Change

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2014, entire). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2014, entire). In our analyses, we use the judgment of the experts to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Deleted: our expert

According to IPCC, "most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change on most landscapes" (IPCC 2014, p. 13). The concept of changing climate can be meaningfully assessed both by looking into the future and reviewing past changes.

(b)(5) DPP & ACP

As part of the current, worldwide collaboration in climate modelling under the IPCC, climate assessments of the full dataset of 30 climate models for historical and 21st century comparisons provide predictions at scales ranging from global to county level in the United States (U.S. Geological Survey (USGS) National Climate Change Viewer (NCCV) 2019). This global climate information has been recently downscaled by the National Aeronautics and Space Administration to scales relevant to our region of interest, and projected into the future under two different scenarios of possible emissions of greenhouse gases (Alder and Hostetler 2017, p. 3). Using the NCCV and assuming the "representative concentration pathways" (RCP) greenhouse

Deleted: more extreme

gas emission scenario RCP 8.5, we calculated projected annual mean changes from 1981–2010 to those projected for 2025–2049 for maximum temperature (+2.9–3.1 degrees Fahrenheit (°F) in NC and +2.9 °F in SC), precipitation (+0.2 inches per month for NC and SC), soil storage (-0.1 - -0.2 inch for NC and -0.1 inch SC), and evaporative deficit (no change for NC or SC) in all counties where dwarf-flowered heartleaf occurs (Adler and Hostetler 2017, entire). We also calculated projected annual mean changes for the RCP 4.5 scenario using the same timeframes for maximum temperature (+2.5–2.7 °F in NC and SC), precipitation (+0.01 inch per month for NC and SC), soil storage (-0.1 - -.02 inch for NC and -0.1 inch for SC), and evaporative deficit (no change for NC or SC) in all counties where dwarf-flowered heartleaf occurs (Adler and Hostetler 2017, entire). Based on these results, all 13 counties within the range of dwarf-flowered heartleaf will be subjected to higher temperatures (annual mean increase of 2.6 °F (RCP 4.5) or 2.9 °F (RCP 8.5)) and slightly higher precipitation (annual mean increase of 0.1 inch per month (RCP 4.5) or 0.2 inch per month (RCP 8.5)) relative to the period of 1981–2010. Because the average annual increase in precipitation is predicted to be only slight, the loss in soil storage is likely primarily the result of higher predicted temperatures.

Deleted: (

Deleted:),

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Dwarf-flowered heartleaf is a long-lived perennial species. Several populations have been revisited after decades and the species was still stable. For example, one population in Rutherford County was first observed in 1957, and was still extant when next observed in 2001 (NCNHP 2018, n.p.). In their analyses of life-history traits in relation to potential vulnerability to variability in demographic vital rates caused by increased variability in climatic patterns, researchers concluded that longer-lived species should be less influenced by climate-driven increases in demographic variability (Morris *et al.* 2008, p. 22; Dalgleish *et al.* 2010, p. 216).

Within the family Aristolochiaeae, more than 50 percent of the plant lineage is myrmecochorous (seed dispersal by ants) (Lengyel et al. 2010, p. 49). Likewise, dwarf-flowered heartleaf employs myrmecochory as a method for seed dispersal (Gaddy1986, entire). While species with ant-dispersed seeds have slower migration rates than species with seeds that are adhesive or ingested (Brunet and Von Oheimb 1998, p. 429), myrmecochory provides for multiple adaptive advantages for plants. Ants can disperse seeds to sites that might be nutrient-enhanced or where plant fitness will be higher. Additionally, ants bury seeds, which may protect them from fire and drought (Boyd 2001, p. 235), two conditions exacerbated by climate change (Karl et al. 2009, entire). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, p. 111).

Deleted: ¶

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: ¶

Populations are located within various ecological settings within the species' range. Dwarf-flowered heartleaf occurs on Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (Padgett 2004, p. 114; Weakley 2015, p. 129), or moist soils adjacent to creeks or streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats, demonstrating the species' ability to adapt to different environmental conditions that could be brought on by changing climate.

Deleted: change

Development

(b)(5) DPP & ACP
(b)(5) DPP & ACP

As discussed above, development was identified as a threat at the time of listing; however, the threat is not be as significant as once thought. The NCNHP monitored 13 populations of dwarf-flowered heartleaf and assessed threats at each population. Of monitored

sites, only 12 percent of populations (one of eight) where development is identified as a threat are also in decline, indicating the species has at least some capacity to withstand the threat of development. The number of populations has increased dramatically since listing and the development threat posed at many of the largest populations is low (NCNHP 2016, pp. 8, 17–20).

In addition, we use three scenarios, projected out to the year 2040. We selected this timeframe because it gives us the ability to reliably predict into the future and to capture the uncertainty related to the potential impacts to each population's resiliency: Status quo, targeted conservation, and high development. Based on the life span of the species, expert input, development as the key risk factor to the species, and uncertainty about future conditions, we chose to project populations out to the year 2040 under each scenario as described in the SSA (p. 34). Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

Deleted: ,

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) model to determine areas predicted to be urbanized by 2040, a time period for which the models provide reliable data. The SLEUTH model has been successfully applied worldwide over the last 15 years to simulate land use change, including urbanization (Clarke 1995, entire).

The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0 to 100 percent. We chose 80 percent probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- Percent increase in projected development within current populations; and
- Percent increase in projected development within areas delineated as potential habitat by the Maxent habitat model.

We know that certain dwarf-flowered heartleaf populations have been extirpated as the result of urban development in the past through loss of habitat. However, there are no data available on the relationships between urbanization and indirect impacts to dwarf-flowered heartleaf. Because of this unknown, we attempted to capture potential impacts in two ways. First, our scenarios reflect a range of potential impacts from nearby urban development. Also, we used two thresholds for percent increase in urban development to capture potential deleterious effects: 25 percent and 50 percent. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25 percent of the area of current populations was likely to have some negative impacts; and development increase of at least 50 percent was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios (targeted conservation and status quo). This is appropriate for several reasons. First, discovery of new EOs is common; many of the populations we consider under **Current Conditions**, above, include detections that have occurred within the last few years. Second, we did not include many

older detections (i.e., we only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years, and the species was still present. For example, one such EO was first observed in 1957, next observed in 2001, and last observed in 2017. It seems as long as suitable habitat is still present, it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

Deleted: and

Deleted: still extant

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e., we define current populations as those observed between 2005 and present day). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005–current day) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate.

Once these older EOs were identified, we created a 1,000-meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20–25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed under **Current Conditions**, above (i.e., low = fewer than 100 individuals; moderate = 100–500 individuals; high = 500–1,000 individuals;

very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and percent Maxent classified as 0.8–1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000-meter buffer. The percent Maxent classified as 0.8–1.0 represents the percentage of all potential habitat within the 1,000-meter buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000-meter buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-flowered heartleaf is likely to persist.

Status Quo Scenario

Under the status quo scenario, we estimate that 75 populations will persist throughout the range, and that there will be a range of impacts from urbanization that are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—no negative impacts from urbanization; and

- Voluntary protection/non-perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold.
    - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

High Development Scenario

Under the high development scenario, we estimate no additional populations will persist throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

- No additional populations are identified as persisting.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold; and
        - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.
    - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold; extirpation of populations if percent increase in urbanization exceeds 90 percent threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we estimate it is likely that several additional populations (i.e., more than in the status quo scenario) will persist throughout the range. This scenario accounts for resilience (which is linked to abundance), habitat suitability (as predicted by the model), projected urban development (from SLEUTH), and protection status. Conservation is happening through various partners – State, land trusts or other non-profits, private individuals, etc. The range of impacts from urbanization are the same as in the status quo scenario. We assessed population resiliency under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—no impacts from urbanization; and
        - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 50 percent threshold.
    - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

Future Resiliency

Status Quo Scenario

In the status quo scenario, we predict 75 of the 78 populations of dwarf-flowered heartleaf will be extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

High Development Scenario

In the high development scenario, we predict 72 of the 78 populations of dwarf-flowered heartleaf will remain extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the targeted conservation scenario, we predicted 79 populations of dwarf-flowered heartleaf will be extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few populations is offset in the status quo and targeted conservation scenarios by the persistence of several additional populations. In the high development scenario, there is a predicted loss of six populations, with loss of resiliency in several additional populations. However, in all three scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press

catastrophic disturbances; however, the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as oil spills over the next 20 to 30 years.

Based on the assumption that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (status quo and targeted conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. There are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Table of viability summary for dwarf-flowered heartleaf under three future scenarios (projected to year 2040) and compared to current condition.

	Current Condition	Status Quo Scenario	High Development Scenario	Targeted Conservation Scenario
Very High Resiliency	28	27	27	27
High Resiliency	5	6	4	6
Moderate Resiliency	26	23	25	23
Low Resiliency	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total Populations	**78**	**75**	**72**	**79**

Determination of Dwarf-flowered Heartleaf Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." For a more detailed discussion on the factors considered when determining whether a species meets the definition of "endangered species" or "threatened species" and our analysis on how we determine the foreseeable future in making these decisions, see *Regulatory Framework*, above.

Status Throughout All of Its Range

After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we have assessed the best scientific and commercial information available regarding the past, present, and future threats faced by the dwarf-flowered heartleaf. We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to dwarf-flowered heartleaf. Of the 78 populations, 75 percent are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend.

(b)(5) DPP & ACP

When dwarf-flowered heartleaf was listed (54 FR 14964; April 14, 1989), the two prominent threats identified were invasive, exotic plants and habitat loss or destruction. As discussed above, invasive, exotic species are not as significant a threat to dwarf-flowered heartleaf as originally thought. Only one of the 11 monitored populations where invasive, exotic species occur was identified as declining. Additionally, dwarf-flowered heartleaf has the capacity to withstand habitat loss and destruction due to development. The species currently has

significant redundancy (78 populations), resilient populations (33 of 78 evaluated populations with high or very high viability), and representation in two different ecological settings. Even under our high development scenario, only two high or very high viability populations are predicted to have lower viability as a result of development. Therefore, we do not believe that competition from invasive, exotic species or habitat loss and destruction are significant threats to the species. Additionally, since listing, there has been a nearly four-fold increase in the number of known populations. Of the 78 populations evaluated in the SSA, 24 (31%) have permanent protection and 18 (23%) have partial protection through voluntary agreements or other commitments of management (e.g., N.C. Department of Transportation). We conclude that the species is currently not in danger of extinction throughout its range.

(b)(5) DPP & ACP

In order to more closely examine the future threat posed by habitat loss or destruction, the Service analyzed three different development scenarios into the future to 2040. Under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (five or six) of currently low resilient populations are predicted to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Of the 78 populations evaluated in the SSA, 24 (31%) have permanent protection and 18 (23%) have partial protection through voluntary agreements or other commitments of management (e.g., N.C. Department of Transportation), reducing the likelihood of development impacting those populations. Recent examination of the species also identified climate change and invasive species as potential future threats. The broadened range (8 counties to 13) and significantly increased population numbers

(24 to 78) since listing in 1989 indicate that the species benefits from sufficient redundancy and resiliency to withstand perturbations from climate change as well as from invasive species. Based on this analysis, we conclude that the species is neither currently in danger of extinction, nor likely to become so within the foreseeable future.

(b)(5) DPP & ACP

Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range. Having determined that the dwarf-flowered heartleaf is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in a significant portion of its range—that is, whether there is any portion of the species' range for which it is true that both (1) the portion is significant; and, (2) the species is in danger of extinction now or likely to become so in the foreseeable future in that portion. Depending on the case, it might be more efficient for us to address the "significance" question or the "status" question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the other question for that portion of the species' range.

(b)(5) DPP & ACP

(b)(5) DPP & ACP

For dwarf-flowered heartleaf we chose to evaluate the status question (i.e., identifying portions where dwarf-flowered heartleaf may be in danger of extinction or likely to become so in the foreseeable future) first. We considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. We examined the following threats: development, invasive and exotic species, and climate change, including cumulative effects.

The NCNHP monitored 13 populations of dwarf-flowered heartleaf throughout the species' range. Eleven of the 13 populations had invasive, exotic species identified as a threat, indicating that invasive, exotic species are found throughout the range and not concentrated in any specific location. Climate change effects, as discussed previously, are very uniform throughout the range (NCCV 2019). The opportunity for habitat loss and destruction due to development is higher on privately owned lands that could be sold for future development (Clarke 1995, entire). Of the 78 populations evaluated, we determined that 31 percent are permanently protected and another 23 percent are partially protected (i.e., voluntary landowner agreements). The unprotected populations are spread throughout the species' range and not geographically clustered together. While there is some variability in the habitats occupied by dwarf-flowered heartleaf across its range, the basic ecological components required for the species to complete its life cycle are present throughout the habitats occupied by the 78 populations of the species. Accordingly, we found no concentration of threats in any portion of the dwarf-flowered heartleaf range at a biologically meaningful scale. Thus, there are no portions of the species' range where the species has a different status from its rangewide status. Therefore, no portions of the species' range provides a basis for determining that the species is in danger of extinction or likely to become an endangered species in the foreseeable future throughout a significant portion of its range. This approach is consistent with the courts' holdings in *Desert Survivors* v. *Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018), and *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d, 946, 959 (D. Ariz. 2017).

Deleted:

Deleted:

Deleted: 119

Formatted: Font: Calibri, 11 pt

Deleted:

(b)(5) DPP & ACP

Determination of Status

Our review of the best available scientific and commercial information indicates that the dwarf-flowered heartleaf does not meet the definition of an endangered species or a threatened species in accordance with sections 3(6) and 3(20) of the Act. Therefore, we propose to remove dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Plants (50 CFR 17.12(h)).

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Plants. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect dwarf-flowered heartleaf.

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a delisted species remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as an endangered or threatened species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2019–0081. Copies can also be obtained from the Service's Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**). We seek information, data, and comments from the public regarding dwarf-flowered heartleaf and the PDM plan. We are also seeking peer review of the draft PDM plan concurrently with this comment period. We anticipate finalizing the PDM plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are not clearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act

We have determined that we do not need to prepare an environmental assessment or environmental impact statement, as defined in the National Environmental Policy Act (42 U.S.C. 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act. We published a notice outlining our reasons for this determination in the *Federal Register* on October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands affected by this proposed rule.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081 and upon request from the Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

§ 17.12 [Amended]

2. Amend § 17.12(h) by removing the entry for "dwarf-flowered heartleaf" under "FLOWERING PLANTS" from the List of Endangered and Threatened Plants.

Dated: _____.

_____

Martha Williams
Director,
U.S. Fish and Wildlife Service.

Deleted: Aurelia Skipwith

(b)(5) DPP & ACP

Chapter 1: INTRODUCTION

The dwarf-flowered heartleaf (*Hexastylis naniflora*) is a species of plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. The dwarf-flowered heartleaf has been listed as threatened under the Endangered Species Act of 1973, as amended (Act), since 1989 (FR 54 14964-14967). The Species Status Assessment (SSA) framework (USFWS 2016, entire) summarizes the information compiled and reviewed by the US Fish and Wildlife Service (Service), incorporating the best available scientific and commercial data, to conduct an in-depth review of the species' biology and threats, evaluate its biological status, and assess the resources and conditions needed to maintain long-term viability. The intent is for the SSA to be easily updated as new information becomes available and to support all functions of the Endangered Species Program from listing to consultations to recovery.

A Recovery Plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to make significant progress toward recovery of the species. The Service is initiating this SSA to aid in determining the appropriateness of reclassifying the species. In the event that the SSA does not support reclassification, the SSA will be used to inform the development of a Recovery Plan. Importantly, the SSA does not result in a decision by the Service on whether this species should be proposed for reclassification under the Act. Instead, this SSA provides a review of the available information strictly related to the biological status of the dwarf-flowered heartleaf. The reclassification decision will be made by the Service after reviewing this document and all relevant laws, regulations, and policies. The results of a proposed decision will be announced in the *Federal Register,* with appropriate opportunities for public input.

For the purpose of this assessment, we generally define viability as the ability of the species to sustain populations in its natural systems over time. Using the SSA framework (Figure 1.1), we consider what the species needs to maintain viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation (Wolf *et al.* 2015, entire).

- **Resiliency** describes the ability of populations to withstand stochastic events (arising from random factors). We can measure resiliency based on metrics of population health;

for example, birth versus death rates and population size. Highly resilient populations are better able to withstand disturbances such as random fluctuations in birth rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic activities.

- **Redundancy** describes the ability of a species to withstand catastrophic events. Measured by the number of populations, their resiliency, and their distribution (and connectivity), redundancy gauges the probability that the species has a margin of safety to withstand or can bounce back from catastrophic events (such as a rare destructive natural event or episode involving many populations).
- **Representation** describes the ability of a species to adapt to changing environmental conditions. Representation can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. The more representation, or diversity, a species has, the more it is capable of adapting to changes (natural or human caused) in its environment. In the absence of species-specific genetic and ecological diversity information, we evaluate representation based on the extent and variability of habitat characteristics across the geographical range.

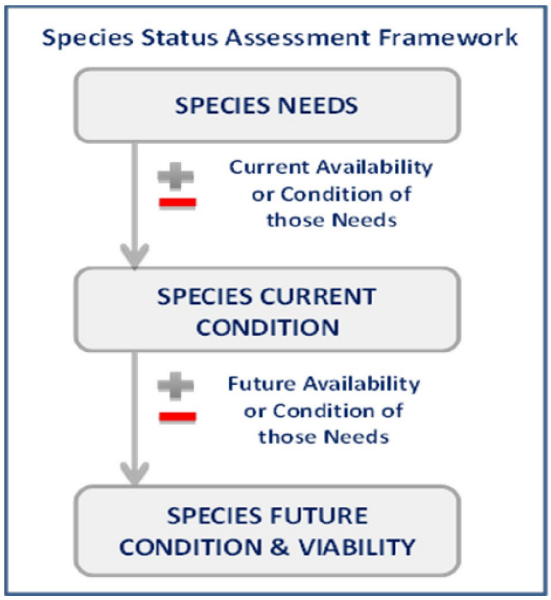


Figure 1.1. Species Status Assessment Framework

To evaluate the biological status of the dwarf-flowered heartleaf, both currently and into the future, we assessed a range of conditions to allow us to consider the species' resiliency, redundancy, and representation (together, the 3Rs). This SSA provides a thorough assessment of biology and natural history, and assesses demographic risks, stressors, and limiting factors in the context of determining the viability and risks of extinction for the species.

The format for this SSA includes: (1) Biology and Species Needs, (2) Current Conditions, (3) Influences on Viability, and (4) Future Conditions. This document is a compilation of the best available scientific and commercial information, and a description of past, present, and likely future risk factors to the dwarf-flowered heartleaf.

Chapter 2: SPECIES BIOLOGY

In this chapter, we provide basic biological information about the dwarf-flowered heartleaf, including its taxonomic history, species description, distribution, life history traits, and habitat characteristics. We then use this information to outline the resource needs within various life stages of dwarf-flowered heartleaf. Here we report those aspects of the life history of the dwarf-flowered heartleaf that are important to our analysis.

Taxonomy and species description

Dwarf-flowered heartleaf is a rare, low growing herbaceous plant in the birthwort family (Aristolochiaceae). The species was described by Blomquist (1957) in his revision of the North American members of the genus *Hexastylis*. The dwarf-flowered heartleaf has been recognized as part of the Virginica Group, and this group was further subdivided into three Subgroups: Virginica, Shuttleworthii, and Heterophylla (Blomquist 1957; Whittemore and Gaddy 1997). Three species have been recognized in the Heterophylla complex, *Hexastylis naniflora, H. heterophylla* and *H. minor*, and field biologist have generally recognized that considerable morphological overlap occurs (Murrell et al. 2007). One of the main concerns regarding this complex was the inability to distinguish between species without access to fresh flowers. Even with fresh flowers, Blomquist (1957) and Gaddy (1987) still recognized considerable overlap in flower morphology making species delineation difficult.

Murell et al. 2007, conducted a comparative genetic analysis using Inter Simple Sequence Repeats, and were unable to find banding patterns that could be used to separate *H. naniflora* from the other members within the complex. However, based on biogeographical, ecological, molecular, morphological, as well as micromorphological work, their results show that *H. naniflora* is a well-defined species.

Although there has been considerable disagreement on the generic distinctiveness of *Hexastylis* and *Asarum* (Barringer 1993 and Kelly 1997, 1998, 2001), a recent phylogeny estimate using chloroplast genes supports that *Hexastylis* is a monophyletic clade and therefore should be

recognized as a genus (Niedenberger 2010). Additionally, most North American publications recognize *Hexastylis* at the generic level (Flora of North America 1997, Weakley 2015).

The Service is not aware of any proposed changes in taxonomy that would affect the continued legal status of *H. naniflora* under the Act. However, within the range of *H. naniflora* there are populations which fall outside of the range of published values for key floral characteristics, overlapping with values described for *H. heterophylla* or *H. minor* (Figure 2.1; Weakley, 2010; Murrell et al. 2007; Gaddy 1987). These geographic areas of overlap in key characters have been the focus of recent genetic analyses (Murrell et al. 2007; Renninger, 2010; Murrell, 2015).

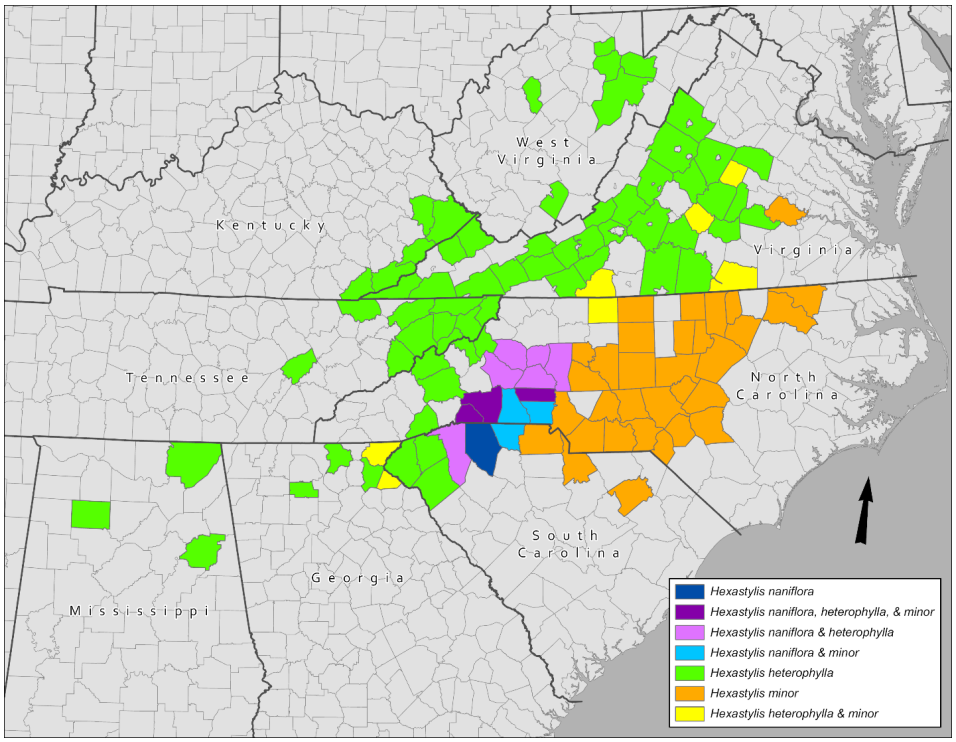


Figure 2.1. Distribution map showing county records for the three species in the *H. heterophylla* complex. Data was gathered from herbarium specimens, Element Occurrence Records (EORs) sheets and field studies. *Based on Murrell et al. 2007.*

The most outstanding characteristic of this species is the small flowers, which are one of the smallest of any species in North America (Blomquist 1957). The plant's heart shaped leaves are dark green in color, evergreen, and leathery, and are supported by long thin petioles from a subsurface rhizome. The shape of the leaf blades, their pattern of variegation, and the ridged reticulation inside the calyx-tube, place this species inside the Virginica group. It differs from all the other members of this group, aside from the small flowers, in having no flare in the calyx-tube. Maximum height rarely exceeds 15 centimeters (cm). The jug shaped flowers are usually beige to dark brown in color and appear from mid-March to early June. The flowers are small and inconspicuous and are found near the base of the petioles. The fruit matures from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981). Characteristics that distinguish it from other *Hexastylis* species are found in floral structures and pollen characters (Gaddy 1987, Padgett 2004, Niedenberger 2010). *H. naniflora* has a smaller calyx tube orifice, which is typically 5mm or less (sometimes up to 7mm) and the ovary is half-inferior, rather than superior (Blomquist 1957, Gaddy 1987, Padgett 2004, HDR 2005). Pollen surface features have also been shown to be an effective character to identify *H. naniflora*, as it has a microporate surface and, unlike any other *Hexastylis* species, lacks gemmae entirely (Padgett 2004, Niedenberger 2010).

Distribution

Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (USFWS 2010, NCNHP 2016). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include four additional counties in North Carolina. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is in Cherokee, Greenville, and Spartanburg Counties. As of 2016, the distribution of this species consisted of 113 populations distributed across 13 counties in these two states (Figure 2.2).

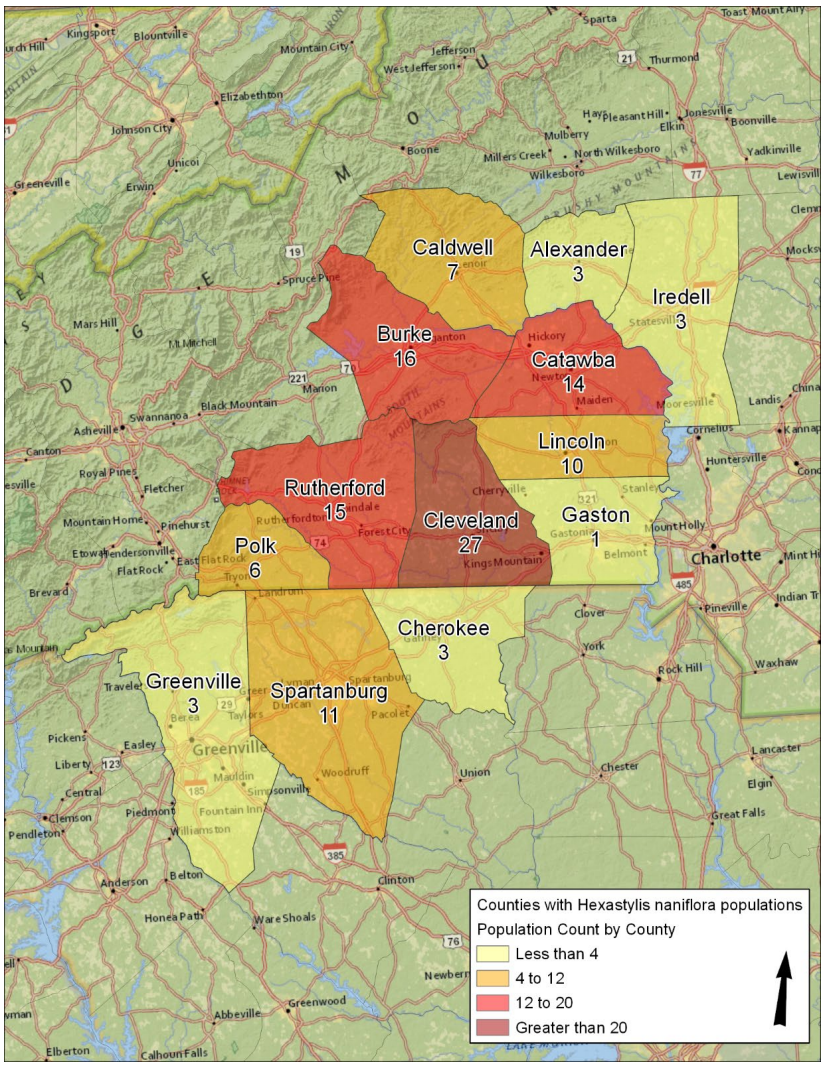


Figure 2.2. Current county distribution for dwarf-flowered heartleaf, with associated number of known populations within each county.

Many of those working with *Hexastylis naniflora* have used the terms “sub site”, “site”, “location”, “occurrence” (often, but not always, in reference to Natural Heritage Program Element Occurrence (EO) Records), “subpopulation” and “population” interchangeably. Others

have aggregated smaller sites into populations according to subjective criteria which have never been explicitly defined. This generates discrepancies among sources with respect to the abundance and distribution of the species, with the net result being that available data are usually not comparable from one source to the next. We describe how the numerous small, site-specific locations containing *H. naniflora* have been aggregated into proxies for 119 biological populations for purposes of this review, using mapping standards devised by NatureServe and its network of Natural Heritage Programs, in the Species Needs section of this report.

Life History

Demographics

The Service is aware of a single effort to collect demographic-level data (survivorship and recruitment of tagged individuals) for dwarf-flowered heartleaf. This effort was conducted during the 1990-1991 field seasons, within a portion of the Peters Creek population in Spartanburg County, SC (Newberry, 1993). This study demonstrated a 96.1% survival rate over these two consecutive seasons, with 50% of the mortality occurring in plants located at the highest position on the forested slope (away from the adjacent floodplain). Mortality was highest in small plants bearing fewer than four leaves. Plant size was variable, with the largest plant bearing 45 leaves and 33 flowers, and situated in the floodplain. In general, plants located in the floodplain were larger than plants located on adjacent slopes. The percentage of flowering plants averaged 70%, with the highest frequency of flowering occurring among plants situated in the floodplain (USFWS 2010).

Pollination and Dispersal

The pollination of *Hexastylis* has not been well studied but the genus was thought to be pollinated by insects including flies, wasps, and thrips (Otte 1977). Additionally, Lengyel et al. (2010) described how, within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal by ants). This supports Gaddy's work (1986), which found three species within the Hexastylis Heterophylla subgroup (*H. heterophylla, H. naniflora, and H. minor*), which employ myrmecochory as a method for seed dispersal.

Ants appear to be a primary dispersal agent for the dwarf-flowered heartleaf (Gaddy 1986; Jones et al. 2014). All diaspores of *Hexastylis naniflora* presented to ants (*Aphaenogaster rudis*) were quickly removed (Gaddy, 1986). This is not to say that they are not occasionally, or even frequently, dispersed and/or pollinated by other means. Jones et al. (2014) suggests that the pollination mechanism is facultative, benefiting from more than one method of pollination/fertilization. Ants were the pollinators in a controlled experiment, and their data supports that when outside molesting forces/pollinators (biotic and abiotic) were limited by their caging procedure, the efficiency of pollination decreased by almost 50%, however, caged flowers did produce seeds, indicating pollination occurred via some alternative method.

Habitat

Dwarf-flowered heartleaf appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Wagner 2013). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of a given population. With the limited range and size in populations, questions arise regarding gene flow among populations. How much is occurring and how often does it occur? It is due, in part, to narrow habitat requirements that conservation measures have been implemented for the protection of the species. Any efforts made to protect this species must consider giving protection to the available habitat.

Dwarf-flowered heartleaf occurs on piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, Weakley 2015, USFWS 2015), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993). Wagner (2013) conducted a habitat suitability study to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used for helping identify the species when not in flower

(relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants.

Soils

The species appears to be restricted to Pacolet sandy loam, Madison gravelly sandy loam, and Musella fine sandy loam soils (Gaddy 1981,1987). The species grows in acidic soils along bluffs and adjacent slopes, in boggy areas next to streams and creekheads, and along the slopes of nearby hillsides and ravines (Gaddy 1980, 1981). The plant is primarily found inhabiting north- to northwest-facing slopes, bluffs, and ravines in close proximity to creeks or streams. Within these areas exists the soil type required for *H. naniflora* to grow. It grows primarily on well-drained, sandy, acidic soils, and will not grow in heavy clay (Gaddy 1981).

The results of soil samples analyzed at the Clemson Soil Lab suggest that major differences in soil chemistry exist between the species in the *H. heterophylla* complex (Murrell et al. 2007). Statistical analysis of the soil samples showed that many of the basic elements were significantly different among the three species. Those significant differences occurred in Phosphorous (P), Potassium (K), Magnesium (Mg), Zinc (Zn), Manganese (Mn), (Na), Sodium, and Cation Exchange Capacity (CEC). Slightly significant differences were seen in Buffer pH (Bu pH), and Acidity.

Soil chemistry showed marked differences between the species in the complex (Murrell et al. 2007). The results indicated that soil chemistry is very different between *H. naniflora* and *H. minor* localities. The results also show that *H. heterophylla* and *H. naniflora* are found in soils where the chemistry is more similar, but still showed significant differences. It would appear that differentiation in soil types could be used as a proxy for species delineation. The soil analysis also indicates that soils must be considered when trying to select sites for relocation of imperiled populations of *H. naniflora*.

Thirteen population sites in North Carolina and South Carolina were examined using the Carolina Vegetation Survey (CVS) method to compare species richness between the three

species of the *Hexastylis heterophylla* complex (Murrell et al. 2007). The analysis did not show statistically significant differences among the three species in the *H. heterophylla* complex. However, *H. naniflora* appears to have an association with three oak species that is lacking in the other two species in the complex. There are a number of oak species (*Q. coccinea*, *Q. prinus* (*Q. montana*), and *Q. velutina*), that tend to co-occur with only *H. naniflora*, but are not present with the other two species in the complex. This may be the result of some microbial need or specific soil nutrient required for those species to occur in the same habitat.

Fire

There are little data on the response to fire by *Hexastylis naniflora*, however, prescribed burns have been conducted within the population at Cowpens National Battlefield in Cherokee County, SC. Preliminary data at this site and recent annual monitoring data of this population support the theory that moderate controlled burns do not negatively affect this population (Walker et al. 2009). Additionally, a dormant season wildfire in Caldwell County did not show evidence of negative impacts to a population in Caldwell County (USFWS 2010). Fire suppression could be a hazard to *H. naniflora* by allowing fire intolerant, nonnative and invasive plants to thrive, as well as the accumulation of thick duff or leaf litter that may shade low growing species (Wagner 2013).

Genetics

Analyses on ecology, morphology, soil chemistry, pollen, and molecular genetics have been evaluated for *Hexastylis naniflora* to determine the boundaries within the *Hexastylis heterophylla* complex, which consists of *H. heterophylla*, *H. minor*, and *H. naniflora* (Murrell 2015, Wagner 2013, Niedenburger 2010, USFWS 2010, Murrell et al. 2007, Padgett 2004). These analyses support the continued recognition of these taxa as well-defined, discrete species. Scanning electron microscopy (SEM) consistently distinguished *H. naniflora* from other members of the *H. heterophylla* complex based on pollen microscopy. Principal Components Analysis of floral characters and soil chemistry also consistently distinguished *H. naniflora* from *H. minor* and *H. heterophylla*. However, efforts to obtain consistently distinct banding patterns

using Inter Simple Sequence Repeats (ISSRs) were unsuccessful at distinguishing *H. naniflora* from other members of this group (Murrell et al., 2007). These results were based upon an extremely small sample size (n=10 *H. naniflora* individuals), and therefore warrant further investigation.

Field observations demonstrate that there are some populations of dwarf-flowered heartleaf with morphological characteristics that do not fit within the range of published values for key traits, overlapping with values for *H. heterophylla* or *H. minor* (Gaddy 1987, Murrell et al. 2007, USFWS 2010, Weakley 2015). These populations with overlap in key characteristics were the focus of a genetic analysis conducted at Appalachian State University (ASU) through funding provided by NCDOT (Murrell 2015). In some populations, floral characteristics are highly variable, which suggests the potential for hybridization or individuals with highly variable flower size and shape (Murrell 2015). Additionally, no vegetative characters were previously known to consistently distinguish *Hexastylis naniflora* from other close relatives. Given the difficulties with field identification of the species, particularly when not in flower, this study sought to develop a microsatellite library of molecular markers to resolve variation in populations of dwarf-flowered heartleaf and apply the markers to populations with highly variable characters, as identified by NCDOT biologists. The morphological and micromorphological information from those variable populations were compared to molecular results with morphological, micromophological, and distributional data to determine genetic structure, biological boundaries, and placement of putative hybrids or intermediate populations of *H. naniflora* (Murrell 2015).

The preliminary findings of this study suggest that populations in the southern range of dwarf-flowered heartleaf exhibit a more uniform genetic pattern, with some possible hybridization with *H. minor*. Populations in the northern part of the range appear to have hybridized with both *H. heterophylla* and *H. minor*, although there are still individuals with "pure" *H. naniflora* genotypes in the northern range (Murrell 2015). It is critical to note that although these data provide anecdotal evidence of hybridization with the *Hexastylis heterophylla* group, intraspecific variation may be caused by forces other than hybridization, such as convergent morphological evolution (Dobzhansky 1937), or the species is in the process of speciation and this study shows a case of incomplete speciation (Murrell 2015), and/or other environmental factors are at play

(Wagner 2013). On May 11, 2016, a meeting was held with USFWS, NCNHP, NCDOT, and ASU to discuss the status of *H. naniflora* and the current work being conducted among the agencies (Amoroso 2016). Based on discussions during this meeting, the results of this study reported by ASU to NCDOT in 2015 are preliminary. Dr. Matt Estep (ASU) provided additional preliminary results to NCNHP in May 2016, showing which populations were sampled, sample size, and percent of samples that show evidence of hybridization, and hybridizing with which species. ASU continues to work towards a more definitive explanation of the variation in the *H. heterophylla* complex (Murrell 2015, Amoroso 2016).

CHAPTER 3: SPECIES NEEDS

For the purpose of this report, we define viability as the ability of the species to sustain populations in the wild over time. Species with greater numbers (redundancy) of healthy populations (resiliency), encompassing a broad array of ecological and genetic diversity in a spatial arrangement that maintains adequate gene flow (representation), are more likely to be viable. Using the Species Status Assessment framework, we describe the species' viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation.

Delineating Populations

As stated in the USFWS five-year review, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to Natural Heritage Program Element Occurrence Records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This has generated considerable discrepancies among sources with respect to the number of known populations within a given area (or across the species' range), to the extent that numbers are not comparable from one source to the next. The tendency, in the past, to treat each location as a separate population also artificially inflated the actual number of populations known.

The Natural Heritage Program collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member Natural Heritage Programs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2002). Since USFWS does not maintain its own database of known locations of *Hexastylis naniflora*, it regards the NHP databases as the best repository for this information (USFWS 2010).

We delineate populations for the purposes of this SSA according to the NatureServe (2002) convention. Separation distances are a key component to delineating populations from EO records. For the dwarf-flowered heartleaf, we used the EO Data Standard which provides a Default Separation Distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several dwarf-flowered heartleaf populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Population Resiliency

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered heartleaf ecology that determine whether populations can grow to maximize habitat occupancy,

thereby increasing resiliency of populations. These factors and habitat elements are discussed below (Figure 3.1).

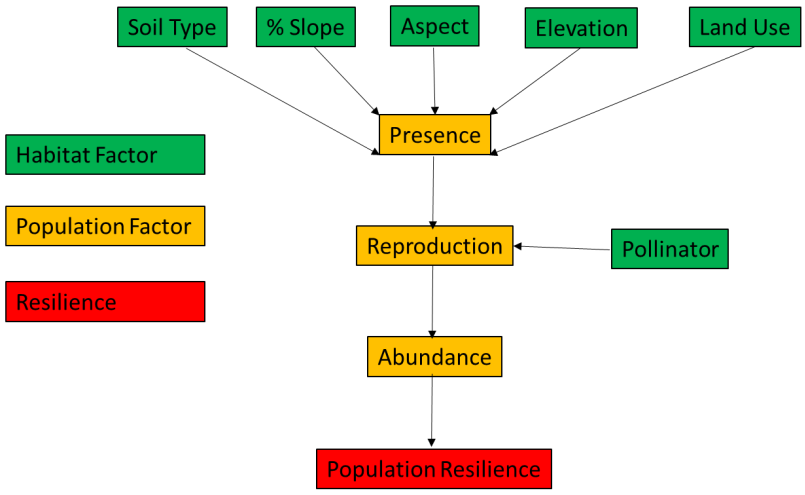


Figure 3.1. Conceptual diagram describing population and habitat factors influencing population resilience for dwarf-flowered heartleaf.

Habitat Factors: Slope, Aspect, Elevation, Soil, and Forest Type

A previous habitat suitability study attempted to quantify the habitat requirements for dwarf-flowered heartleaf (Wagner 2013). With this model in mind, and the input of species experts as to important habitat factors for the species, we used updated habitat data, as well as inclusion of updated EOs, to create a new habitat model to identify potential habitat throughout the species range. All source datasets and variables created are described in Appendix 3.

Source Data and Model Variables

Fifty-three, 10-digit hydrologic units (HUC) comprise the analysis extent (Figure 3.2). In North Carolina, it includes all 10-digit HUC that fall within the boundaries of 8-digit HUC with known occurrence of *Hexastylis naniflora*. In South Carolina, we also included all 10-digit HUC that fell within the boundaries of 8-digit HUC with known occurrence of *Hexastylis naniflora*, but

excluded the southern portions of the HUC-8 areas due to the boundaries being exceedingly large and far away from any known occurrences.

Hexastylis naniflora element occurrence data was obtained from the North Carolina Natural Heritage Program and the South Carolina Heritage Trust Program. Current populations of *Hexastylis naniflora* were identified by reviewing the last observed data in the database and excluding all populations that have not been observed since 2005 to remain consistent in our approach of assessing resiliency described previously. To represent these current population areas in Maxent, a raster cell center was retained for every 30 x 30 meter pixel that was situated within the current element occurrence data polygons.

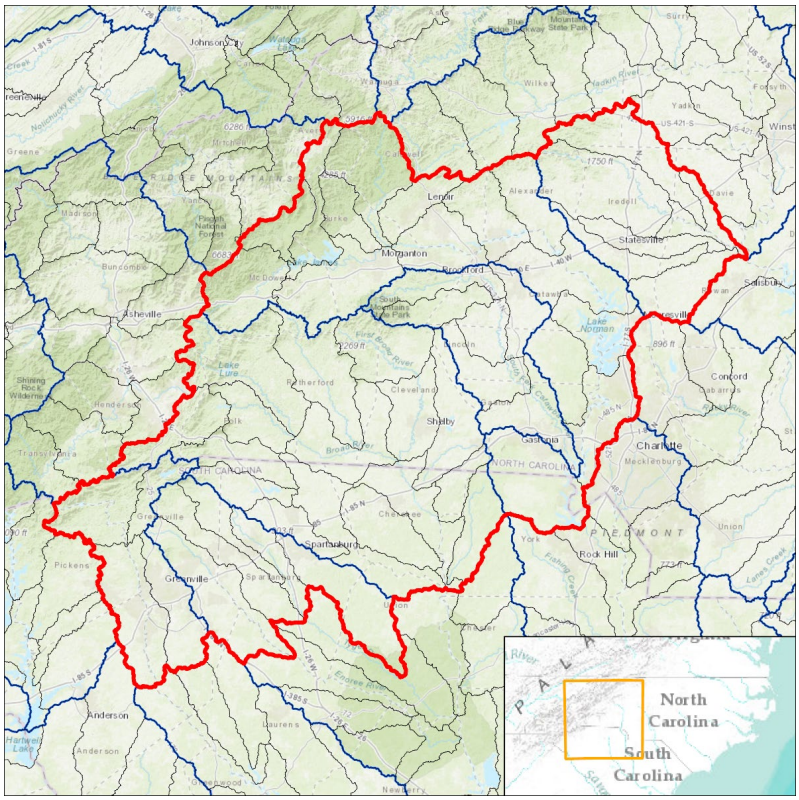


Figure 3.2. Analysis extent of the habitat model for *Hexastylis naniflora.* Red line indicates Maxent analysis extent, blue lines are 8-digit HUC boundaries, black lines are 10-digit HUC

boundaries. The orange line in the inset map indicates where the analysis extent is situated in North and South Carolina

Model Development

We used Maxent software (version 3.4.1) for species habitat modeling (Philips et al., 2018). An initial single model Maxent run was done to determine which variables could be excluded due to limited percent contribution to the model. Any variable that contributed less than 1% to the single model run results was excluded in the final model. The following variables were excluded: landcover diversity, canopy height, SSURGO drainage class, SSURGO hydrologic group, aspect 9-class, aspect 5-class, slope, solar radiation, and maximum annual temperature. It is interesting to note that a previous habitat modelling effort (Wagner 2013) included aspect and slope, whereas the Maxent model excluded these variables. This does not mean these variables are not important components of dwarf-flowered heartleaf habitat, but rather these variables did not significantly improve the model. Also, landform data was included, and perhaps landform, which includes components of aspect and slope combined is a more meaningful variable than aspect or slope independently.

For the final model, a 10-run replicate Maxent model was created using cross-validation. For replicate models, the occurrence data is randomly split into a number of equal-sized groups called “folds”, and separate models are created leaving out each fold in turn. The individual model runs are then averaged together to derive the final model.

Results

Figure 3.3 shows the model output. The minimum cutoff value (to determine if an area is considered potential habitat for a species) of 0.39 was determined by using the average 10th percentile training presence. The 10th percentile training presence uses the suitability threshold associated with the presence record that occurs at the 10th percentile of presence records (Phillips 2018). This value excludes some of the outlier population areas in the Maxent predictions to focus on the typical habitat conditions for this species. The total area ranked greater than 0.39 in the Maxent model was just 6.00% of the total analysis area (Table 3.1).

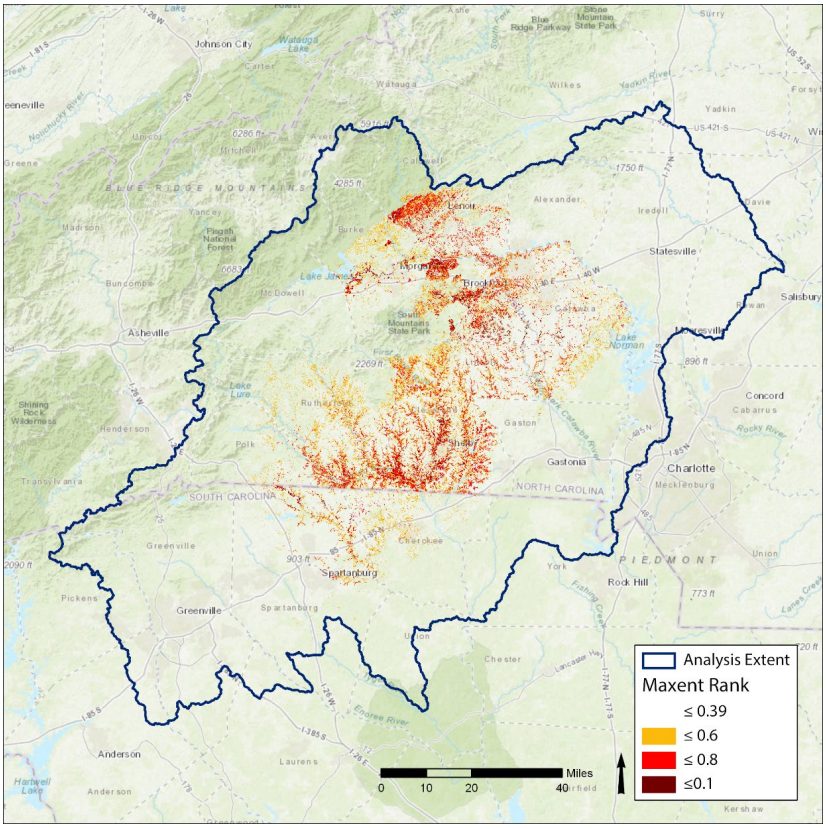


Figure 3.3. Maxent model output map

Table 3.1-Area estimates of the Maxent model

Maxent Score	Acres	Square Miles	Percent of Total
0.39 and greater	302,834.13	473.18	6.02%
0.6 and greater	128,273.52	200.43	2.55%
0.8 and greater	22,115.97	34.56	0.44%

The average area-under-curve (AUC) score for the replicate Maxent model is 0.86. The AUC is calculated from the receiver operating characteristic (ROC) plot. This value has a range of 0 – 1 and may be interpreted as a single test statistic that assesses model performance, indicating the

ability of the model to correctly classify the occurrence data used. The model performed well in its predictions, with a mean AUC of 0.86 (AUC value of 0.5 is no better than random; AUC<0.5 is worse than random; AUC>0.5 is greater predictive power than random; Baldwin 2009).

The Maxent output supplies estimates of the relative contributions of the environmental variables to the Maxent model (Table 3.2). SSURGO map unit key) is the top contributing variable. One hundred and thirty-five individual soil types are present within the polygon boundaries of the *Hexastylis naniflora* element occurrences. Many of these individual soil types are part of soil complexes and are separated by things such as percent slope, erosion, how stony/rocky, and amount of clay. The most common individual soil type was Meadowfield-Rhodhiss complex, 25 to 60 percent slopes, very stony (14.1% of total). However, collectively the Meadowfield soils only comprised 14.3% of all soils). The individual Pacolet soil types were very common and collectively comprise 36% of all soil types present. Woolwine, Rion, and Fairview soils were also collectively common, comprising 10.4%, 9.7%, and 8.8% of all soils present respectively.

Table 3.2. Percent contribution of the environmental variables

Environmental Variable	Percent Contribution
SSURGO map unit key	23.5%
Minimum Annual Temperature	17.8%
Average Annual Precipitation	15.7%
Landcover	12.9%
Landcover Majority	12.0%
Landcover Hexastylis Grouping	5.4%
Geomorphons	4.9%
Elevation	4.6%
Canopy Cover	3.2%

The minimum annual average temperature range in the analysis extent is 39 – 51 degrees Fahrenheit. The majority of the *Hexastylis naniflora* element occurrences (89%) are found at the 47 and 48 degrees. The average annual precipitation range in the analysis extent is 42 – 81

inches per year. The majority of the *Hexastylis naniflora* element occurrences (82%) are found in the 47 – 49 inches per year range.

Piedmont forested landcover habitats dominate the land area of the element occurrences. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier (53%), Southern Piedmont Mesic Forest (9%), Southern Piedmont Dry Oak-Pine Forest (5.2%), Southern Piedmont Small Floodplain and Riparian Forest (4.4%), and collectively comprise 71% of the element occurrences area. Evergreen Plantation or Managed Pine (9%), Harvested Forest (7.2%), Developed, Open Space (5%), Pasture/Hay (2.1%) collectively comprise 22% of the total element occurrence area. The remaining 6 percent of element occurrence area is comprised of a mix of 14 other natural and disturbed landcover classes, but each at small percentages.
The landcover majority classification scheme reduces the total number of landcover classes present in the analysis extent from 23 to 11. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier is still the dominant landcover class (58%). However disturbed categories are increased in area (sum total of 35%). Evergreen plantation or managed pine (12%) and Pasture/Hay (12%) are the only other categories that have at least 10% or greater area. The increase in disturbed landcover area representation in the landcover majority layer suggests that many *Hexastylis naniflora* population areas are situated in areas impacted by disturbed landcover. This is likely due to urban encroachment and increasing fragmentation of habitats.
The landcover *Hexastylis naniflora* grouping reveals the amount of disturbance present in *Hexastylis naniflora* population areas. Landcover classes grouped as disturbed comprises 27% of the total area. Mixed forest (deciduous and evergreen) comprises 58%, pasture/hay 12%, and hardwood forest 2%. Open water, evergreen and barren landcover groupings are all at less than 1% each.

Geomorphons revealed that the majority of *Hexastylis naniflora* element occurrence areas are situated in concave landforms. Geomorphon categories hollow (13%), valley (46%), and depression (10%) collectively comprise 69% of all *Hexastylis naniflora* population areas. Flat landforms comprise 15.5% of the area and convex landforms the remaining 15.5%.
Within the analysis extent, the range of elevation present is 335 – 5,265 feet. For *Hexastylis naniflora*, the prime elevation range is from 666 – 908 feet (53% of total element occurrence

area). A lesser elevation range is present from 935 – 1,184 (37% of total element occurrence area).

Canopy cover for the *Hexastylis naniflora* populations are dominated by Tree Cover 70-80% (20.2%) and Tree Cover 80-90% (63.9%). The rest of the canopy cover categories are 2% or less.

We performed a Kruskal-Wallis 1-way non-parametric Analysis of Variance (ANOVA) to investigate the relationship between Maxent scores and current resilience of populations (Table 3.3). There are significant differences in the average Maxent scores between the four resilience categories ($p = 0.04$) and the mean Maxent score increases as population resilience increases from low to very high. The model gives us some predictive ability regarding habitat suitability where higher Maxent scores, on average, result in higher population resilience.

Table 3.3 Results of the Kruskal-Wallis 1-way non-parametric ANOVA investigating relationships between Maxent scores and current resilience groups for dwarf-flowered heartleaf.

Groups	*Count*	*Mean Rank*
low	13	30.7
moderate	25	30.7
high	5	42.8
very high	28	45.7

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	4375.7	4	1093.92	2.65	0.0404
Within Groups	28036.3	68	412.30		
Total	32412.0	72			

Reproduction and Presence of Pollinators

The pollination of *Hexastylis* has not been well studied but the genus is thought to be pollinated by insects including flies, wasps, and thrips (Otte 1977). Additionally, Lengyel et al. (2010) described how, within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal via ants). This supports Gaddy's work (1986), which found three species within the Hexastylis Heterophylla subgroup (*H. heterophylla, H. naniflora, and H. minor*), which employ myrmecochory as a method for seed dispersal.

Because the flower for this species is oftentimes partially or completely covered with soil and leaf litter, possibly inhibiting pollinator activity (Gonzalez 1972), there is still uncertainty in the pollination mechanism for dwarf-flowered heartleaf. Otte (1977) suggests that a variety of possible pollinators reside in this leaf litter, however, the calyx opening is considered to be far too small for efficient pollinating (Gaddy 1981). There are, however, invertebrates within this proposed size limit that could theoretically act as pollinators. It is possible that the species employs self-pollination, with or without a vector, or that cross-pollination occurs by a number of invertebrates. Jones et al. (2014) investigated pollination of dwarf-flowered heartleaf under a manipulative experimental design, and found that while insects may play a significant role in pollination, even without them, flowers managed to produce a partial seed set. However, two points need to be considered here. First, although flowers managed to produce seeds in the absence of insect pollinators, the efficiency of pollination decreased by almost 50%. Also, even if successful pollination occurs in the absence of insect vectors, the dispersal of plants amongst populations would be limited, and could result in decreased resilience due to genetic concerns such as limited gene flow and issues associated with potential inbreeding depression.

Abundance

The influence of stochastic variation in demographic (reproductive and mortality) rates is much higher for small populations than large ones. Stochastic variation in demographic rates causes small populations to fluctuate randomly in size. In general, the smaller the population, the greater the probability that fluctuations will lead to extinction. There are also genetic concerns with

small populations, including reduced availability of compatible mates, genetic drift, and inbreeding depression. Small populations of dwarf-flowered heartleaf have low resilience, leaving them particularly vulnerable to stochastic events.

As of 2016, the combined databases of the NCNHP and SCDNR contain 239 Element Occurrence Records (EORs) for *H. naniflora* (NCNHP 2016, SCDNR 2016). These EORs depict roughly 113 locations which are sufficiently geographically distinct to be regarded as proxies for populations of the species (See *Delineating Populations*). Thus, the total number of populations has increased more than four-fold (from 24 to 113) since the species was listed in 1989.

At this time, the largest known populations have been monitored by NCNHP and NCDOT. The estimates for entire populations are based on a consistent monitoring methodology developed by NCDOT, USFWS, and NCNHP with monitoring plots representing roughly 10% of a population. Populations were delineated to get a more accurate boundary and size of the area occupied. All rosettes are counted annually in each monitoring plot to estimate an extrapolated population size, based on the number and density in the plots. As a result of these efforts, better estimates of population sizes for the largest known populations are available, compared to when the last five-year review was completed in 2010 (Robinson and Padgett 2016).

The 113 EORs have been estimated to contain anywhere from a single rosette to over 100,000 rosettes. Appendix 1 was created by NCNHP (2016) to replicate the same format and population data as Table B2 of the most recent USFWS five-year review of *H. naniflora* (USFWS 2010), for comparison of changes since 2010, and summarizes the largest occurrences of *H. naniflora*, with the size of the population based on the number of rosettes it was last estimated to contain. The number of populations estimated to contain over 1,000 rosettes is 26. This is approximately 23% of the total known populations and many of these populations contain well over 1,000 individuals.

There are, however, 13 populations (12% of all known) that are simply known to be extant, with no available estimate of population size (NCNHP 2016, SCDNR 2016). If the most recent population estimates for each EOR are compiled across years of observation, the 113 populations

could conservatively be estimated to contain a collective total of more than 300,000 rosettes (NCNHP 2016, SCDNR 2016).

Population Trends

Although abundance is critical in assessing the resilience of dwarf-flowered heartleaf, trends in population growth can also be informative. Long-term growth trends are typically defined as the degree of change in population size over 200 years, whereas short-term growth is typically measured as that degree of change over a 10 year period. We lack a robust data set to assess trends at either of these time scales. However, from 2012-2016, NCNHP conducted systematic annual surveys of thirteen of the largest populations across the range.

Based on the results of the five-year monitoring efforts completed in 2016, nine out of thirteen populations remain stable during the five years of data collection (Robinson and Padgett 2016). The largest known population, Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop in Rutherford County, NC, is estimated to have over 100,000 rosettes (Robinson and Padgett 2016). This large population consists of many scattered subpopulations on private property; two of the subpopulations are protected as a Registered Heritage Area, although Registry is a non-binding agreement with landowners that can be cancelled at any time (NCNHP 2018).

Two of the thirteen populations increased in numbers from 2012-2016: Cliffside Steam Station and Broad River: Floyds Creek, Long Branch. The Cliffside Steam Station is protected with a voluntary agreement with Duke Energy and was estimated to contain over 39,000 rosettes in 2016. The Broad River: Floyds Creek, Long Branch population is not at all protected, but was last estimated to consist of over 12,000 individuals in 2016 (Robinson and Padgett 2016).

Based on the results of recent surveys and a review of all known populations of *Hexastylis naniflora*, the overall trend over approximately 30 years is estimated to be declining 10-30%. This is estimated by a combination of documented declines of some populations, while many others appear to be remaining relatively stable, and some have increased.

Chapter 4: CURRENT CONDITIONS

Below we assess current resilience, representation, and redundancy as they relate to population and habitat factors known to be important for species viability. Based off of recent reports (Robinson and Padgett 2016; Robinson 2016), the species consists of 119 populations distributed across 12 counties in North Carolina and South Carolina. Populations are composed of both multiple EOs and stand-alone EO records. Recent genetic research discussed in Chapter 2, suggests that dwarf-flowered heartleaf, as originally described, is found in the southern portion of its presumed range based on current EO locations, and the northern portion could be a currently undescribed species (Figure 4.1; Estep pers. Comm. 2018). The genetic analysis to support this is complete, but a review of the morphology is ongoing and a new species has not yet been described (Estep pers. Comm. 2018). For the purpose of this SSA, we assume all EO detections are *H. naniflora*, and represent the best currently available scientific data.

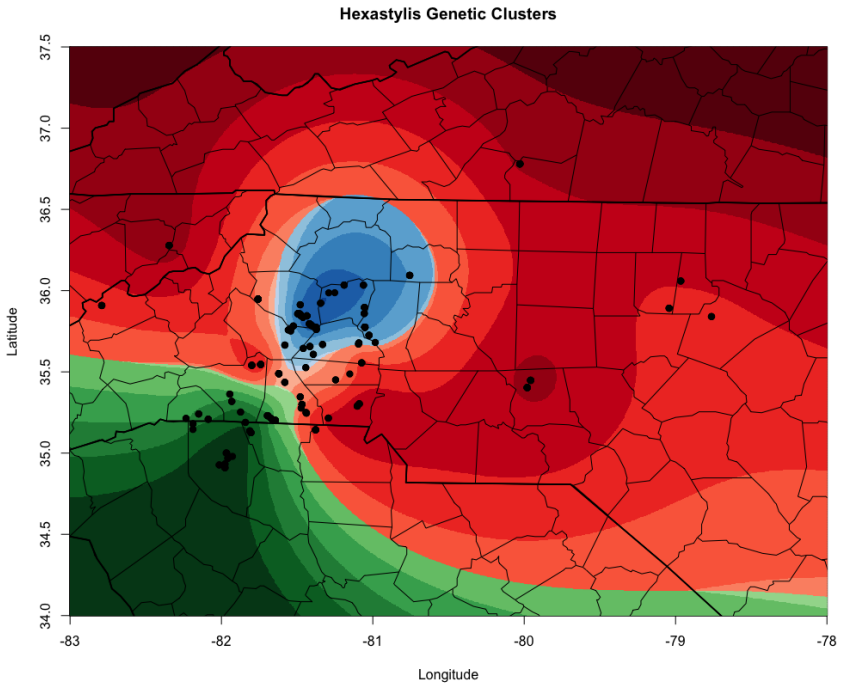


Figure 4.1. Recent genetic analyses detailing clustering of the genus Hexastylis. Black dots represent GIS locations of individual plants included in the genetic analysis. Green areas represent "true" *H. naniflora*; Blue represents a possible new species; Red represents other species in the genus (*H. minor, H. heterophylla*, etc.).

Current Population Resilience

Categorizing Resilience

For the purposes of this SSA, we use population size as the main driver of population resilience. The unit of measurement for population size in this species is a "clump" (rosette). As discussed previously, populations in North Carolina were delineated by NCNHP, whereas the Service defined populations in South Carolina. These delineations were based off of NatureServe criteria such as EO separation distance and intervening landscape matrix. EO data included a wide range of years since the species was last observed at a given location (1964-2017), so although recent reports suggest the species consists of 113 populations, some of that data is fairly outdated. For the purposes of this SSA, we only used EOs that were observed since 2005. We did this for several reasons. First, we did not want to go back too far and assume a population was still present. Second, we wanted to be consistent in what we considered "current" for both categorizing resilience and use in the habitat model (discussed later). Also, experts concurred that records as old as 12 years are still likely to persist. Finally, there was a natural break in the data at the year 2005, coinciding with the year the last five-year review was initiated, where the number of EOs dropped off significantly in the years 2004 and earlier. It is important to note that many of the populations that we excluded from our analysis may still persist on the landscape. In fact, many EOs for this species have persisted for decades, despite not having intervening surveys to confirm their persistence.

Deleted: R

Based on the criteria (excluding EOs prior to 2005), there are currently 78 populations distributed across the range of dwarf-flowered heartleaf, although this may be an underestimate as discussed above.

To determine overall resilience for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resilience categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are also incorporated secondarily. Appendix 2 shows the NCNHP EO rank specifications for dwarf-flowered heartleaf. The EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, given there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, depending on habitat conditions; poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016; Robinson and Padgett 2016) focus monitoring studies on populations with greater than 1,000 individuals, populations that are assumed to be very viable. Because we do not have habitat level information for every population we assessed, we synthesized all of the above population size information and created four resilience categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Occupancy and Abundance

There are 78 populations of dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). Table 4.2 shows the contribution of each resilience category as follows: 36% (very high); 7% (high); 34% (moderate); 23% (low). When looking at cumulative percentages of resilience, it is interesting to note that 77% of all of the populations are classified as moderate to very high resilience (Table 4.2).

Table 4.1. Current populations of dwarf-flowered heartleaf and associated resilience across the species range. Abundance and last observation date based on Natural Heritage Program data (2018).

Site Name	State	County	Last Observed	Total plants	Resilience
Glade Creek, Alex County	NC	Alexander	2017	>1000	very high
Catawba River: Hoyle Crk-Micol Crk	NC	Burke	2013	>1000	very high
Island Creek Heath Bluff	NC	Burke	2016	>1000	very high
Gunpowder Creek: South of Hudson	NC	Caldwell	2012	>1000	very high
Peaked Top Rare Plant Site/Foothills Landfill	NC	Caldwell	2014	>1000	very high
Jacob Fork West Corridor	NC	Catawba	2012	>1000	very high
Murrays Mill/Upper Balls Creek NA	NC	Catawba	2013	>1000	very high
NCDOT TIP: R-2824	NC	Catawba	2015	>1000	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	NC	Catawba	2013	>1000	very high
Cowpens NBF - Site 1	SC	Cherokee	2016	>1000	very high
Cliffside Steam Station	NC	Cleveland/Rutherford	2016	>1000	very high
Broad River/Sandy Run NA	NC	Cleveland	2012	>1000	very high
Broad River: Brushy Creek	NC	Cleveland	2016	>1000	very high
Buffalo Creek: Kings Mountain Res	NC	Cleveland	2016	>1000	very high
Buffalo Creek: Tributaries N and S of SR 2047	NC	Cleveland	2012	>1000	very high
Rhyne Conservation Preserve	NC	Lincoln	2016	>1000	very high
Mill Creek Forest and Seep	NC	Polk	2016	>1000	very high
New Hope Springhead Swamp	NC	Polk	2016	>1000	very high
Big Horse Creek Rare Plant Site	NC	Rutherford	2015	>1000	very high
Broad River: Floyds Creek	NC	Rutherford	2016	>1000	very high
Davenport Road/Mountain View Rare Plant Site	NC	Rutherford	2016	>1000	very high
Facebook Site	NC	Rutherford	2016	>1000	very high
Floyds Creek Tributray Rare Plant Site	NC	Rutherford	2012	>1000	very high
New Bethel Rare Plant Site	NC	Rutherford	2015	>1000	very high
Richardson Creek trib above Toms Lake	NC	Rutherford	2016	>1000	very high
DNR Peters Creek Heritage Preserve	SC	Spartanburg	2016	>1000	very high
Taylor Blalock Res	SC	Spartanburg	2016	>1000	very high
Leepers Creek Heartleaf Site	NC	Lincoln	2006	>1000	very high
Little Gunpowder Creek Rare Plant Site 1	NC	Caldwell	2015	500-1000	high
Little Gunpowder Creek Rare Plant Site 2	NC	Caldwell	2015	500-1000	high
Northern Catawba County	NC	Catawba	2017	500-1000	high

Site Name	State	County	Last Observed	Total plants	Resilience
Rock Barn Solar Farm	NC	Catawba	2010-2011	500-1000	high
Buffalo Creek Rare Plant Site	NC	Cleveland	2012	500-1000	high
Third Creek Rare Plant Site	NC	Alexander	2010	100-500	moderate
Hickory Area	NC	Burke/Catawba/Caldwell	2016	100-500	moderate
Burke County - Drowning Creek UT	NC	Burke	2017	100-500	moderate
Simms Hill/Little River Uplands	NC	Burke	2015	100-500	moderate
Smith Cliff/Henry Fork River	NC	Burke	2015	100-500	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	NC	Catawba	2016	100-500	moderate
NCDOT TIP R-2824	NC	Catawba	2015	100-500	moderate
South Fork Catawba River, Henry Fork	NC	Catawba	2007	100-500	moderate
Broad River/Sandy Run NA	NC	Cleveland	2012	100-500	moderate
Brushy Creek Headwaters	NC	Cleveland	2014	100-500	moderate
First Broad River: Crooked Run Creek	NC	Cleveland	2010	100-500	moderate
No Business Creek, Boyd Tract	NC	Cleveland	2007	100-500	moderate
West Shelby Mesic Slope	NC	Cleveland	2016	100-500	moderate
UT of Kings Mountain Res	NC	Gaston	2012	100-500	moderate
Buffalo Shoals Creek	NC	Iredell	2014	100-500	moderate
Cat Square Heartleaf Forest	NC	Lincoln	2012	100-500	moderate
Collinsville (Hughes) Creek Slopes	NC	Polk	2016	100-500	moderate
Fox Knoll Farm	NC	Polk	2016	100-500	moderate
Forest City: Adj to Isothermal CC	NC	Rutherford	2010	100-500	moderate
Jonas Road Rare Plant Site	NC	Rutherford	2014	100-500	moderate
Knob Creek NA	NC	Cleveland	2005	100-500	moderate
Buffalo Creek	NC	Cleveland	2005	100-500	moderate
Kross Keys NA	NC	Polk	2005	100-500	moderate
Catawba River: North Fork Mountain Creek	NC	Catawba	2005	100-500	moderate
Catawba River: Lake James	NC	Burke	2006	100-500	moderate
Hogpen Branch Transplant Site	NC	Rutherford	2005	100-500	moderate
NCDOT TIP R-3603A	NC	Alexander	2017	<100	low
South Mountains Pleasant Grove Uplands	NC	Burke	2016	<100	low
Gunpowder Creek	NC	Caldwell	2012	<100	low
Killian Crossroads	NC	Catawba	2010	<100	low
Pott Creek	NC	Catawba	2012	<100	low
Beaverdam Crk at First Broad River	NC	Cleveland	2011	<100	low
Buffalo Creek: Potts Creek	NC	Cleveland	2012	<100	low
Buffalo Creek: Ravine	NC	Cleveland	2007	<100	low
Hickory Creek - UT (Shelby High School)	NC	Cleveland	2016	<100	low
Boulder Creek Subdivision - Jordan Road	SC	Greenville	2016	<100	low
Gateway Elementary School	SC	Greenville	2017	<100	low
Fanjoy Road Site	NC	Iredell	2015	<100	low
Levan Family Farm	NC	Iredell	2013	<100	low

Site Name	State	County	Last Observed	Total plants	Resilience
Lincoln County, SR-1314	NC	Lincoln	2014	<100	low
Northeast Lincolnton: UT Walker Branch	NC	Lincoln	2009	<100	low
Sandy Spring Church Springhead Swamp	NC	Polk	2005	<100	low
First Broad River: Hickory Creek	NC	Cleveland	2006	<100	low
Smith Cliff/Henry Fork River	NC	Burke	2005	<100	low
First Broad River: Beaverdam Creek Tribs	NC	Cleveland	2006	<100	low

Table 4.2. Population resilience categories by county for dwarf-flowered heartleaf.

County	Very High	High	Moderate	Low	Totals
Alexander	1		1	1	3
Burke/Catawba/Caldwell			1		1
Burke	2		4	2	8
Caldwell	2	2		1	5
Catawba	4	2	4	2	12
Cherokee	1				1
Cleveland/Rutherford	1				1
Cleveland	4	1	7	6	18
Gaston			1		1
Greenville				2	2
Iredell			1	2	3
Lincoln	2		1	2	5
Polk	2		3	1	6
Rutherford	7		3		10
Spartanburg	2				2
Totals	**28**	**5**	**26**	19	**78**
% of total	*36*	*7*	*34*	*23*	*100*
Cumulative %	*40*	*43*	*77*	*100*	--

Deleted: 18

Population Trends

Although we lack an adequate past time series of abundance data for all populations to estimate growth rates or population trends, NCNHP conducted surveys of thirteen of the largest populations across the range of the species from 2012-2016. Table 4.3 shows the results of all of these surveys. Two populations show an increasing trend, nine show a stable trend, and two show a decreasing trend.

Table 4.3. Summary of population trends over 5 years of monitoring data for 13 of the largest populations of dwarf-flowered heartleaf across its range (from: Robinson and Padgett 2016).

Trend	Survey	Site	2016 estimated number of plants (Rosettes)	2016 area occupied (Acres)
Increasing	NCNHP	Cliffside Steam Station (EO 276)	39,535	52
	NCNHP	Broad River: Floyds Creek, Long Branch (EO 177)	12,687	5.67
Stable	NCNHP	Island Creek Bluff/Love Lady Site (EO 029)	50,481	61.76
	NCNHP	Rhyne Preserve (EO 302)	19,873	22.43
	NCNHP	Mills Creek Forest and Seep (EO 023)	1,733	1.39
	NCNHP	New Hope Springhead Swamp (EO 125)	12,235	5.03
	NCNHP	Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop (EO099)	106,940	83.39
	NCNHP	Broad River: Cleghorn Creek, US 221 (EO 176)	6,750	7.24
	NCNHP	Cowpens National Battlefield (SC EO 016, 017, 018)	2,823	6.05
	NCNHP	Peters Creek Preserve (SC EO 011)	3,306	8.98
	NCNHP	Blalock Reservoir (SC EO 007, 031)	3,505	7.59
Decreasing	NCNHP	Second Broad River (Forest City Industrial Complex) (EO 154)	2,576	4.74
	NCNHP	South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)	123	0.09

Current Species Representation

Representation describes the ability of a species to adapt to changing environmental conditions. We lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species.

Current Species Redundancy

For the dwarf-flowered heartleaf to maintain viability, the species also needs to exhibit some degree of redundancy. Species-level redundancy reflects the ability of a species to withstand catastrophic events, and is best achieved by having multiple, widely distributed populations relative to the spatial occurrence of catastrophic events. Redundancy for dwarf-flowered heartleaf is the total number and resilience of population segments and their distribution across the species range.

An important question when investigating redundancy for dwarf-flowered heartleaf is, "what exactly is a catastrophe?" We consider a catastrophe to be any population level disturbance that has the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, like hurricanes, and often with devastating effects, however they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010).

As stated previously, there are 78 populations of dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). The populations are spread across the range, although a majority occur in North Carolina. Although, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances, the species range is very small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

CHAPTER 5: INFLUENCES ON VIABILITY

Hexastylis naniflora populations occur in rapidly growing urban areas with expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. In addition to threats associated with residential, commercial, and industrial development, other documented threats include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of ponds, impacts from grazing cattle, ORV damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or siltation (NCNHP 2016, Robinson and Padgett 2016). Climate change may exacerbate these risk factors through changes in temperature and precipitation.

Threats were assessed for populations monitored by NCNHP during 2012-2016 (Robinson and Padgett 2016), and EOs were reviewed for other documented threats to populations. Indirect or direct threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank for each threat factor determines the overall value for each threat observed at each population. No significant changes in threats within populations were noted from 2012-2016. Threats observed during these years included development, incompatible forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and road construction.

Below, we summarize primary threats to the viability of dwarf-flowered heartleaf. Primary influences will be carried forward in our future projections in the next section.

Human Population Change

Increasing human populations drive development. With increases in population, there will be increasing conversion of open space to more impervious cover, with a subsequent increase in roads and other associated infrastructure. Increases in roads and impervious cover have the potential to lead to habitat loss and/or fragmentation, a primary risk factor for dwarf-flowered

heartleaf. Tables 5.1-5.2 and Figures 5.1-5.2 show the estimated human population increases for North Carolina and South Carolina counties within the range of the species. The most populous counties include Greenville and Spartanburg in South Carolina, and Catawba, Gaston and Iredell counties in North Carolina.

Table 5.1-Human population projections for North Carolina counties within the range of dwarf-flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

County	2018	2023	2028	2033	2037
Alexander	38,609	39,244	39,686	39,992	40,169
Burke	90,865	93,124	95,382	97,644	99,452
Caldwell	83,919	86,723	88,689	91,126	92,870
Catawba	157,424	159,799	162,175	164,549	166,447
Cleveland	98,862	99,685	100,004	100,128	100,170
Gaston	221,112	227,667	237,344	245,276	252,388
Iredell	179,740	195,623	211,501	227,383	240,088
Lincoln	84,494	91,034	96,865	103,069	107,858
Polk	21,273	21,823	22,288	22,681	22,955
Rutherford	67,880	68,154	68,283	68,341	68,368

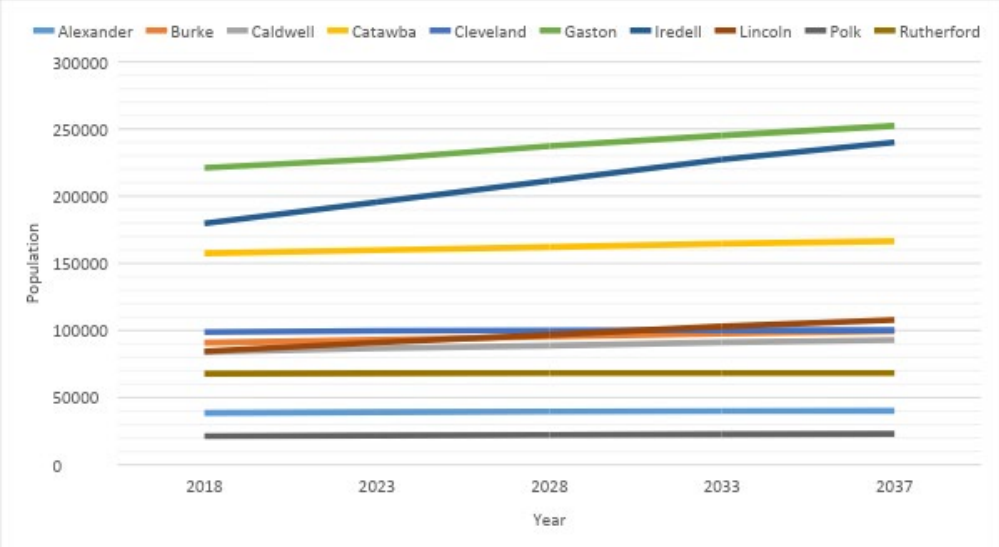


Figure 5.1- Human population projections for North Carolina counties within the range of dwarf-flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

Table 5.2- Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

County	2020	2025	2030	2035
Cherokee	61,760	64,760	67,350	70,170
Greenville	492,890	517,740	542,290	567,010
Spartanburg	310,220	323,550	336,810	350,110

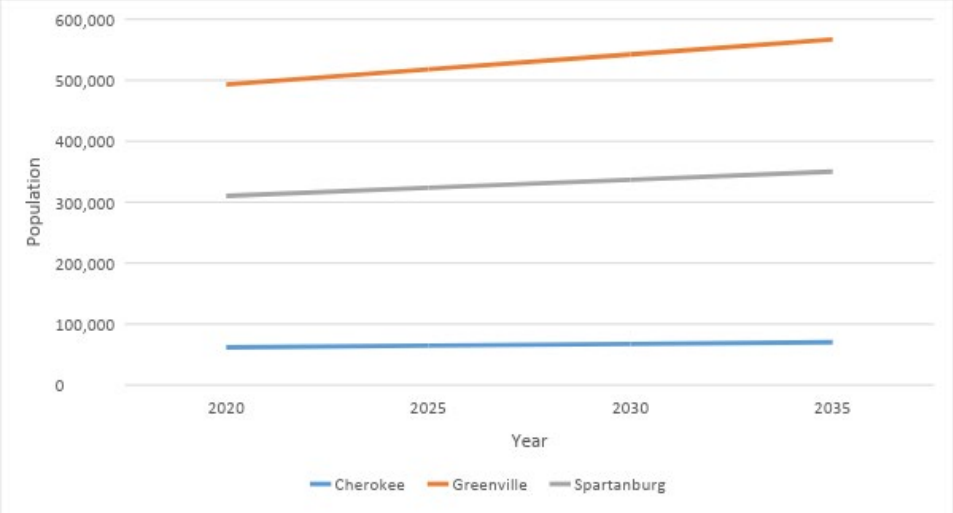


Figure 5.2. Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

Development

A large number of the known populations occur near expanding urban areas and are threatened by the residential, commercial, and industrial development associated with this growth. Populations occurring in more rural areas are threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds.

A 2010 review of existing NHP EOR data revealed that all or portions of 26 populations (24% of the total) had been directly or indirectly impacted through development projects or other causes such as trash disposal, expansion of residential lawns, cattle, or invasive exotics (NCNHP 2010; SCDNR 2010). Another 16 populations have been specifically reported to be threatened by one or more of these same sources. Therefore, threats have either occurred or are reasonably foreseeable within 42 of the 113 populations (corresponding to 37% of all known populations). Of these 42 populations, all or portions of 22 (50%) had been adversely impacted by activities

requiring ESA Section 7 consultation with the USFWS. The fact that nearly 20% of all known populations had been subject to formal Section 7 consultation illustrates the threats faced by the species.

In the same 2010 review, the most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving *H. naniflora* is road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations between the USFWS and the NCDOT. Collectively, these projects have adversely impacted or are currently expected to impact some 22,135 rosettes. In most cases the Section 7 process has resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection to those plants remaining (post-construction) within NCDOT right-of-way (ROW).

Other forms of economic development have also resulted in the destruction or modification of habitats occupied by *H. naniflora*; in many cases, these activities have also required Section 7 consultations with the USFWS. Examples of these activities include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities (in compliance with Federal Aviation Administration standards) at a regional airport. Collectively, these activities have involved the loss or relocation of several thousand rosettes.

Blalock Reservoir in Spartanburg County, South Carolina was once estimated to contain the largest population of *H. naniflora*, with over 11,000 rosettes reported here in 1997 (JJ&G, 1998). This population was the subject of a section 7 consultation as a result of a proposal to raise the elevation of Blalock Reservoir, which provides water supply storage to Spartanburg County and the City of Spartanburg (USFWS, 2001). Approximately one-third of this population was directly threatened by inundation, and the Federal agency committed to the relocation of some 3,054 rosettes to remaining areas of occupied habitat around the reservoir. At the conclusion of formal section 7 consultation, the USFWS anticipated that as many as 6,619 rosettes (assuming that all transplants survived) would be afforded protection through restrictive covenants placed on properties owned by the Spartanburg Water System (SWS) surrounding Blalock Reservoir.

However, this population was last reported to contain a mere 1,400 rosettes (Newberry, 2006), and has twice since been impacted by encroachments from adjacent landowners (Newberry, 2009; Schneider, 2006, and JJ&G, 2006). Some of these apparent declines could be partially an artifact of incomplete survey effort, in that the exhaustive surveys which led to the 1997 estimate (of 11,000 rosettes) have never been repeated. However, it seems unlikely that plants occurring on privately owned shoreline not subject to restrictive covenants would be any more stable than those occurring on properties specifically protected and managed for the species (by SWS).

Invasive Species and Woody Encroachment

Several of the known populations of dwarf-flowered heartleaf occur on steep ravine slopes which also support stands of mixed hardwoods with an understory of mountain laurel (*Kalmia latifolia*) or *Rhododendron spp*. These stands are often very dense and reduce the amount of light reaching the dwarf-flowered heartleaf plants growing below. Under these conditions the plants often show reduced vigor and reduced flower and fruit production. Careful, selective logging or natural tree fall and limited understory removal would open up these populations to more light. Additional light, if not accompanied by increased siltation from the intensive soil disturbances associated with forest clear-cutting, probably would benefit these populations (Gaddy 1981).

Invasive exotic plant species are rampantly spreading throughout riparian corridors and ravines across the range of this species (USFWS 2011). Invasive exotics such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum* spp.), Japanese honeysuckle (*Lonicera japonica*) and Japanese Nepal grass (*Microstegium vimineum*) are known to threaten several populations; however, the scope and magnitude of this threat has not been comprehensively assessed. This threat requires active management in order to be successfully abated. At present, the majority of protected populations are secured against habitat conversion, but lack designated managers with the technical expertise and available resources (funding and personnel) to address this threat.

Climate Change

There is a growing concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074; Golladay *et al.* 2004, p. 504; Cook *et al.* 2004, p. 1015). Because typical habitats for this species include moist soils adjacent to creeks, streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993), specific effects of climate change to the dwarf-flowered heartleaf are likely related to changes in soil moisture associated with potential increases in drought.

Warming in the Southeast is expected to be greatest in the summer (NCCV 2016) which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p.7; NCCV 2016). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p.7).

Despite the recognition of potential climate effects on ecosystem processes, there is uncertainty about what the exact climate future for the Southeastern US will be and how the ecosystems and species in this region will respond. Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. As a result, impacts from rapid urbanization in the region might be exacerbated under even a mild to moderate climate future.

Regardless of a pessimistic, optimistic, or status quo climate future, the following systematic changes are expected to be realized to varying degrees in the Southeastern US (IPCC 2013):

- More frequent drought
- More extreme heat (resulting in increases in air and water temperatures, Figure 5-3)

- Increased heavy precipitation events (e.g., flooding)
- More intense storms (e.g., frequency of major hurricanes increases)
- Rising sea level and accompanying storm surge

In recent years, the Southeast has experienced moderate to severe droughts that many observers have implicated in population declines and poor transplant survivorship (NCNHP, 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). The extent to which these climate changes will significantly affect populations of dwarf-flowered heartleaf is currently unknown.

Appendices 4a and 4b gives summary reports on historical and future predicted climate parameters from the USGS National Climate Change Viewer for both North Carolina and South Carolina. As discussed above, the trend for these States is consistent with the general trend in the Southeast: more frequent drought, more extreme heat, and increased precipitation events. If these predictions hold true, dwarf-flowered heartleaf habitat would likely be impacted through increased evaporative rates and decreased soil moisture (Appendices 4a and 4b), increased potential for catastrophic wildfire events, as well as potential disruption of stream bank morphology through increased flooding events. Our habitat model indicates a preferred temperature and precipitation range, indicating that the species would be sensitive to a changing climate.

Chapter 6: FUTURE CONDITION

Future Considerations

Our analysis of the past, current, and future influences on what the dwarf-flowered heartleaf needs for long term viability revealed that there are several influences that pose risks to future viability of the species. These risks are primarily related to habitat changes from development and long term climate change. We use projections of urban development to assess potential habitat loss and fragmentation. We also considered how climate change may exacerbate the impacts of development in a qualitative fashion using a narrative approach.

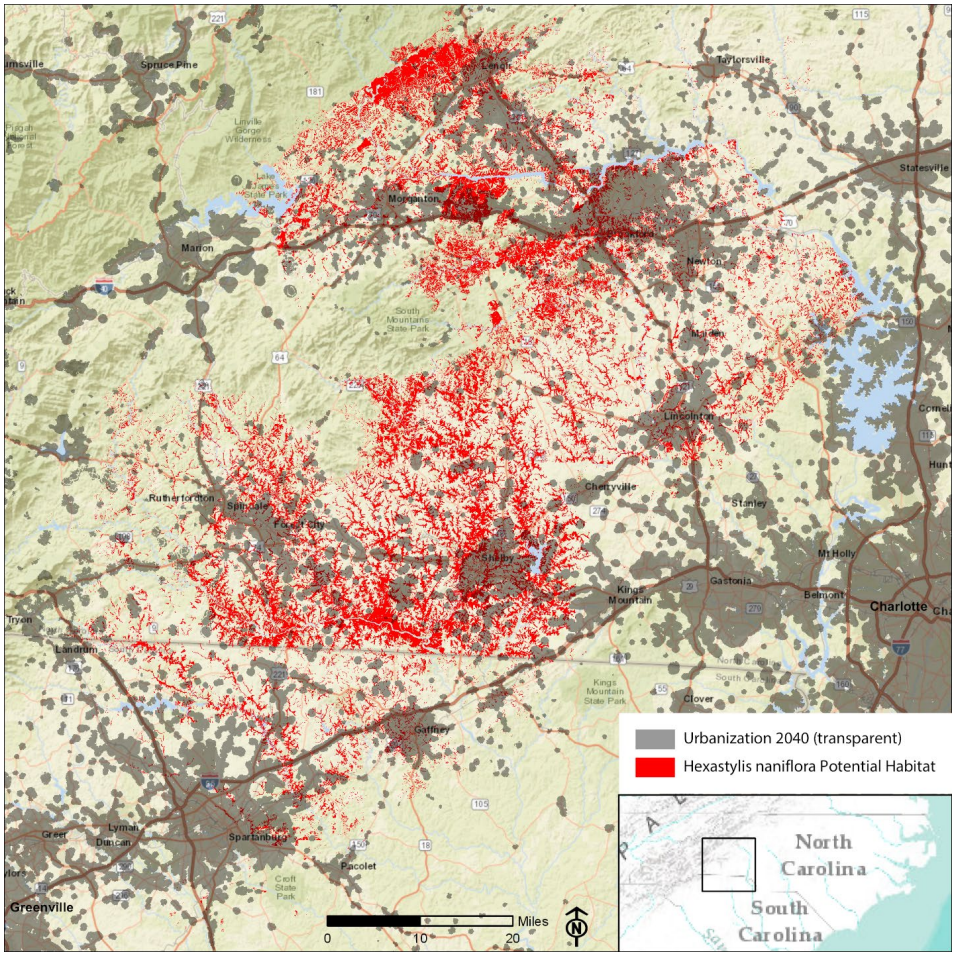
Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below. Based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape, we chose to project populations out to the year 2040 under each scenario, but no further.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040 (Figure 6.1). SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise

known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995).

Figure 6.1. Results of the SLEUTH model with *Hexastylis naniflora* potential habitat predicted by the MAXENT model overlaid.



The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and other SSAs, and this threshold represents a highly likely outlook for urbanization of the

landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations (from Current Conditions—68 populations)
- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There is no data available on the exact relationships between urbanization and the impacts to dwarf-flowered heartleaf. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative impacts; development increase of at least 50% was likely to have significant impacts to populations. We also assume that populations currently on protected lands are likely to see smaller impacts from urbanization compared to those that are not protected, but protection status (perpetuity vs non-perpetuity) matters. For example, Registered Heritage Areas are non-binding agreements with a land owner, and if the land changes ownership, or the owner decides not to continue with the agreement, then the Registry is no longer valid. Appendix 5 shows the protection status of each delineated population which helped to inform our assessment of resilience under each scenario.

Commented [RNR1]: Is this Appendix 4?

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. We believe this is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider for Current Conditions include detections that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to persist. Dwarf-flowered heartleaf is a long-lived perennial, and several EOs have been revisited

after more than 10 years and the species was present. For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future, was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resilience of that population.

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics including resilience category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resilience categories were assessed using last known abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score was calculated by taking the mean Maxent score of all potential habitat within the 1,000 foot buffer. The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 foot buffer that falls within the highest habitat class. Together, these two habitat metrics give

general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 foot buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-flowered heartleaf is likely to persist. Table 6.1 (North Carolina) and 6.2 (South Carolina) show all of the EOs we considered and the corresponding metrics associated with resilience categories, urban development, and habitat scores.

Table 6.1. North Carolina raw data for metrics assessed to investigate potential sites where dwarf-flowered heartleaf was historically found and is likely to persist. Resilience categories are based on last known abundance estimates as follows: 1 = low; 2 = moderate; 3 = high; 4 = very high. MAXENT Average Mean refers to the mean Maxent score of all potential habitat. % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat that falls within the highest habitat class. % Urban Development refers to the percentage of the 1,000 foot buffer around the EO that is projected to be urbanized in the year 2040.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	2	34	1	3
2				
3	2	22	0	10
4	2	22	0	7
5	2	21	0	0
6				
8	1	27	0	6
9	3	44	4	0
10	4	33	2	0
11				
12	4	54	10	0
13	1	31	1	30
14	2	61	16	7
15				
16	4	18	0	47
17	1	50	13	0
18	1	36	8	2
19				
20	2	22	1	88
21	2	34	4	54

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
23	4	15	0	8
25	1	47	15	30
27				
28	2	43	12	29
29	4	43	8	30
30	4	27	2	74
31	4	30	3	86
32	2	34	2	47
33	2	33	3	0
34	1	49	13	63
35	1	42	10	23
36	1	19	0	12
37	4	41	6	17
38	2	14	0	46
39	1	19	0	11
40	2	37	2	32
44	4	20	0	59
45	1	27	5	13
46	3	42	6	6
47	1	28	1	96
48	1	14	0	12
49	4	61	14	5
50				
51	4	52	11	18
52	2	46	4	0
53	1	35	4	24
54	1	35	1	10
55	4	30	0	0
56	2	40	2	6
57	2	21	0	80
58	1	42	5	0
59	2	11	0	49
60	1	25	0	2
61	3	41	0	0
62	2	34	0	0
63	1	27	0	6
64	2	39	9	11
69	2	46	11	19
70	2	38	1	0
71	2	30	2	0

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
72	2	52	14	0
73	4	60	17	1
74	3	65	14	4
75	4	47	6	9
76	4	42	4	10
77	3	31	1	27
79	2	39	1	0
80	1	43	4	15
83	2	17	0	11
84	2	13	0	1
85	2	42	4	5
87				
89	2	13	2	0
90	2	28	2	0
91	1	49	5	0
92	2	15	0	30
106	4	39	4	38
107	1	14	0	40
113	4	46	4	7
114				
115	2	37	3	26
118	3	42	0	9
121	2	41	5	0
122	1	12	0	39
124	1	12	0	9
125	4	15	0	41
130	2	17	0	24
149	4	64	17	3
151	2	16	0	27
154	4	30	1	22
157	2	20	0	0
158	3	36	7	5
159	4	62	24	60
160	3	62	24	32
161	4	64	28	30
162	1	32	2	58
163	2	15	0	56
164	3	18	0	52
165	1	13	0	56
166	1	14	0	40

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
167	4	30	0	20
168	4	19	0	34
169	1	30	0	12
170	2	17	0	40
172	1	39	3	7
173	2	30	1	48
174	1	42	4	16
175				
180	2	21	1	0
181	4	29	2	0
182	4	45	4	0
183	2	15	0	5
184	4	19	0	19
187	2	20	1	35
188	2	24	0	53
189	1	25	0	14
190				
191	2	34	2	0
192	2	35	3	0
193	2	36	7	6
194	4	51	14	18
195	1	21	0	96
196	1	23	4	67
197	4	35	8	38
198	2	32	6	25
199	2	29	5	43
200	1	26	2	87
201	1	39	4	63
202	4	35	4	85
203	1	43	4	49
204				
205	2	43	1	49
206	1	37	3	66
207	2	33	2	85
208	1	32	1	67
209	2	33	2	94
210				
212	1	37	3	85
213	1	36	4	72
219	1	32	1	4

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
222	2	23	3	7
223				
224	1	22	3	17
225	2	24	2	12
227	4	55	2	5
229	2	28	0	21
230	1	54	15	13
231	1	41	7	0
233	4	53	12	14
235	2	50	8	6
236	2	62	14	5
237	2	67	16	5
238	4	51	15	0
239	2	63	14	5
240	1	57	18	0
241	2	62	16	3
242	1	53	9	0
246	1	62	13	4
249	4	47	5	0
250	4	45	4	0
251	4	43	4	0
254	2	54	18	6
255				
256	2	54	15	13
258	3	19	0	51
259	4	25	0	0
262	4	29	2	50
263				
264				
265				
266				
267	2	29	1	0
268	1	33	2	0
269	2	49	17	0
270	1	46	18	1
271	1	26	7	0
272	1	33	0	71
273	2	28	2	0
274	2	50	8	0
275	2	12	0	0

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
276	4	42	5	21
277				
278				
279	1	32	4	89
280	2	64	30	30
281	1	64	31	36
282	1	64	31	51
283	1	65	34	59
284	1	64	35	45
286				
287	2	15	0	35
291	2	21	1	84
292	2	14	0	83
293	1	8	0	16
294	2	36	4	61
296	2	3	0	5
297				
298	2	16	0	1
299	1	12	0	0
300	1	9	0	18
303	2	31	0	0
304	2	31	0	0
305	1	30	2	0
306	1	4	0	53
308	2	15	0	3
309	1	5	0	0
310	4	58	26	35
311	2	15	0	0
312	4	17	0	57
313				
314				
315	1	36	4	61
317	1	15	0	53
318	2	34	4	52
319	4	43	4	10
320	4	41	6	98
321				

Min	1	3	0	0
Max	4	67	35	98

Table 6.2. South Carolina raw data for metrics assessed to investigate potential sites where dwarf-flowered heartleaf was historically found and is likely to persist. Resilience categories are based on last known abundance estimates as follows: 1 = low; 2 = moderate; 3 = high; 4 = very high. MAXENT Average Mean refers to the mean Maxent score of all potential habitat. % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat that falls within the highest habitat class. % Urban Development refers to the percentage of the 1,000 foot buffer around the EO that is projected to be urbanized in the year 2040.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	2	21	0	0
2	2	1	0	4
3				
4	1	13	0	10
5	2	0	0	64
6	1	0	0	36
7	4	27	0	35
8	2	0	0	14
9				
10				
11	4	14	0	52
12				
13	1	7	0	100
14	4	14	0	43
15	1	0	0	4
16	4	22	0	38
17	4	22	0	33
18	3	19	0	52
19	1	12	0	65
20	2	5	0	100
21	3	5	0	90
22	1	0	0	0
23				
24	1	4	0	3
25	1	14	0	48
26	4	12	0	65
27	4	18	1	40

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
28	4	19	1	49
29				
30	2	7	0	88
31	4	0	0	0
32	2	7	0	93
33	2	2	0	20
34	1	31	3	1
35	1	23	1	53
36	2	6	0	0
37	1	24	2	0
38	4	5	0	37
39	1	6	0	1
40	2	6	0	20
41	1	11	0	87
42	2	3	0	6
43	1	23	0	43
44				
45				
46	1	10	0	96
47				
48				
49	3	8	0	70
50	2	5	0	54
51	1	0	0	35
52	3	0	0	0
53	2	10	0	66
54	2	9	0	91
55	1	4	0	99
56	2	14	0	96
57	3	15	0	38
59	2	4	0	17
60	4	17	1	12
Min	1	0	0	0
Max	4	31	3	100

Next, we implemented a set of ranking rules using the data from Tables 6.1 and 6.2 to further assess which EOs had a higher likelihood of persistence on the landscape. We used SMART

methodology to quantify and implement our ranking rules. Because the metrics of interest vary in data type (i.e. categorical vs continuous) and range of values (i.e. not all continuous variables have the same maximum and minimum), our first step was to normalize all of the data on a scale of 0-100. Normalization techniques allow for aggregation of criteria with numerical and comparable data. We decided to analyze North and South Carolina data separately because the Maxent model predicts habitat differently across state lines due to differences in soil classification. We weighted each variable according to our opinion of the level of contribution each variable had to the probability of persistence of that particular EO. This resulted in abundance having the highest weight (100%), with habitat (as calculated by average Maxent score) and urbanization given relatively similar weighting (80%). The results of the normalization procedure and weighting can be found in Tables 6.3 and 6.4.

Table 6.3. Normalized scores for SMART analysis of North Carolina EOs and weighting scores. Resilience category represents the normalized scoring based on the last known abundance (0=low; 33=moderate; 67=high; 100=very high); MAXENT Mean is the normalized score of the average Maxent rank of all potential habitat; MAXENT percent 0.8-1 represents the normalized score of the percentage of potential habitat that falls within the highest rank category; 80% or greater SLEUTH Percent of Total is the total amount of current urbanization plus predicted urbanization at year 2040 (>80% probability) from the SLEUTH model.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	33	49	3	97
2				
3	33	30	0	90
4	33	29	0	93
5	33	28	1	100
6				
8	0	37	0	94
9	67	65	11	100
10	100	46	6	100
11				
12	100	80	28	100
13	0	43	2	69
14	33	90	44	93
15				

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
16	100	23	0	52
17	0	73	37	100
18	0	52	22	98
19				
20	33	30	3	11
21	33	48	12	45
23	100	19	0	92
25	0	68	42	69
27				
28	33	62	33	71
29	100	63	22	69
30	100	38	5	24
31	100	43	8	12
32	33	48	5	52
33	33	47	8	100
34	0	73	37	35
35	0	60	29	77
36	0	25	0	88
37	100	60	17	82
38	33	17	0	53
39	0	24	0	89
40	33	54	7	67
44	100	26	1	40
45	0	37	14	86
46	67	60	18	94
47	0	39	2	2
48	0	17	0	88
49	100	91	39	95
50				
51	100	77	31	82
52	33	68	11	100
53	0	50	11	76
54	0	49	1	90
55	100	43	0	100
56	33	58	7	94
57	33	28	0	19
58	0	60	15	100
59	33	12	0	50
60	0	34	1	98
61	67	59	1	100

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
62	33	49	0	100
63	0	38	0	94
64	33	56	24	88
69	33	67	31	80
70	33	55	3	100
71	33	42	5	100
72	33	77	41	100
73	100	89	48	99
74	67	97	41	95
75	100	69	16	91
76	100	61	11	89
77	67	43	2	72
79	33	56	4	100
80	0	62	11	85
83	33	22	0	89
84	33	15	0	99
85	33	61	10	95
87				
89	33	15	5	100
90	33	38	5	100
91	0	71	13	100
92	33	18	0	70
106	100	56	10	61
107	0	16	0	59
113	100	68	11	93
114				
115	33	53	8	74
118	67	61	1	91
121	33	59	13	100
122	0	14	0	60
124	0	13	0	91
125	100	19	0	58
130	33	22	0	76
149	100	95	49	97
151	33	20	0	72
154	100	41	2	78
157	33	26	0	100
158	67	51	20	95
159	100	92	69	39
160	67	92	69	68

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
161	100	95	79	69
162	0	45	7	41
163	33	18	0	43
164	67	24	0	47
165	0	16	0	43
166	0	16	0	59
167	100	41	0	79
168	100	25	0	65
169	0	42	0	88
170	33	22	0	60
172	0	56	8	93
173	33	42	3	52
174	0	62	12	84
175				
180	33	28	2	100
181	100	41	6	100
182	100	66	12	100
183	33	18	1	95
184	100	24	0	81
187	33	27	2	64
188	33	33	0	46
189	0	33	1	86
190				
191	33	48	7	100
192	33	49	10	100
193	33	51	19	94
194	100	75	40	81
195	0	28	0	3
196	0	30	10	32
197	100	50	24	61
198	33	45	18	74
199	33	41	14	56
200	0	35	6	11
201	0	56	11	36
202	100	49	11	13
203	0	62	11	50
204				
205	33	62	4	50
206	0	52	8	33
207	33	47	4	14

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
208	0	45	4	32
209	33	46	5	4
210				
212	0	53	9	14
213	0	52	11	27
219	0	45	2	96
222	33	31	9	92
223				
224	0	29	8	83
225	33	32	6	88
227	100	81	7	95
229	33	39	0	79
230	0	80	44	87
231	0	59	20	100
233	100	79	34	86
235	33	74	22	94
236	33	93	41	95
237	33	100	46	95
238	100	74	41	100
239	33	94	40	94
240	0	85	51	100
241	33	93	47	97
242	0	78	27	100
246	0	93	38	95
249	100	68	13	100
250	100	65	12	100
251	100	62	11	100
254	33	80	51	93
255				
256	33	80	44	87
258	67	25	0	48
259	100	34	0	100
262	100	41	6	49
263				
264				
265				
266				
267	33	41	3	100
268	0	46	7	100
269	33	72	49	100

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
270	0	67	52	99
271	0	35	19	100
272	0	47	0	28
273	33	39	7	100
274	33	73	23	100
275	33	14	0	100
276	100	61	14	79
277				
278				
279	0	46	11	9
280	33	95	85	70
281	0	95	88	64
282	0	96	88	48
283	0	97	95	40
284	0	95	100	54
286				
287	33	18	0	64
291	33	28	4	14
292	33	16	0	16
293	0	7	0	84
294	33	52	11	38
296	33	0	0	95
297				
298	33	20	0	99
299	0	13	0	100
300	0	9	0	82
303	33	44	1	100
304	33	43	0	100
305	0	42	5	100
306	0	1	0	46
308	33	18	0	97
309	0	3	0	100
310	100	86	75	64
311	33	19	0	100
312	100	22	0	42
313				
314				
315	0	51	10	38
317	0	19	0	46
318	33	48	12	47

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
319	100	63	12	89
320	100	60	17	0
321				

Weights			
100	60	20	80

Table 6.4. Normalized scores for SMART analysis of South Carolina EOs and weighting scores. Resilience category represents the normalized scoring based on the last known abundance (0=low; 33=moderate; 67=high; 100=very high); MAXENT Mean is the normalized score of the average Maxent rank of all potential habitat; MAXENT percent 0.8-1 represents the normalized score of the percentage of potential habitat that falls within the highest rank category; 80% or greater SLEUTH Percent of Total is the total amount of current urbanization plus predicted urbanization at year 2040 (>80% probability) from the SLEUTH model.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	33	67	14	100
2	33	2	0	96
3				
4	0	42	3	90
5	33	0	0	36
6	0	0	0	64
7	100	87	2	65
8	33	0	0	86
9				
10				
11	100	43	0	48
12				
13	0	23	0	0
14	100	43	0	57
15	0	0	0	96
16	100	72	1	62
17	100	70	1	67
18	67	62	0	48
19	0	37	0	35

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
20	33	16	0	0
21	67	15	0	10
22	0	1	0	100
23				
24	0	13	0	97
25	0	44	0	52
26	100	40	0	35
27	100	56	18	60
28	100	60	28	51
29				
30	33	22	0	12
31	100	0	0	100
32	33	23	0	7
33	33	5	0	80
34	0	100	100	99
35	0	75	34	47
36	33	18	0	100
37	0	78	66	100
38	100	16	0	63
39	0	19	0	99
40	33	18	0	80
41	0	36	0	13
42	33	10	0	94
43	0	72	0	57
44				
45				
46	0	32	0	4
47				
48				
49	67	27	0	30
50	33	16	0	46
51	0	1	0	65
52	67	0	0	100
53	33	33	0	34
54	33	29	0	9
55	0	13	0	1
56	33	43	0	4
57	67	47	8	62
59	33	13	0	83
60	100	53	21	88

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
	Weights			
	100	60	20	80

To determine a final rank for likelihood of persistence, we calculated a weighted sum for each EO. We then converted the weighted sum to a final rank value that ranged from 0-100. Finally, we determined the top 10% or 90th percentile, and top 25% or 75th percentile ranking for EOs in each state. Table 6.5 summarizes the final ranks and top 10% and 25% percentile ranks for North and South Carolina. We will include the top 10% in the status quo scenario, and the top 25% in the conservation scenario.

Table 6.5. Final Rank Scores for EOs in North and South Carolina. Dark green represents the top 10% of scores, and light green includes the top 25% of scores.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

South Carolina		North Carolina	
EO_Code	Final Score	EO_Code	Final Score
60	79	149	94
7	79	73	93
17	75	49	92
16	74	12	90
27	71	238	90
28	70	161	88
31	69	227	87
14	66	249	86
11	63	233	86
38	62	182	85
34	61	250	85
1	60	251	84
26	59	194	84
52	56	51	84
57	56	310	84
18	55	75	84
37	54	113	84
36	48	319	81
42	44	76	81

2	43
40	42
59	41
49	41
8	39
33	39
4	37
39	35
35	34
43	34
24	33
21	32
22	31
53	31
50	31
15	30
25	26
56	24
5	24
54	22
30	22
32	20
51	20
6	20
19	19
20	17
41	12
46	8
13	5
55	3
3	0
9	0
10	0
12	0
23	0
29	0
44	0
45	0
47	0
48	0

74	81
10	80
181	79
55	79
37	79
276	78
259	77
159	77
29	76
160	73
167	72
9	72
154	72
23	71
106	71
197	71
61	70
46	70
184	69
237	69
158	68
118	68
241	68
239	67
236	66
14	66
72	64
168	64
254	64
269	64
262	64
280	63
274	62
256	62
125	61
235	60
52	60
16	60
121	58
77	58
85	57

79	57
44	57
70	57
312	56
192	56
56	56
69	55
33	55
30	55
191	55
193	55
64	55
62	55
202	55
240	54
1	54
303	54
246	54
71	54
320	54
304	54
267	53
273	53
90	53
31	53
28	51
242	51
17	51
5	50
180	50
270	50
157	50
222	49
230	49
115	48
281	48
91	48
4	48
298	48
311	48
225	48

198	47
89	47
3	47
84	47
308	47
275	47
183	46
40	46
284	46
258	46
231	46
229	46
58	46
164	46
83	45
282	44
18	44
205	43
172	42
296	42
283	42
268	42
80	41
130	41
174	41
305	41
199	41
271	40
25	40
32	40
219	40
35	40
151	40
54	39
318	39
187	39
173	39
92	39
21	39
60	38
63	38

8	38
294	37
169	37
287	37
170	36
45	36
53	36
188	34
189	34
299	34
38	33
224	33
39	33
36	33
13	32
309	31
124	31
59	31
48	31
34	30
203	30
163	30
207	28
293	27
300	27
57	25
209	25
201	25
315	24
291	24
162	23
20	23
206	23
107	22
166	22
122	22
292	21
213	21
208	20
272	20
317	19

196	18
212	17
165	17
306	14
279	14
200	12
47	10
195	7
2	0
6	0
11	0
15	0
19	0
27	0
50	0
87	0
114	0
175	0
190	0
204	0
210	0
223	0
255	0
263	0
264	0
265	0
266	0
277	0
278	0
286	0
297	0
313	0
314	0
321	0

Below we describe how we integrated potential positive and negative influences across the scenarios. We can assume there is some tipping point at which an area becomes so urbanized it is unsuitable for dwarf-flowered heartleaf, but we don't know exactly what that tipping point is. Similarly, we can assume additional populations are likely to be found or rediscovered across the

range, but there is no clear way to predict the exact number or location of these populations. Although there is great uncertainty associated with how the species will be influenced by these factors, the three scenarios are intended to capture the range of this uncertainty. Note, changes in climate have potential to exacerbate the effects of urbanization, but these effects are not likely to occur within our projection window (e.g. 2040).

Status Quo Scenario

Under the status quo scenario, we assume a few populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the % increase in urban development and whether a population is protected or not. We assessed population resilience under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no negative impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

High Development Scenario

Under the high development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization that are relatively high, and are also affected by whether a population is protected or not. We assessed population resilience under the following assumptions:

- No additional populations are identified as persisting
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
        - Voluntary protection/non-perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold; extirpation of populations if % increase in urbanization exceeds >90% threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we assume it is likely several additional populations (i.e. more than status quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resilience under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold

- Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

Future Resilience

Our focus on future resilience of dwarf-flowered heartleaf is on the potential impacts from urbanization. Table 6.6 shows a summary of currently delineated populations and the predicted urban development to occur within each of the populations. The table only includes those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Populations not included in this table are not predicted to be urbanized at all, so for the purposes of future analysis, will be assumed to retain the same resilience category as current. For those populations included in the table, we focus on those populations that are anticipated to increase in urbanization beyond a threshold value, depending on the scenario, but thresholds include >25% and >50% increases. Also taken into account is whether or not a population is on protected lands, and if so, whether the population is protected in perpetuity or not. Below is a summary of projected future resilience under each of the three scenarios.

Table 6.6. Results of the SLEUTH model. Populations consist of both stand-alone EOs and aggregates of multiple EOs following the definition of delineating demographic populations from Chapter 4. Included are only those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Red cells indicate populations that are predicted to increase >50% in urbanization. Orange cells indicate populations that are predicted to increase >25% in urbanization.

Population Number	Total Area (sq m)	Already classed Urban	80% chance	90% chance	95% chance	97.5% chance	100% chance	>80%
206	17346.37096	0.40%	0.00%	0.00%	0.00%	6.24%	93.41%	99.65%
306	7804.656249	0.00%	15.11%	49.91%	7.83%	0.00%	22.40%	95.24%
208	55360.86786	17.31%	0.00%	0.00%	0.00%	0.00%	82.69%	82.69%
279	1951.661571	0.00%	0.00%	0.00%	0.00%	0.00%	80.85%	80.85%
214	15043.2984	0.00%	0.00%	1.44%	10.97%	0.00%	55.72%	68.13%
248	25486.15611	28.80%	0.00%	3.22%	0.02%	0.02%	53.03%	56.30%
316	43177.79587	20.06%	0.00%	16.68%	7.08%	0.00%	20.67%	44.43%
247	49898.17159	5.87%	0.00%	6.37%	0.00%	0.00%	23.35%	29.73%
291	11666.76374	35.39%	12.28%	13.53%	2.43%	0.00%	0.23%	28.47%
287	7901.775408	0.00%	0.00%	11.50%	0.00%	0.00%	14.25%	25.75%
312	6535.273235	0.00%	25.28%	0.00%	0.00%	0.00%	0.00%	25.28%
32	31220.60253	60.74%	0.00%	20.39%	0.00%	0.00%	0.00%	20.39%
177	26954.54153	25.34%	12.19%	0.92%	0.10%	5.31%	0.13%	18.66%
292	15611.18205	0.00%	0.00%	0.00%	0.00%	0.00%	18.40%	18.40%
261	21644.22924	0.00%	0.00%	13.21%	3.35%	0.00%	0.00%	16.56%
295	23486.00987	18.20%	0.00%	3.41%	11.99%	0.25%	0.00%	15.65%
125	20742.3249	0.00%	1.02%	5.65%	0.00%	6.67%	0.00%	13.34%
59	8172.007769	0.00%	13.09%	0.00%	0.00%	0.00%	0.00%	13.09%
302	120342.0641	1.46%	2.55%	2.55%	0.77%	2.33%	3.98%	12.19%
178	376781.2214	28.59%	2.79%	2.40%	0.68%	0.59%	2.64%	9.11%
93	43754.11642	0.19%	0.00%	0.00%	0.00%	0.00%	7.82%	7.82%
77	6044.427562	0.00%	1.51%	6.14%	0.00%	0.00%	0.00%	7.64%
179	15145.19453	85.06%	1.14%	0.00%	5.12%	0.00%	0.49%	6.75%
44	15081.76951	61.17%	0.27%	0.00%	0.00%	0.00%	4.68%	4.95%
252	39595.93143	63.47%	0.00%	3.80%	0.00%	0.00%	0.00%	3.80%
100	423621.7376	9.01%	1.32%	1.10%	0.72%	0.14%	0.00%	3.27%
276	123688.7819	0.61%	0.36%	1.87%	0.01%	0.00%	0.00%	2.24%
216	66424.06073	0.00%	0.91%	0.00%	0.00%	0.00%	0.00%	0.91%
154	33924.92259	0.00%	0.00%	0.37%	0.00%	0.00%	0.00%	0.37%
29	249998.8742	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.05%
1	30711.68144	0.41%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2	36339.91976	11.32%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3	24498.03483	24.77%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
31	42929.76479	100.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
96	95947.32128	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
130	1168.240433	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
176	39787.48373	0.89%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
195	7805.599588	99.94%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
317	584.7346337	99.70%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
318	5396.859208	99.74%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
320	125.5182447	98.79%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Status Quo Scenario

In the Status Quo scenario, there are predicted to be 75 populations of dwarf-flowered heartleaf on the landscape (Table 6.7). The predicted resilience of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the seven additional populations predicted to persist under this scenario, four are in South Carolina, and three in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), and moderate (4).

Table 6.7. Predicted resilience categories for *Hexastylis naniflora* populations under the Status Quo scenario, and comparison to current condition.

Site Name	Current Resilience	Status Quo
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	high

Site Name	Current Resilience	Status Quo
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributray Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	high
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate

Site Name	Current Resilience	Status Quo
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	low
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low
EO 194 (North Carolina)	n/a	present
EO 60 (South Carolina)	n/a	present

Commented [RNR2]: If you'd rather put names for these. 194 is First Broad River: unnamed tributary. 60 is Cherokee Creek/Bonner and Robin School Roads.

High Development Scenario

In the High Development scenario, there are predicted to be 72 populations of dwarf-flowered heartleaf on the landscape (Table 6.8). The predicted resilience of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No new future populations are predicted to be discovered. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to moderate resilience; one high resilience population is predicted to drop to moderate; two moderate populations are predicted to drop to low resilience; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Table 6.8. Predicted resilience categories for *Hexastylis naniflora* populations under the High Development scenario, and comparison to current condition.

Site Name	Current Resilience	High Development
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	moderate
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributary Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	moderate
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate

Site Name	Current Resilience	High Development
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	extirpated
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low

Site Name	Current Resilience	High Development
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low

Targeted Conservation Scenario

In the Targeted Conservation scenario, there are predicted to be 79 populations of dwarf-flowered heartleaf on the landscape (Table 6.9). The predicted resilience of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations discovered to persist, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the sixteen additional populations predicted to persist under this scenario, ten are in South Carolina, and six in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), moderate (11), and low (2).

Table 6.9. Predicted resilience categories for *Hexastylis naniflora* populations under the Targeted Conservation scenario, and comparison to current condition.

Site Name	Current Resilience	Targeted Conservation
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high

Site Name	Current Resilience	Targeted Conservation
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	high
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributray Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	high
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate

Site Name	Current Resilience	Targeted Conservation
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	low
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low
EO 194 (North Carolina)	n/a	present
EO 72 (North Carolina)	n/a	present
EO 118 (North Carolina)	n/a	present
EO 60 (South Carolina)	n/a	present
EO 34 (South Carolina)	n/a	present
EO 1 (South Carolina)	n/a	present

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resilience and extirpation of a few populations

Commented [RNR3]: See above

Commented [RNR4]: See above

Commented [RNR5]: 1 – Cherokee Creek/SC11
34 – Arrowood Branch
118 – Big Island Carolina Hemlock Bluff
72 – First Broad Hop-Hornbeam NA

is offset by the fact that several additional populations were found to persist in the Status Quo and Targeted Conservation scenarios. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resilience in several additional populations. Regardless of the scenario, the majority of the populations expected to persist on the landscape in 2040 are of at least moderate resilience.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances, however the species range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

Given that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where we have relatively few current populations. As discussed below, we believe there are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, we believe our scenarios do not predict declines in species representation.

Table 6.10. Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	CURRENT	STATUS QUO	HIGH DEVELOPMENT	TARGETED CONSERVATION
VERY HIGH	28	27	27	27
HIGH	5	6	4	6
MODERATE	26	23	25	23
LOW	19	17	16	17
EXTIRPATED	n/a	5	6	5
PERSISTING	n/a	2	0	6
TOTAL	**78**	**75**	**72**	**79**

Deleted: ADDITIONAL

Opportunities for Additional Conservation

Although our scenarios focus on areas where dwarf-flowered heartleaf have been found in the past, the Maxent model identifies a number of areas as high quality potential habitat for the species that falls outside the immediately known occurrence areas. A few of these areas are detailed below (Figure 6.2).

1. West of the city of Lenoir, south of Highway 90/Adako Rd., north of Highway 64 within Caldwell County. This area identifies a large block of potential habitat. This area falls just outside the administrative boundary of the Pisgah National Forest. The bluffs and tributaries along the Johns River are identified as the best habitat, but there is also ample habitat identified along the forested areas of Celia, Husband, Abingdon and Greasy Creeks. The only known occurrence within this area is associated with Abingdon Creek and is under a conservation easement.
2. Henry Fork River bluffs and tributaries east of Highway 18 within Burke County. A historic element occurrence is present by the Burke County line, but the entire area is identified as good quality potential habitat for the species where forested habitats remain.
3. South West corner of Catawba County west of Highway 321. Several disjointed patches of high quality potential habitat are identified in this region associated with the river and creek slopes. Rock Creek, Jacob Fork River, Pott Creek, and their associated tributaries all contain blocks of potential habitat. A number of element occurrences are identified within this area, but additional habitat is identified both upstream and downstream of the known occurrences.

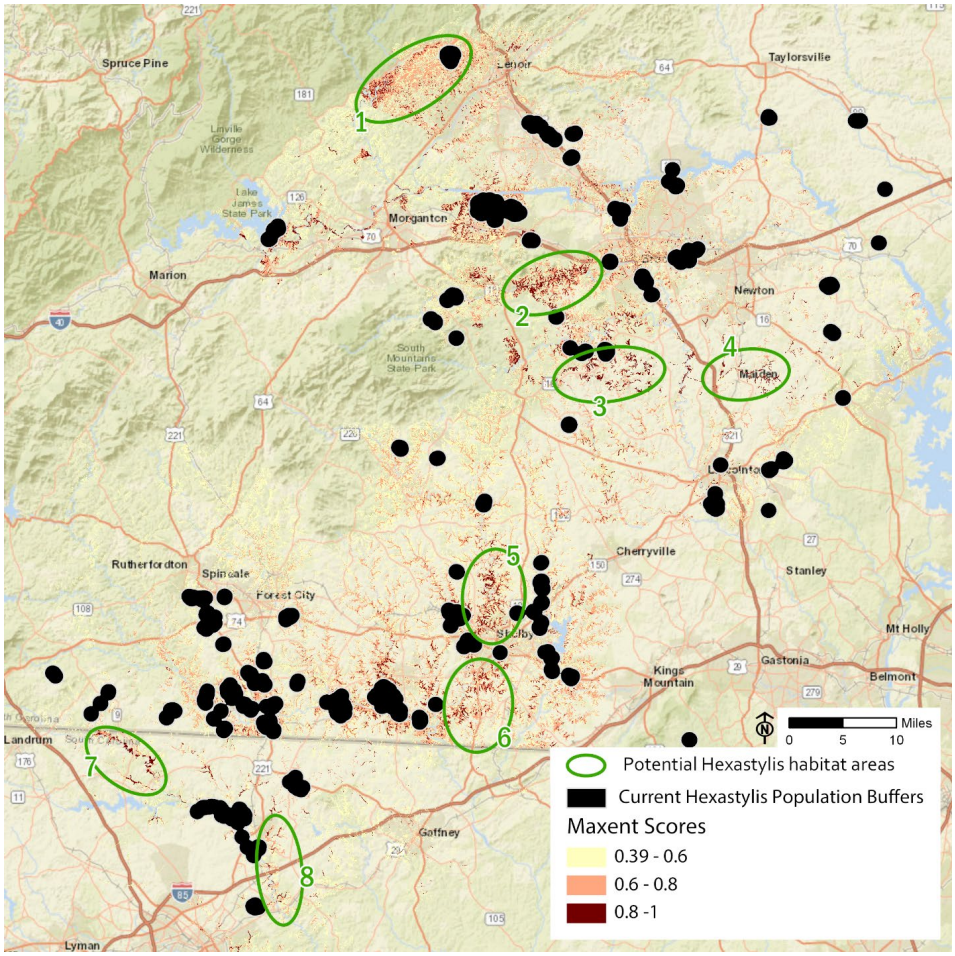
4. Clark, Pinch Gut, Maiden, and Allen Creeks, north of the town of Maiden. The slopes along these creeks all contain quality potential habitat. Known element occurrences are in the general area, but none are situated within the creeks listed.
5. First Broad River North of Highway 74, Rutherford County. Two older element occurrences are located within this area, however, the forested bluffs along the First Broad River and associated tributaries are identified as good quality potential habitat in many additional upstream and downstream areas in this system.

6. Hickory Creek, Sulphur Springs Branch (Little Hickory), Shoal Creek, and tributaries draining into First Broad River South of the Town of Shelby, north of the South Carolina border. The town of Shelby has likely disconnected this site from area 5 listed above. Here, slopes along the creeks and tributaries draining into the First Broad River are identified as potential habitat more so than the slopes along the First Broad River themselves. There in only a single element occurrence known upstream along Hickory Creek.

7. North Pacolet River and Obed Creek, north of where they join. The majority of potential habitat falls along the slopes of the North Pacolet River. Two older element occurrences (1991 last observation) are found in the tributaries draining into the North Pacolet River, and many occurrences are found further upstream. The habitat model suggests that additional undiscovered habitat areas are present.

8. Pacolet River and Island Creek, north of Peters Creek, downstream of the Pacolet River dam. This area displays limited amounts of good quality potential habitat. Recent element occurrences are present in the upper headwaters of Peters and Zekial Creeks (Zekial Creek drains into Peters Creek) and in areas north of the Pacolet River dam, but none are known along the areas identified in this immediate area.

Figure 6.2. Areas identified as high quality potential habitat by Maxent model for *Hexastylis naniflora* that fall outside the immediately known occurrence areas.



Literature Cited

Amoroso, J.L. 2016. *Hexastylis naniflora* status meeting with USFWS, NCNHP, ASU, and NCDOT [meeting minutes]. North Carolina Department of Natural and Cultural Resources office, Asheville, NC, 11 May 2016.

Baldwin, R.A. 2009. Use of maximum entropy modeling in wildlife research. Entropy. 11:854-866.

Barringer, K. 1993. New combinations in North American *Asarum* (Aristolochiaceae). Novon 3:225-227.

Blomquist, H.L. 1957. A Revision of *Hexastylis* in North America. Brittonia 8:255-281.

Clarke, K.C., Riggan, P., and Brass, J.A., 1995. A cellular automaton model of wildfire propagation and extinction, Photogram. Eng. Rem S. 60, 1355-1367.

Dobzhansky, T. 1937. Genetics and the origin of species. Columbia University Press, New York, NY.

DeWan, A., N. Dubois, K. Theoharides, and J. Boshoven. 2010. Understanding the impacts of climate change on fish and wildlife in North Carolina.

Flora of North America 1997. Flora of North America north of Mexico. Volume 3, Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York, NY. 590 pp. Contains Whittemore and Gaddy's treatment of *Asarum* and *Hexastylis*.

Gaddy, L.L. 1980. Status Report on *Hexastylis naniflora* Blomquist. Prepared for and submitted to USFWS, Endangered Species Office, Region 4, Atlanta, Georgia. July 1980.

Gaddy, L.L. 1981. The status of *Hexastlylis naniflora* Blomquist in North Carolina. Unpublished report prepared under contract to the Plant Conservation Program, North Carolina Department of
Agriculture, Raleigh.

Gaddy, L. 1986. Twelve new ant-dispersed species from the southern Appalachians. *Bulletin of the Torrey Botanical Club* 113: 247-251.

Gaddy, L.L. 1987. A review of the taxonomy and biogeography of *Hexastylis* (Aristolochiaceae). Castanea 52(3):186-196.

Golder Associates, Inc. 2009. Year 5 Monitoring Report, *Hexastylis naniflora*, Foothills Conservation Area, Caldwell County, North Carolina. Submitted to: Republic Services of North Carolina, LLC; copies (per cover letter) distributed to US Army Corps of Engineers, Asheville Regulatory Office and USFWS Asheville ES Office. June 26, 2009.

Golladay SW, Gagnon P, Kearns M, Battle JM. Hicks DW. Response of freshwater mussel assemblages (Bivalvia: Unionidae) to a record drought in the Gulf Coastal Plain of southwest Georgia. J. N. Am. Benthol. Soc. 2004;23:494–506.

Gonzalez, V. C. 1972. The ecology of *Hexastylis arifolia*, an evergreen herb in the North Carolina deciduous forest. Ph.D. disseration, Duke University. Durham, North Carolina, USA. HDR. 2005. Identification of *Hexastylis naniflora*. Notes on characteristics and field observations provided to the North Carolina Natural Heritage Program, Raleigh.

IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

Jones M.S., T. H. Jones, and J. J. English. 2014. The Pollination of *Hexastylis naniflora* in Cleveland County, North Carolina. Castanea: June 2014, Vol. 79, No. 2, pp. 74-77.

Jordan, Jones and Goulding (JJ&G), Inc. 1998. Section 404 Application and Conceptual Mitigation Plan, Lake Blalock Expansion Project. USFWS Log number 4-6-97-358. ACOE Project # 80-97-1732 (S). Section 9: *Hexastylis naniflora* Biological Assessment. Received by the Asheville Field Office July 16, 1998.

Jordan, Jones and Goulding (JJ&G), Inc. 2006. Lake Blalock Buffer Disturbance – Vicinity of Casey Creek Road. Memorandum to: Eddie Dearbury, Spartanburg Water Systems. Date: October 25, 2006.

Karl, T. R., Melillo, J. M., & Peterson, T. C. (Eds.). (2009). Global Climate Change Impacts in the United States. Washington, DC: U.S. Global Change Research Program.

Kelly, L. M. 1997. A Cladistic Analysis of *Asarum* (Aristolochiaceae) and Implications for the Evolution of Herkogamy. American Journal of Botany 84:1752-1765.

Kelly, L. M. 1998. Phylogenetic Relationships in *Asarum* (Aristolochiaceae) Based on Morphology and ITS Sequences. American Journal of Botany 85:1454-1467.

Kelly, L. M. 2001. Taxonomy of *Asarum* Section *Asarum* (Aristolochiaceae). Systematic Botany 26:17-53.

Lengyel, S., A. D. Gove, A. M. Latimer, J. D. Majer, and R. R. Dunn. 2010. Convergent evolution of seed dispersal by ants, and phylogeny and biogeography in flowering plants: A global survey. *Perspectives in Plant Ecology, Evolution and Systematic*s 12: 43-55.

McLaughlin, J.F. et al. (2002). Climate change hastens population extinctions. Proceedings of the National Academy of Sciences 99(9): 6070–6074.

Murrell, Z. et al. 2007. Ecological, Morphological, Micromorphological and Molecular Analyses of the Species in the *Hexastylis heterophylla* Complex. A report to the North Carolina Department of Transportation. NCDOT and CTE Joint Project 2002-2004, FHWA/NC/2004-01. May 2007.

Murrell, Z. 2015. Development of molecular and morphological tools to circumscribe and identify the Dwarf Flowered Heartleaf (*Hexastylis naniflora*). Report to the North Carolina Department of Transportation, NCDOT Project 2012-2111, July 2015.

National Climate Change Viewer. 2016. USGS. Accessed at https://www2.usgs.gov/climate_landuse/clu_rd/nccv.asp, January 2018.

NatureServe. 2002. Element Occurrence Data Standard, 6 February 2002. NatureServe, Arlington, Virginia. Accessed at http://www.natureserve.org/library/deliminting_plant_eos_Oct_2004.pdf, August 2016.

NCOSBM. North Carolina Budget and Management County and State Population Projections. Accessed at https://www.osbm.nc.gov/demog/county-projections, March 2018.

Newberry, G. 2006. South Carolina Populations of *Hexastylis naniflora*: 2006 updates. Received by the USFWS Asheville Field Office, September 7, 2006.

Newberry, G. 2009. University of South Carolina at Spartanburg. Evaluation of damage to *Hexastylis naniflora* plants on acreage bordering the hunt club. Letter to Jon Morgan, Lake Warden, Spartanburg Water Systems. Dated February 24, 2009.

North Carolina Natural Heritage Program (NCNHP). 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: August 5, 2016.

North Carolina Natural Heritage Program (NCNHP). 2018. Natural Heritage Element Occurrences. Accessed at https://www.ncnhp.org/activities/conservation/natural-heritage-element-occurrences, January 2018.

Newberry, G. 1993. Progress Report on Monitoring Studies of *Hexastylis naniflora*. Unpublished report. Copy submitted to the USFWS Asheville Field Office, on September 7, 2006.

Niedenberger, B.A. 2010. Molecular phylogeny and comparative pollen morphology of the genus *Hexastylis* (Aristolochiaceae). M.S. thesis. Appalachian State University, Boone, NC.

Otte, D. 1977. The pollination biology of *Hexastylis arifolia* (Michx.) Small var. *arifolia* and *H. minor* (Ashe) Blomquist (Aristolochiaceae) in the area of Chapel Hill, North Carolina. M.S. Thesis, University of North Carolina Chapel Hill, Chapel Hill, North Carolina, USA.

Padgett, J. E. 2004. Biogeographical, ecological, morphological, and micromorphological analyses of the species in the *Hexastylis heterophylla* complex. M.S. thesis. Appalachian State University, Boone, NC.

Phillips, S. J. 2018. A Brief Tutorial on Maxent. Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-02/21.

Renninger, H. 2010. North Carolina Department of Transportation (NCDOT). E-mail communication to Carolyn Wells, USFWS Asheville Field Office. Date: May 28, 2010. Subject: Dwarf-flowered heartleaf research proposal.

Robinson L.G. 2016. Dwarf-flowered Heartleaf range-wide status report. Final report to U.S. Department of Interior—U.S. Fish and Wildlife Service by North Carolina Natural Heritage Program. August 2016.

Robinson, L.G. and J.E. Padgett. 2016. Dwarf-flowered Heartleaf (*Hexastylis naniflora*) comprehensive review and monitoring report. Final report to the U.S. Department of Interior—U.S. Fish and Wildlife Service by the North Carolina Natural Heritage Program. August 2016.

Schneider, S. 2006. Spartanburg Water System (SWS) & Sanitary Sewer District, Assistant General Manager. E-mail communication to Lora Zimmerman, USFWS (formerly with the Charleston Field Office), dated December 18, 2006. Subject: Meeting at SWS on December 21, 2006 [to discuss Lake Blalock Buffer Disturbance].

South Carolina Department of Natural Resources (SCDNR) Heritage Trust. 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: February 4, 2016.

USFWS. 2001. Biological Opinion for Spartanburg Water System, Lake Blalock, P/N 2000-IP-194-W, USFWS log number 4-6-01-F-115. May 10, 2001.

USFWS. 2010. Draft Five Year Review for *Hexastylis naniflora* (dwarf flowered heartleaf). September 30, 2010. Submitted to the USFWS Southeast Regional Office September 30, 2010.

USFWS. 2015, August. Fact sheet for *Hexastylis naniflora*. Retrieved from https://www.fws.gov/raleigh/species/es_dwarf-flowered_heartleaf.html.

USFWS. 2016. USFWS species status assessment framework: an integrated analytical framework for conservation. Version 3.4.8, August 2016.

Wagner, J. 2013. Developing new morphological, geographic, and molecular tools to circumscribe *Hexastylis naniflora*. M.S. thesis. Appalachian State University, Boone, NC.

Walker, J. et al. 2009. What are the effects of prescribed fire on *Hexastylis naniflora*, a federally protected plant species? Unpublished final report prepared by U.S. Forest Service, Southern Research Station, Clemson University, Clemson, SC. Submitted to Timothy Stone, Superintendent, Cowpens National Battlefield. In partial fulfillment for Agreement 04-IA-11330138-234, between the NPS and USFS Southern Research Station. Revised March 19, 2009.

Warren II, R. J., 2008. Mechanisms driving understory evergreen herb distributions across slope aspects: as derived from landscape position. *Plant Ecology* 198: 297-308.

Weakley, A. 2010. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at

Chapel Hill. Working Draft as of March 8, 2010.
Weakley, A. 2015. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Working Draft as of 21 May 2015.

Whittemore, A. T., and L. L. Gaddy. 1997. Hexastylis. In Flora of North America Editorial Committee [Eds.], Flora of North America north of Mexico, vol. 3, 54–58. Oxford University Press, New York, New York, USA.
Wolf. S., B. Hartl, C. Carroll, M.C. Neel, and D.N. Greenwald. 2015. Beyond PVA: why recovery under the Endangered Species Act is more than population viability. BioScience 65:200-207.

Chapter 1: INTRODUCTION

The dwarf-flowered heartleaf (*Hexastylis naniflora*) is a species of plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. The dwarf-flowered heartleaf has been listed as threatened under the Endangered Species Act of 1973, as amended (Act), since 1989 (FR 54 14964-14967). The Species Status Assessment (SSA) framework (USFWS 2016, entire) summarizes the information compiled and reviewed by the US Fish and Wildlife Service (Service), incorporating the best available scientific and commercial data, to conduct an in-depth review of the species' biology and threats, evaluate its biological status, and assess the resources and conditions needed to maintain long-term viability. The intent is for the SSA to be easily updated as new information becomes available and to support all functions of the Endangered Species Program from listing to consultations to recovery.

A Recovery Plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to make significant progress toward recovery of the species. The Service is initiating this SSA to aid in determining the appropriateness of reclassifying the species. In the event that the SSA does not support reclassification, the SSA will be used to inform the development of a Recovery Plan. Importantly, the SSA does not result in a decision by the Service on whether this species should be proposed for reclassification under the Act. Instead, this SSA provides a review of the available information strictly related to the biological status of the dwarf-flowered heartleaf. The reclassification decision will be made by the Service after reviewing this document and all relevant laws, regulations, and policies. The results of a proposed decision will be announced in the *Federal Register*, with appropriate opportunities for public input.

For the purpose of this assessment, we generally define viability as the ability of the species to sustain populations in its natural systems over time. Using the SSA framework (Figure 1.1), we consider what the species needs to maintain viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation (Wolf *et al.* 2015, entire).

- **Resiliency** describes the ability of populations to withstand stochastic events (arising from random factors). We can measure resiliency based on metrics of population health;

for example, birth versus death rates and population size. Highly resilient populations are better able to withstand disturbances such as random fluctuations in birth rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic activities.

- **Redundancy** describes the ability of a species to withstand catastrophic events. Measured by the number of populations, their resiliency, and their distribution (and connectivity), redundancy gauges the probability that the species has a margin of safety to withstand or can bounce back from catastrophic events (such as a rare destructive natural event or episode involving many populations).
- **Representation** describes the ability of a species to adapt to changing environmental conditions. Representation can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. The more representation, or diversity, a species has, the more it is capable of adapting to changes (natural or human caused) in its environment. In the absence of species-specific genetic and ecological diversity information, we evaluate representation based on the extent and variability of habitat characteristics across the geographical range.

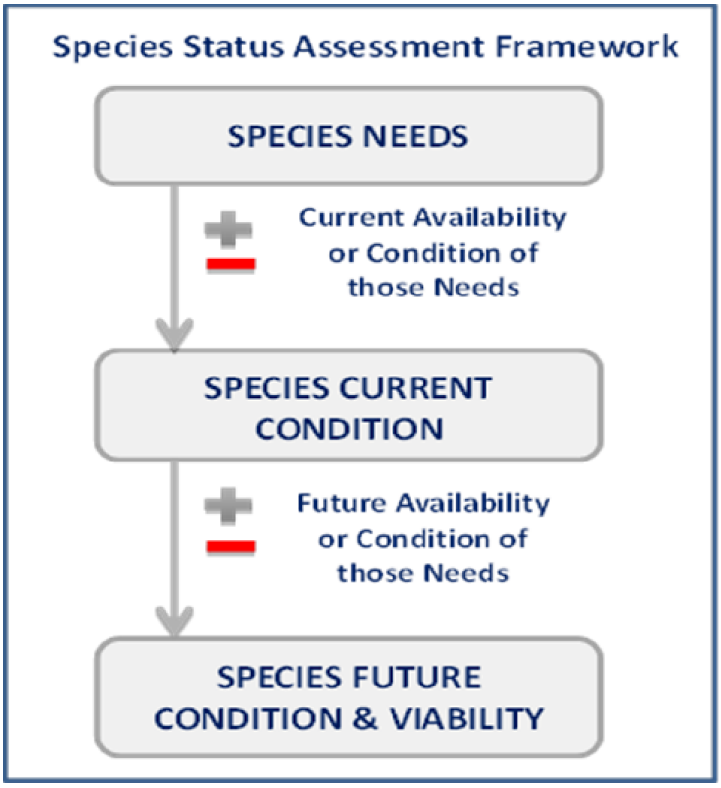


Figure 1.1. Species Status Assessment Framework

To evaluate the biological status of the dwarf-flowered heartleaf, both currently and into the future, we assessed a range of conditions to allow us to consider the species' resiliency, redundancy, and representation (together, the 3Rs). This SSA provides a thorough assessment of biology and natural history, and assesses demographic risks, stressors, and limiting factors in the context of determining the viability and risks of extinction for the species.

The format for this SSA includes: (1) Biology and Species Needs, (2) Current Conditions, (3) Influences on Viability, and (4) Future Conditions. This document is a compilation of the best available scientific and commercial information, and a description of past, present, and likely future risk factors to the dwarf-flowered heartleaf.

Chapter 2: SPECIES BIOLOGY

In this chapter, we provide basic biological information about the dwarf-flowered heartleaf, including its taxonomic history, species description, distribution, life history traits, and habitat characteristics. We then use this information to outline the resource needs within various life stages of dwarf-flowered heartleaf. Here we report those aspects of the life history of the dwarf-flowered heartleaf that are important to our analysis.

Taxonomy and species description

Dwarf-flowered heartleaf is a rare, low growing herbaceous plant in the birthwort family (Aristolochiaceae). The species was described by Blomquist (1957) in his revision of the North American members of the genus *Hexastylis*. The dwarf-flowered heartleaf has been recognized as part of the Virginica Group, and this group was further subdivided into three Subgroups: Virginica, Shuttleworthii, and Heterophylla (Blomquist 1957; Whittemore and Gaddy 1997). Three species have been recognized in the Heterophylla complex, *Hexastylis naniflora, H. heterophylla* and *H. minor*, and field biologist have generally recognized that considerable morphological overlap occurs (Murrell et al. 2007). One of the main concerns regarding this complex was the inability to distinguish between species without access to fresh flowers. Even with fresh flowers, Blomquist (1957) and Gaddy (1987) still recognized considerable overlap in flower morphology making species delineation difficult.

Murell et al. 2007, conducted a comparative genetic analysis using Inter Simple Sequence Repeats, and were unable to find banding patterns that could be used to separate *H. naniflora* from the other members within the complex. However, based on biogeographical, ecological, molecular, morphological, as well as micromorphological work, their results show that *H. naniflora* is a well-defined species.

Although there has been considerable disagreement on the generic distinctiveness of *Hexastylis* and *Asarum* (Barringer 1993 and Kelly 1997, 1998, 2001), a recent phylogeny estimate using chloroplast genes supports that *Hexastylis* is a monophyletic clade and therefore should be

recognized as a genus (Niedenberger 2010). Additionally, most North American publications recognize *Hexastylis* at the generic level (Flora of North America 1997, Weakley 2015).

The Service is not aware of any proposed changes in taxonomy that would affect the continued legal status of *H. naniflora* under the Act. However, within the range of *H. naniflora* there are populations which fall outside of the range of published values for key floral characteristics, overlapping with values described for *H. heterophylla* or *H. minor* (Figure 2.1; Weakley, 2010; Murrell et al. 2007; Gaddy 1987). These geographic areas of overlap in key characters have been the focus of recent genetic analyses (Murrell et al. 2007; Renninger, 2010; Murrell, 2015).

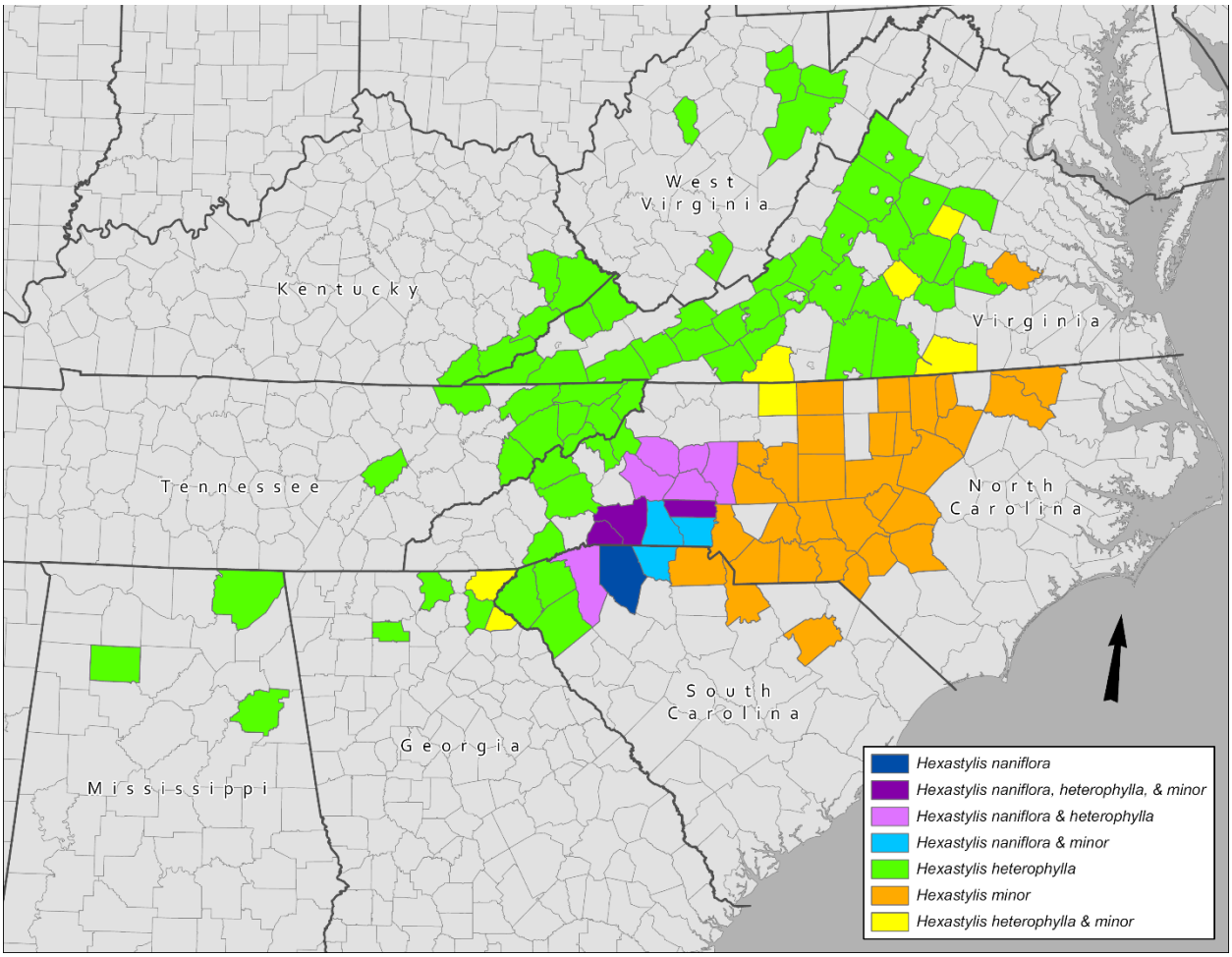


Figure 2.1. Distribution map showing county records for the three species in the *H. heterophylla* complex. Data was gathered from herbarium specimens, Element Occurrence Records (EORs) sheets and field studies. *Based on Murrell et al. 2007.*

The most outstanding characteristic of this species is the small flowers, which are one of the smallest of any species in North America (Blomquist 1957). The plant's heart shaped leaves are dark green in color, evergreen, and leathery, and are supported by long thin petioles from a subsurface rhizome. The shape of the leaf blades, their pattern of variegation, and the ridged reticulation inside the calyx-tube, place this species inside the Virginica group. It differs from all the other members of this group, aside from the small flowers, in having no flare in the calyx-tube. Maximum height rarely exceeds 15 centimeters (cm). The jug shaped flowers are usually beige to dark brown in color and appear from mid-March to early June. The flowers are small and inconspicuous and are found near the base of the petioles. The fruit matures from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981). Characteristics that distinguish it from other *Hexastylis* species are found in floral structures and pollen characters (Gaddy 1987, Padgett 2004, Niedenberger 2010). *H. naniflora* has a smaller calyx tube orifice, which is typically 5mm or less (sometimes up to 7mm) and the ovary is half-inferior, rather than superior (Blomquist 1957, Gaddy 1987, Padgett 2004, HDR 2005). Pollen surface features have also been shown to be an effective character to identify *H. naniflora*, as it has a microporate surface and, unlike any other *Hexastylis* species, lacks gemmae entirely (Padgett 2004, Niedenberger 2010).

Distribution

Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (USFWS 2010, NCNHP 2016). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include four additional counties in North Carolina. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is in Cherokee, Greenville, and Spartanburg Counties. As of 2016, the distribution of this species consisted of 113 populations distributed across 13 counties in these two states (Figure 2.2).

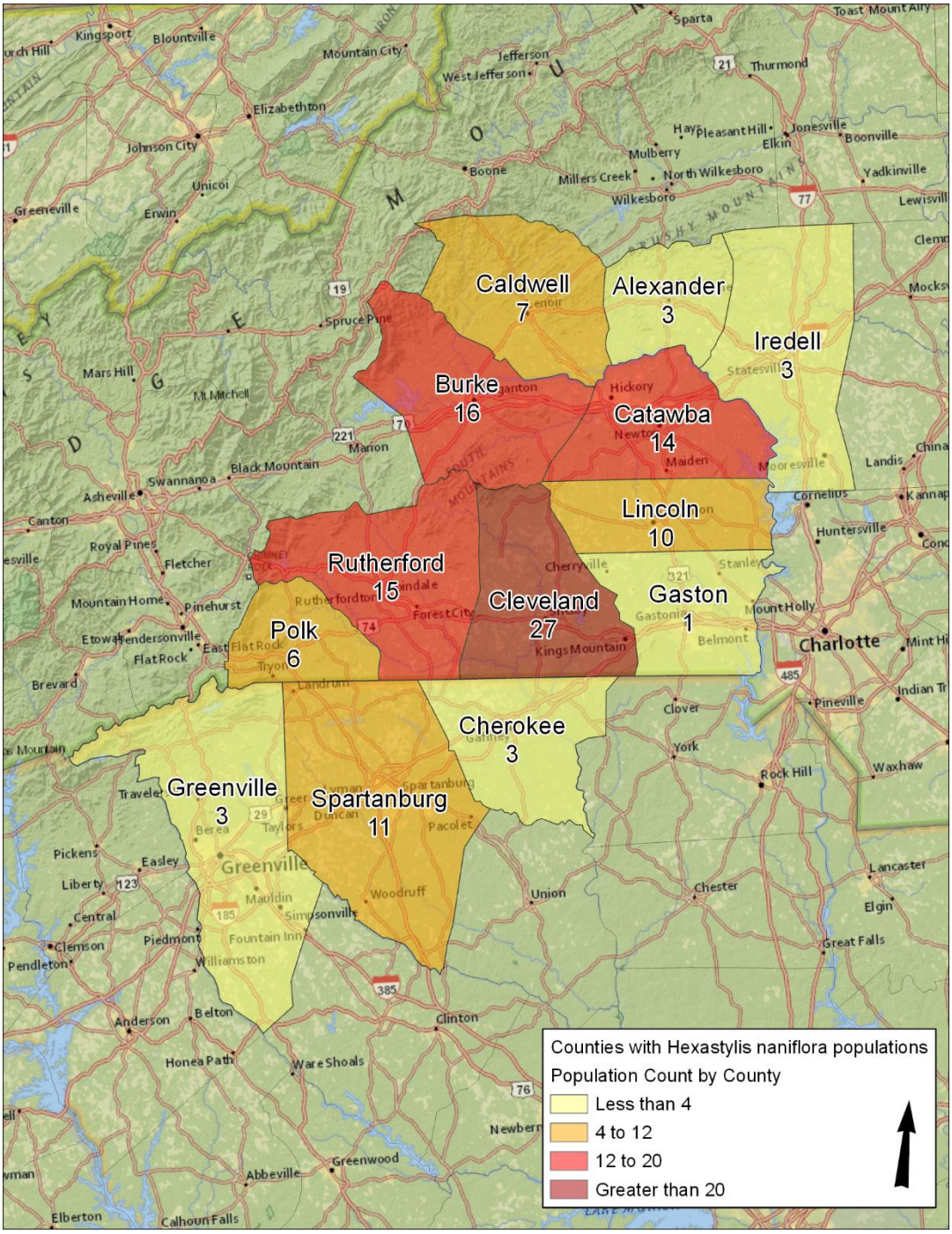


Figure 2.2. Current county distribution for dwarf-flowered heartleaf, with associated number of known populations within each county.

Many of those working with *Hexastylis naniflora* have used the terms “sub site”, “site”, “location”, “occurrence” (often, but not always, in reference to Natural Heritage Program Element Occurrence (EO) Records), “subpopulation” and “population” interchangeably. Others

have aggregated smaller sites into populations according to subjective criteria which have never been explicitly defined. This generates discrepancies among sources with respect to the abundance and distribution of the species, with the net result being that available data are usually not comparable from one source to the next. We describe how the numerous small, site-specific locations containing *H. naniflora* have been aggregated into proxies for 119 biological populations for purposes of this review, using mapping standards devised by NatureServe and its network of Natural Heritage Programs, in the Species Needs section of this report.

Life History

Demographics

The Service is aware of a single effort to collect demographic-level data (survivorship and recruitment of tagged individuals) for dwarf-flowered heartleaf. This effort was conducted during the 1990-1991 field seasons, within a portion of the Peters Creek population in Spartanburg County, SC (Newberry, 1993). This study demonstrated a 96.1% survival rate over these two consecutive seasons, with 50% of the mortality occurring in plants located at the highest position on the forested slope (away from the adjacent floodplain). Mortality was highest in small plants bearing fewer than four leaves. Plant size was variable, with the largest plant bearing 45 leaves and 33 flowers, and situated in the floodplain. In general, plants located in the floodplain were larger than plants located on adjacent slopes. The percentage of flowering plants averaged 70%, with the highest frequency of flowering occurring among plants situated in the floodplain (USFWS 2010).

Pollination and Dispersal

The pollination of *Hexastylis* has not been well studied but the genus was thought to be pollinated by insects including flies, wasps, and thrips (Otte 1977). Additionally, Lengyel et al. (2010) described how, within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal by ants). This supports Gaddy's work (1986), which found three species within the Hexastylis Heterophylla subgroup (*H. heterophylla, H. naniflora, and H. minor*), which employ myrmecochory as a method for seed dispersal.

Ants appear to be a primary dispersal agent for the dwarf-flowered heartleaf (Gaddy 1986; Jones et al. 2014). All diaspores of *Hexastylis naniflora* presented to ants (*Aphaenogaster rudis*) were quickly removed (Gaddy, 1986). This is not to say that they are not occasionally, or even frequently, dispersed and/or pollinated by other means. Jones et al. (2014) suggests that the pollination mechanism is facultative, benefiting from more than one method of pollination/fertilization. Ants were the pollinators in a controlled experiment, and their data supports that when outside molesting forces/pollinators (biotic and abiotic) were limited by their caging procedure, the efficiency of pollination decreased by almost 50%, however, caged flowers did produce seeds, indicating pollination occurred via some alternative method.

Habitat

Dwarf-flowered heartleaf appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Wagner 2013). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of a given population. With the limited range and size in populations, questions arise regarding gene flow among populations. How much is occurring and how often does it occur? It is due, in part, to narrow habitat requirements that conservation measures have been implemented for the protection of the species. Any efforts made to protect this species must consider giving protection to the available habitat.

Dwarf-flowered heartleaf occurs on piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, Weakley 2015, USFWS 2015), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993). Wagner (2013) conducted a habitat suitability study to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used for helping identify the species when not in flower

(relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants.

Soils

The species appears to be restricted to Pacolet sandy loam, Madison gravelly sandy loam, and Musella fine sandy loam soils (Gaddy 1981,1987). The species grows in acidic soils along bluffs and adjacent slopes, in boggy areas next to streams and creekheads, and along the slopes of nearby hillsides and ravines (Gaddy 1980, 1981). The plant is primarily found inhabiting north- to northwest-facing slopes, bluffs, and ravines in close proximity to creeks or streams. Within these areas exists the soil type required for *H. naniflora* to grow. It grows primarily on well-drained, sandy, acidic soils, and will not grow in heavy clay (Gaddy 1981).

The results of soil samples analyzed at the Clemson Soil Lab suggest that major differences in soil chemistry exist between the species in the *H. heterophylla* complex (Murrell et al. 2007). Statistical analysis of the soil samples showed that many of the basic elements were significantly different among the three species. Those significant differences occurred in Phosphorous (P), Potassium (K), Magnesium (Mg), Zinc (Zn), Manganese (Mn), (Na), Sodium, and Cation Exchange Capacity (CEC). Slightly significant differences were seen in Buffer pH (Bu pH), and Acidity.

Soil chemistry showed marked differences between the species in the complex (Murrell et al. 2007). The results indicated that soil chemistry is very different between *H. naniflora* and *H. minor* localities. The results also show that *H. heterophylla* and *H. naniflora* are found in soils where the chemistry is more similar, but still showed significant differences. It would appear that differentiation in soil types could be used as a proxy for species delineation. The soil analysis also indicates that soils must be considered when trying to select sites for relocation of imperiled populations of *H. naniflora*.

Thirteen population sites in North Carolina and South Carolina were examined using the Carolina Vegetation Survey (CVS) method to compare species richness between the three

species of the *Hexastylis heterophylla* complex (Murrell et al. 2007). The analysis did not show statistically significant differences among the three species in the *H. heterophylla* complex. However, *H. naniflora* appears to have an association with three oak species that is lacking in the other two species in the complex. There are a number of oak species (*Q. coccinea*, *Q. prinus* (*Q. montana*), and *Q. velutina*), that tend to co-occur with only *H. naniflora*, but are not present with the other two species in the complex. This may be the result of some microbial need or specific soil nutrient required for those species to occur in the same habitat.

Fire

There are little data on the response to fire by *Hexastylis naniflora*, however, prescribed burns have been conducted within the population at Cowpens National Battlefield in Cherokee County, SC. Preliminary data at this site and recent annual monitoring data of this population support the theory that moderate controlled burns do not negatively affect this population (Walker et al. 2009). Additionally, a dormant season wildfire in Caldwell County did not show evidence of negative impacts to a population in Caldwell County (USFWS 2010). Fire suppression could be a hazard to *H. naniflora* by allowing fire intolerant, nonnative and invasive plants to thrive, as well as the accumulation of thick duff or leaf litter that may shade low growing species (Wagner 2013).

Genetics

Analyses on ecology, morphology, soil chemistry, pollen, and molecular genetics have been evaluated for *Hexastylis naniflora* to determine the boundaries within the *Hexastylis heterophylla* complex, which consists of *H. heterophylla*, *H. minor*, and *H. naniflora* (Murrell 2015, Wagner 2013, Niedenburger 2010, USFWS 2010, Murrell et al. 2007, Padgett 2004). These analyses support the continued recognition of these taxa as well-defined, discrete species. Scanning electron microscopy (SEM) consistently distinguished *H. naniflora* from other members of the *H. heterophylla* complex based on pollen microscopy. Principal Components Analysis of floral characters and soil chemistry also consistently distinguished *H. naniflora* from *H. minor* and *H. heterophylla*. However, efforts to obtain consistently distinct banding patterns

using Inter Simple Sequence Repeats (ISSRs) were unsuccessful at distinguishing *H. naniflora* from other members of this group (Murrell et al., 2007). These results were based upon an extremely small sample size (n=10 *H. naniflora* individuals), and therefore warrant further investigation.

Field observations demonstrate that there are some populations of dwarf-flowered heartleaf with morphological characteristics that do not fit within the range of published values for key traits, overlapping with values for *H. heterophylla* or *H. minor* (Gaddy 1987, Murrell et al. 2007, USFWS 2010, Weakley 2015). These populations with overlap in key characteristics were the focus of a genetic analysis conducted at Appalachian State University (ASU) through funding provided by NCDOT (Murrell 2015). In some populations, floral characteristics are highly variable, which suggests the potential for hybridization or individuals with highly variable flower size and shape (Murrell 2015). Additionally, no vegetative characters were previously known to consistently distinguish *Hexastylis naniflora* from other close relatives. Given the difficulties with field identification of the species, particularly when not in flower, this study sought to develop a microsatellite library of molecular markers to resolve variation in populations of dwarf-flowered heartleaf and apply the markers to populations with highly variable characters, as identified by NCDOT biologists. The morphological and micromorphological information from those variable populations were compared to molecular results with morphological, micromophological, and distributional data to determine genetic structure, biological boundaries, and placement of putative hybrids or intermediate populations of *H. naniflora* (Murrell 2015).

The preliminary findings of this study suggest that populations in the southern range of dwarf-flowered heartleaf exhibit a more uniform genetic pattern, with some possible hybridization with *H. minor*. Populations in the northern part of the range appear to have hybridized with both *H. heterophylla* and *H. minor*, although there are still individuals with "pure" *H. naniflora* genotypes in the northern range (Murrell 2015). It is critical to note that although these data provide anecdotal evidence of hybridization with the *Hexastylis heterophylla* group, intraspecific variation may be caused by forces other than hybridization, such as convergent morphological evolution (Dobzhansky 1937), or the species is in the process of speciation and this study shows a case of incomplete speciation (Murrell 2015), and/or other environmental factors are at play

(Wagner 2013). On May 11, 2016, a meeting was held with USFWS, NCNHP, NCDOT, and ASU to discuss the status of *H. naniflora* and the current work being conducted among the agencies (Amoroso 2016). Based on discussions during this meeting, the results of this study reported by ASU to NCDOT in 2015 are preliminary. Dr. Matt Estep (ASU) provided additional preliminary results to NCNHP in May 2016, showing which populations were sampled, sample size, and percent of samples that show evidence of hybridization, and hybridizing with which species. ASU continues to work towards a more definitive explanation of the variation in the *H. heterophylla* complex (Murrell 2015, Amoroso 2016).

CHAPTER 3: SPECIES NEEDS

For the purpose of this report, we define viability as the ability of the species to sustain populations in the wild over time. Species with greater numbers (redundancy) of healthy populations (resiliency), encompassing a broad array of ecological and genetic diversity in a spatial arrangement that maintains adequate gene flow (representation), are more likely to be viable. Using the Species Status Assessment framework, we describe the species' viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation.

Delineating Populations

As stated in the USFWS five-year review, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to Natural Heritage Program Element Occurrence Records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This has generated considerable discrepancies among sources with respect to the number of known populations within a given area (or across the species' range), to the extent that numbers are not comparable from one source to the next. The tendency, in the past, to treat each location as a separate population also artificially inflated the actual number of populations known.

The Natural Heritage Program collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member Natural Heritage Programs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2002). Since USFWS does not maintain its own database of known locations of *Hexastylis naniflora*, it regards the NHP databases as the best repository for this information (USFWS 2010).

We delineate populations for the purposes of this SSA according to the NatureServe (2002) convention. Separation distances are a key component to delineating populations from EO records. For the dwarf-flowered heartleaf, we used the EO Data Standard which provides a Default Separation Distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several dwarf-flowered heartleaf populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Population Resiliency

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered heartleaf ecology that determine whether populations can grow to maximize habitat occupancy,

thereby increasing resiliency of populations. These factors and habitat elements are discussed below (Figure 3.1).

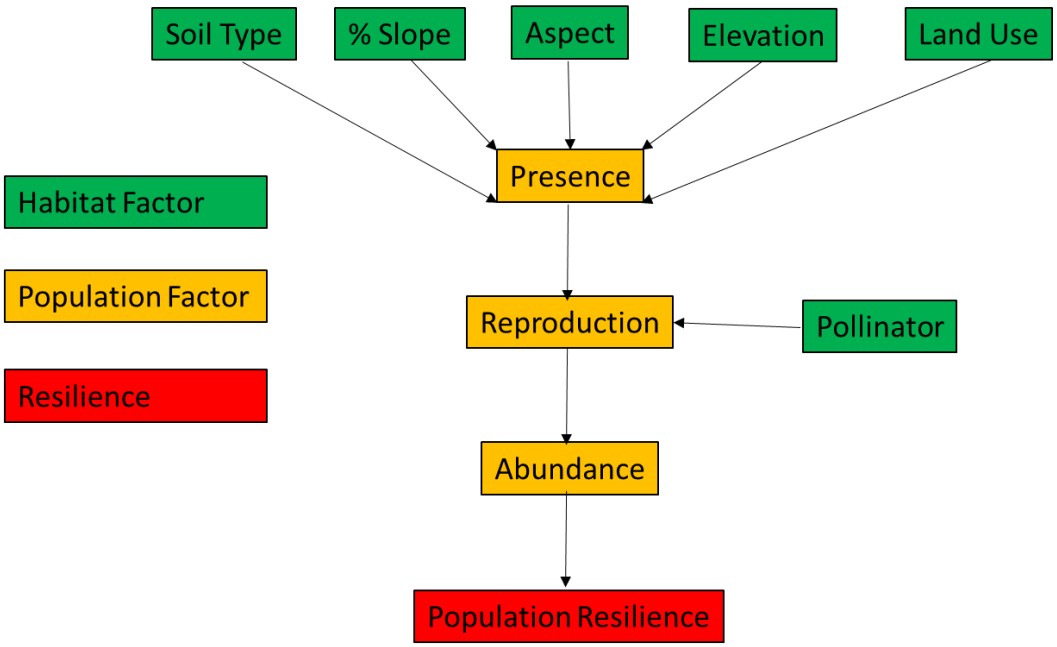


Figure 3.1. Conceptual diagram describing population and habitat factors influencing population resilience for dwarf-flowered heartleaf.

Habitat Factors: Slope, Aspect, Elevation, Soil, and Forest Type

A previous habitat suitability study attempted to quantify the habitat requirements for dwarf-flowered heartleaf (Wagner 2013). With this model in mind, and the input of species experts as to important habitat factors for the species, we used updated habitat data, as well as inclusion of updated EOs, to create a new habitat model to identify potential habitat throughout the species range. All source datasets and variables created are described in Appendix 3.

Source Data and Model Variables

Fifty-three, 10-digit hydrologic units (HUC) comprise the analysis extent (Figure 3.2). In North Carolina, it includes all 10-digit HUC that fall within the boundaries of 8-digit HUC with known occurrence of *Hexastylis naniflora*. In South Carolina, we also included all 10-digit HUC that fell within the boundaries of 8-digit HUC with known occurrence of *Hexastylis naniflora*, but

excluded the southern portions of the HUC-8 areas due to the boundaries being exceedingly large and far away from any known occurrences.

Hexastylis naniflora element occurrence data was obtained from the North Carolina Natural Heritage Program and the South Carolina Heritage Trust Program. Current populations of *Hexastylis naniflora* were identified by reviewing the last observed data in the database and excluding all populations that have not been observed since 2005 to remain consistent in our approach of assessing resiliency described previously. To represent these current population areas in Maxent, a raster cell center was retained for every 30 x 30 meter pixel that was situated within the current element occurrence data polygons.

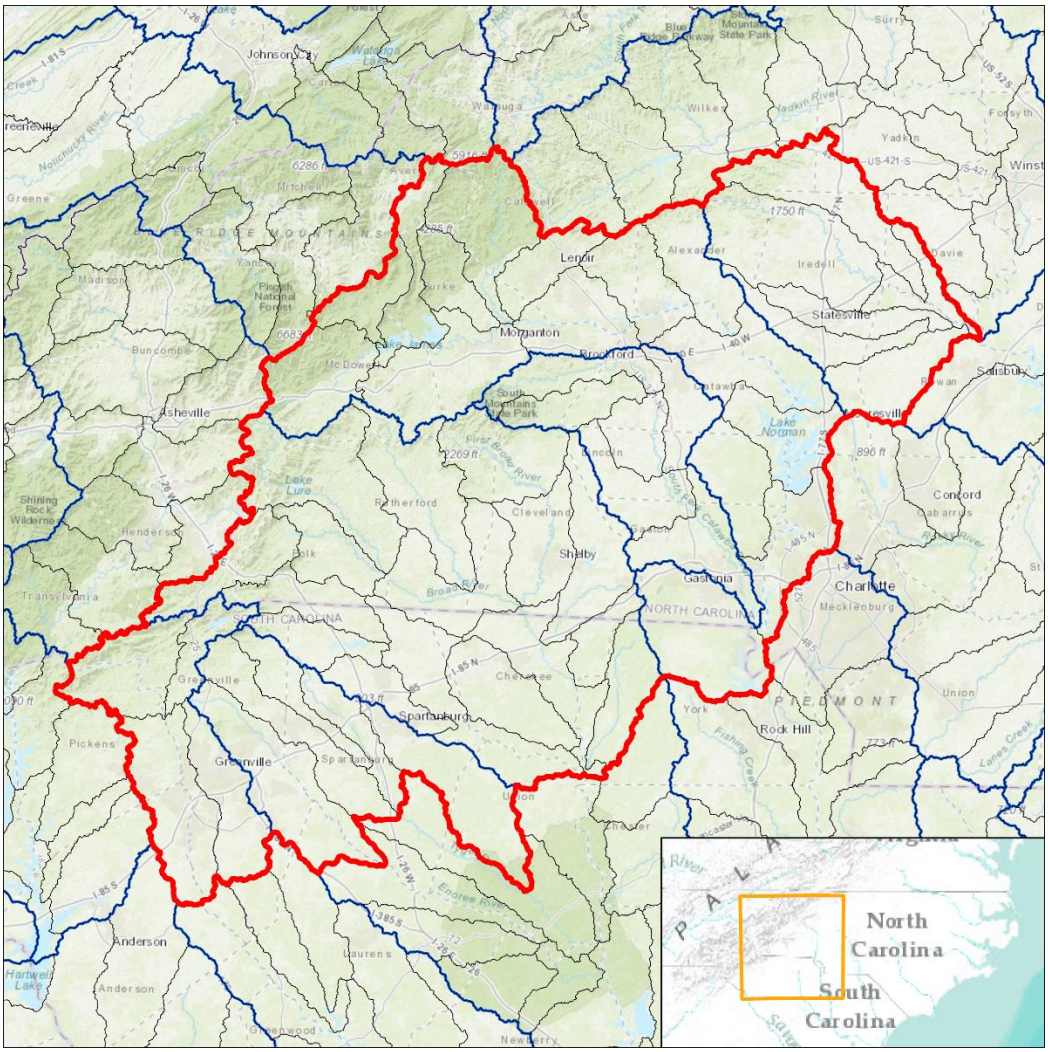


Figure 3.2. Analysis extent of the habitat model for *Hexastylis naniflora.* Red line indicates Maxent analysis extent, blue lines are 8-digit HUC boundaries, black lines are 10-digit HUC

boundaries. The orange line in the inset map indicates where the analysis extent is situated in North and South Carolina

Model Development

We used Maxent software (version 3.4.1) for species habitat modeling (Philips et al., 2018). An initial single model Maxent run was done to determine which variables could be excluded due to limited percent contribution to the model. Any variable that contributed less than 1% to the single model run results was excluded in the final model. The following variables were excluded: landcover diversity, canopy height, SSURGO drainage class, SSURGO hydrologic group, aspect 9-class, aspect 5-class, slope, solar radiation, and maximum annual temperature. It is interesting to note that a previous habitat modelling effort (Wagner 2013) included aspect and slope, whereas the Maxent model excluded these variables. This does not mean these variables are not important components of dwarf-flowered heartleaf habitat, but rather these variables did not significantly improve the model. Also, landform data was included, and perhaps landform, which includes components of aspect and slope combined is a more meaningful variable than aspect or slope independently.

For the final model, a 10-run replicate Maxent model was created using cross-validation. For replicate models, the occurrence data is randomly split into a number of equal-sized groups called “folds”, and separate models are created leaving out each fold in turn. The individual model runs are then averaged together to derive the final model.

Results

Figure 3.3 shows the model output. The minimum cutoff value (to determine if an area is considered potential habitat for a species) of 0.39 was determined by using the average 10th percentile training presence. The 10th percentile training presence uses the suitability threshold associated with the presence record that occurs at the 10th percentile of presence records (Phillips 2018). This value excludes some of the outlier population areas in the Maxent predictions to focus on the typical habitat conditions for this species. The total area ranked greater than 0.39 in the Maxent model was just 6.00% of the total analysis area (Table 3.1).

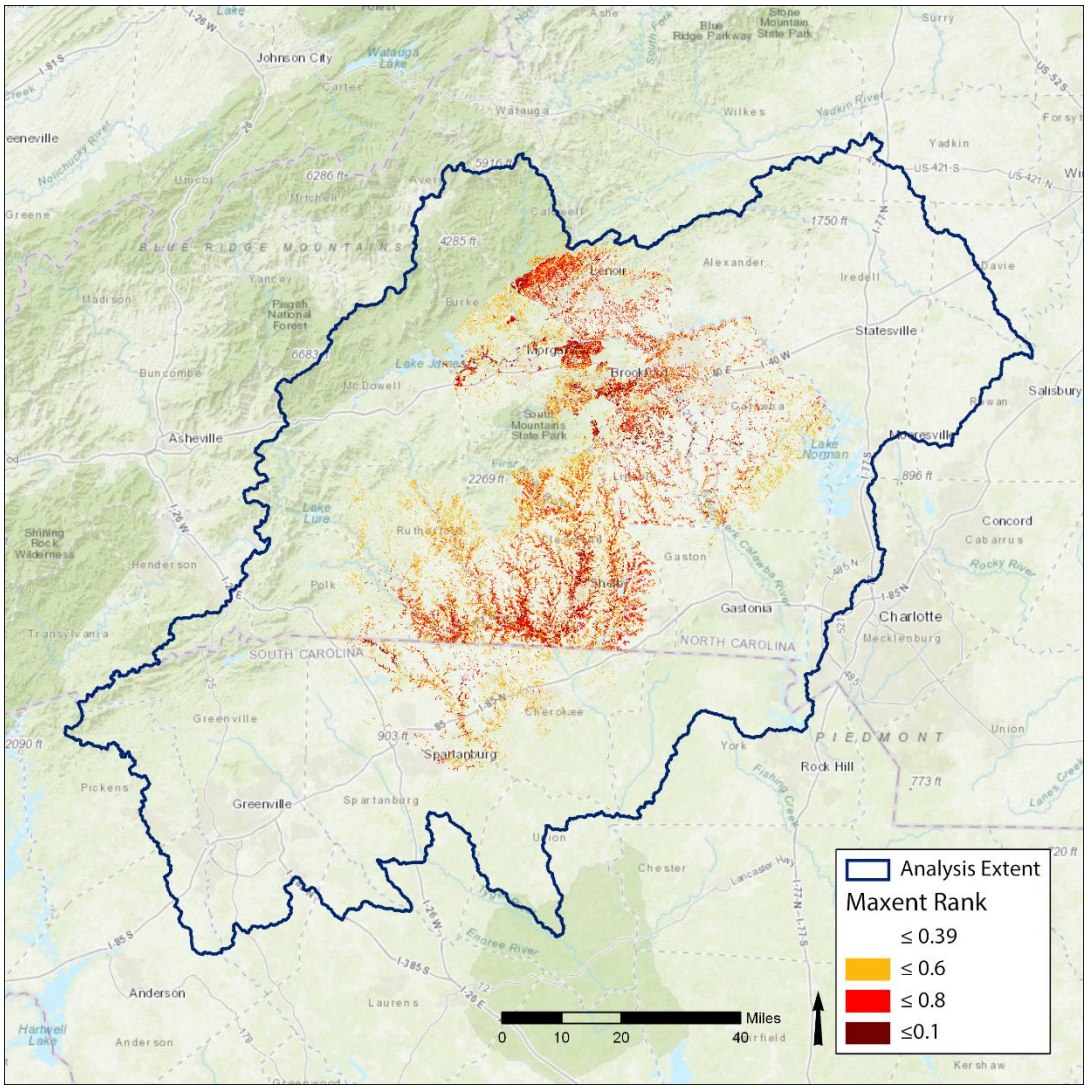


Figure 3.3. Maxent model output map

Table 3.1-Area estimates of the Maxent model

Maxent Score	Acres	Square Miles	Percent of Total
0.39 and greater	302,834.13	473.18	6.02%
0.6 and greater	128,273.52	200.43	2.55%
0.8 and greater	22,115.97	34.56	0.44%

The average area-under-curve (AUC) score for the replicate Maxent model is 0.86. The AUC is calculated from the receiver operating characteristic (ROC) plot. This value has a range of 0 – 1 and may be interpreted as a single test statistic that assesses model performance, indicating the

ability of the model to correctly classify the occurrence data used. The model performed well in its predictions, with a mean AUC of 0.86 (AUC value of 0.5 is no better than random; AUC<0.5 is worse than random; AUC>0.5 is greater predictive power than random; Baldwin 2009).

The Maxent output supplies estimates of the relative contributions of the environmental variables to the Maxent model (Table 3.2). SSURGO map unit key) is the top contributing variable. One hundred and thirty-five individual soil types are present within the polygon boundaries of the *Hexastylis naniflora* element occurrences. Many of these individual soil types are part of soil complexes and are separated by things such as percent slope, erosion, how stony/rocky, and amount of clay. The most common individual soil type was Meadowfield-Rhodhiss complex, 25 to 60 percent slopes, very stony (14.1% of total). However, collectively the Meadowfield soils only comprised 14.3% of all soils). The individual Pacolet soil types were very common and collectively comprise 36% of all soil types present. Woolwine, Rion, and Fairview soils were also collectively common, comprising 10.4%, 9.7%, and 8.8% of all soils present respectively.

Table 3.2. Percent contribution of the environmental variables

Environmental Variable	Percent Contribution
SSURGO map unit key	23.5%
Minimum Annual Temperature	17.8%
Average Annual Precipitation	15.7%
Landcover	12.9%
Landcover Majority	12.0%
Landcover Hexastylis Grouping	5.4%
Geomorphons	4.9%
Elevation	4.6%
Canopy Cover	3.2%

The minimum annual average temperature range in the analysis extent is 39 – 51 degrees Fahrenheit. The majority of the *Hexastylis naniflora* element occurrences (89%) are found at the 47 and 48 degrees. The average annual precipitation range in the analysis extent is 42 – 81

inches per year. The majority of the *Hexastylis naniflora* element occurrences (82%) are found in the 47 – 49 inches per year range.

Piedmont forested landcover habitats dominate the land area of the element occurrences. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier (53%), Southern Piedmont Mesic Forest (9%), Southern Piedmont Dry Oak-Pine Forest (5.2%), Southern Piedmont Small Floodplain and Riparian Forest (4.4%), and collectively comprise 71% of the element occurrences area. Evergreen Plantation or Managed Pine (9%), Harvested Forest (7.2%), Developed, Open Space (5%), Pasture/Hay (2.1%) collectively comprise 22% of the total element occurrence area. The remaining 6 percent of element occurrence area is comprised of a mix of 14 other natural and disturbed landcover classes, but each at small percentages.
The landcover majority classification scheme reduces the total number of landcover classes present in the analysis extent from 23 to 11. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier is still the dominant landcover class (58%). However disturbed categories are increased in area (sum total of 35%). Evergreen plantation or managed pine (12%) and Pasture/Hay (12%) are the only other categories that have at least 10% or greater area. The increase in disturbed landcover area representation in the landcover majority layer suggests that many *Hexastylis naniflora* population areas are situated in areas impacted by disturbed landcover. This is likely due to urban encroachment and increasing fragmentation of habitats.
The landcover *Hexastylis naniflora* grouping reveals the amount of disturbance present in *Hexastylis naniflora* population areas. Landcover classes grouped as disturbed comprises 27% of the total area. Mixed forest (deciduous and evergreen) comprises 58%, pasture/hay 12%, and hardwood forest 2%. Open water, evergreen and barren landcover groupings are all at less than 1% each.

Geomorphons revealed that the majority of *Hexastylis naniflora* element occurrence areas are situated in concave landforms. Geomorphon categories hollow (13%), valley (46%), and depression (10%) collectively comprise 69% of all *Hexastylis naniflora* population areas. Flat landforms comprise 15.5% of the area and convex landforms the remaining 15.5%.
Within the analysis extent, the range of elevation present is 335 – 5,265 feet. For *Hexastylis naniflora*, the prime elevation range is from 666 – 908 feet (53% of total element occurrence

area). A lesser elevation range is present from 935 – 1,184 (37% of total element occurrence area).

Canopy cover for the *Hexastylis naniflora* populations are dominated by Tree Cover 70-80% (20.2%) and Tree Cover 80-90% (63.9%). The rest of the canopy cover categories are 2% or less.

We performed a Kruskal-Wallis 1-way non-parametric Analysis of Variance (ANOVA) to investigate the relationship between Maxent scores and current resilience of populations (Table 3.3). There are significant differences in the average Maxent scores between the four resilience categories ($p = 0.04$) and the mean Maxent score increases as population resilience increases from low to very high. The model gives us some predictive ability regarding habitat suitability where higher Maxent scores, on average, result in higher population resilience.

Table 3.3 Results of the Kruskal-Wallis 1-way non-parametric ANOVA investigating relationships between Maxent scores and current resilience groups for dwarf-flowered heartleaf.

Groups	*Count*	*Mean Rank*
low	13	30.7
moderate	25	30.7
high	5	42.8
very high	28	45.7

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	4375.7	4	1093.92	2.65	0.0404
Within Groups	28036.3	68	412.30		
Total	32412.0	72			

Reproduction and Presence of Pollinators

The pollination of *Hexastylis* has not been well studied but the genus is thought to be pollinated by insects including flies, wasps, and thrips (Otte 1977). Additionally, Lengyel et al. (2010) described how, within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal via ants). This supports Gaddy's work (1986), which found three species within the Hexastylis Heterophylla subgroup (*H. heterophylla, H. naniflora, and H. minor*), which employ myrmecochory as a method for seed dispersal.

Because the flower for this species is oftentimes partially or completely covered with soil and leaf litter, possibly inhibiting pollinator activity (Gonzalez 1972), there is still uncertainty in the pollination mechanism for dwarf-flowered heartleaf. Otte (1977) suggests that a variety of possible pollinators reside in this leaf litter, however, the calyx opening is considered to be far too small for efficient pollinating (Gaddy 1981). There are, however, invertebrates within this proposed size limit that could theoretically act as pollinators. It is possible that the species employs self-pollination, with or without a vector, or that cross-pollination occurs by a number of invertebrates. Jones et al. (2014) investigated pollination of dwarf-flowered heartleaf under a manipulative experimental design, and found that while insects may play a significant role in pollination, even without them, flowers managed to produce a partial seed set. However, two points need to be considered here. First, although flowers managed to produce seeds in the absence of insect pollinators, the efficiency of pollination decreased by almost 50%. Also, even if successful pollination occurs in the absence of insect vectors, the dispersal of plants amongst populations would be limited, and could result in decreased resilience due to genetic concerns such as limited gene flow and issues associated with potential inbreeding depression.

Abundance

The influence of stochastic variation in demographic (reproductive and mortality) rates is much higher for small populations than large ones. Stochastic variation in demographic rates causes small populations to fluctuate randomly in size. In general, the smaller the population, the greater the probability that fluctuations will lead to extinction. There are also genetic concerns with

small populations, including reduced availability of compatible mates, genetic drift, and inbreeding depression. Small populations of dwarf-flowered heartleaf have low resilience, leaving them particularly vulnerable to stochastic events.

As of 2016, the combined databases of the NCNHP and SCDNR contain 239 Element Occurrence Records (EORs) for *H. naniflora* (NCNHP 2016, SCDNR 2016). These EORs depict roughly 113 locations which are sufficiently geographically distinct to be regarded as proxies for populations of the species (See *Delineating Populations*). Thus, the total number of populations has increased more than four-fold (from 24 to 113) since the species was listed in 1989.

At this time, the largest known populations have been monitored by NCNHP and NCDOT. The estimates for entire populations are based on a consistent monitoring methodology developed by NCDOT, USFWS, and NCNHP with monitoring plots representing roughly 10% of a population. Populations were delineated to get a more accurate boundary and size of the area occupied. All rosettes are counted annually in each monitoring plot to estimate an extrapolated population size, based on the number and density in the plots. As a result of these efforts, better estimates of population sizes for the largest known populations are available, compared to when the last five-year review was completed in 2010 (Robinson and Padgett 2016).

The 113 EORs have been estimated to contain anywhere from a single rosette to over 100,000 rosettes. Appendix 1 was created by NCNHP (2016) to replicate the same format and population data as Table B2 of the most recent USFWS five-year review of *H. naniflora* (USFWS 2010), for comparison of changes since 2010, and summarizes the largest occurrences of *H. naniflora*, with the size of the population based on the number of rosettes it was last estimated to contain. The number of populations estimated to contain over 1,000 rosettes is 26. This is approximately 23% of the total known populations and many of these populations contain well over 1,000 individuals.

There are, however, 13 populations (12% of all known) that are simply known to be extant, with no available estimate of population size (NCNHP 2016, SCDNR 2016). If the most recent population estimates for each EOR are compiled across years of observation, the 113 populations

could conservatively be estimated to contain a collective total of more than 300,000 rosettes (NCNHP 2016, SCDNR 2016).

Population Trends

Although abundance is critical in assessing the resilience of dwarf-flowered heartleaf, trends in population growth can also be informative. Long-term growth trends are typically defined as the degree of change in population size over 200 years, whereas short-term growth is typically measured as that degree of change over a 10 year period. We lack a robust data set to assess trends at either of these time scales. However, from 2012-2016, NCNHP conducted systematic annual surveys of thirteen of the largest populations across the range.

Based on the results of the five-year monitoring efforts completed in 2016, nine out of thirteen populations remain stable during the five years of data collection (Robinson and Padgett 2016). The largest known population, Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop in Rutherford County, NC, is estimated to have over 100,000 rosettes (Robinson and Padgett 2016). This large population consists of many scattered subpopulations on private property; two of the subpopulations are protected as a Registered Heritage Area, although Registry is a non-binding agreement with landowners that can be cancelled at any time (NCNHP 2018).

Two of the thirteen populations increased in numbers from 2012-2016: Cliffside Steam Station and Broad River: Floyds Creek, Long Branch. The Cliffside Steam Station is protected with a voluntary agreement with Duke Energy and was estimated to contain over 39,000 rosettes in 2016. The Broad River: Floyds Creek, Long Branch population is not at all protected, but was last estimated to consist of over 12,000 individuals in 2016 (Robinson and Padgett 2016).

Based on the results of recent surveys and a review of all known populations of *Hexastylis naniflora*, the overall trend over approximately 30 years is estimated to be declining 10-30%. This is estimated by a combination of documented declines of some populations, while many others appear to be remaining relatively stable, and some have increased.

Chapter 4: CURRENT CONDITIONS

Below we assess current resilience, representation, and redundancy as they relate to population and habitat factors known to be important for species viability. Based off of recent reports (Robinson and Padgett 2016; Robinson 2016), the species consists of 119 populations distributed across 12 counties in North Carolina and South Carolina. Populations are composed of both multiple EOs and stand-alone EO records. Recent genetic research discussed in Chapter 2, suggests that dwarf-flowered heartleaf, as originally described, is found in the southern portion of its presumed range based on current EO locations, and the northern portion could be a currently undescribed species (Figure 4.1; Estep pers. Comm. 2018). The genetic analysis to support this is complete, but a review of the morphology is ongoing and a new species has not yet been described (Estep pers. Comm. 2018). For the purpose of this SSA, we assume all EO detections are *H. naniflora*, and represent the best currently available scientific data.

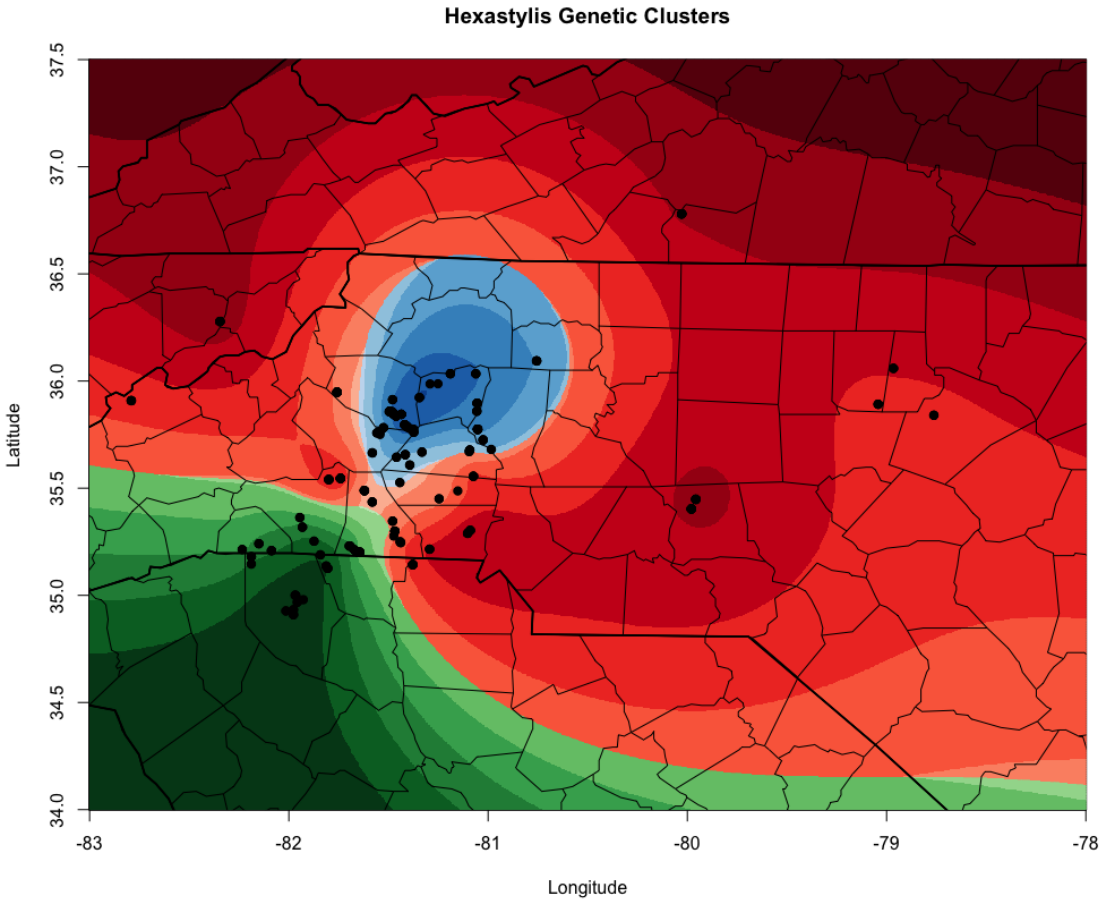


Figure 4.1. Recent genetic analyses detailing clustering of the genus Hexastylis. Black dots represent GIS locations of individual plants included in the genetic analysis. Green areas represent "true" *H. naniflora*; Blue represents a possible new species; Red represents other species in the genus (*H. minor, H. heterophylla*, etc.).

Current Population Resilience

Categorizing Resilience

For the purposes of this SSA, we use population size as the main driver of population resilience. The unit of measurement for population size in this species is a "clump" (rosette). As discussed previously, populations in North Carolina were delineated by NCNHP, whereas the Service defined populations in South Carolina. These delineations were based off of NatureServe criteria such as EO separation distance and intervening landscape matrix. EO data included a wide range of years since the species was last observed at a given location (1964-2017), so although recent reports suggest the species consists of 113 populations, some of that data is fairly outdated. For the purposes of this SSA, we only used EOs that were observed since 2005. We did this for several reasons. First, we did not want to go back too far and assume a population was still present. Second, we wanted to be consistent in what we considered "current" for both categorizing resilience and use in the habitat model (discussed later). Also, experts concurred that records as old as 12 years are still likely to persist. Finally, there was a natural break in the data at the year 2005, coinciding with the year the last five-year review was initiated, where the number of EOs dropped off significantly in the years 2004 and earlier. It is important to note that many of the populations that we excluded from our analysis may still persist on the landscape. In fact, many EOs for this species have persisted for decades, despite not having intervening surveys to confirm their persistence.

Based on the criteria (excluding EOs prior to 2005), there are currently 78 populations distributed across the range of dwarf-flowered heartleaf, although this may be an underestimate as discussed above.

To determine overall resilience for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resilience categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are also incorporated secondarily. Appendix 2 shows the NCNHP EO rank specifications for dwarf-flowered heartleaf. The EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, given there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, depending on habitat conditions; poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016; Robinson and Padgett 2016) focus monitoring studies on populations with greater than 1,000 individuals, populations that are assumed to be very viable. Because we do not have habitat level information for every population we assessed, we synthesized all of the above population size information and created four resilience categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Occupancy and Abundance

There are 78 populations of dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). Table 4.2 shows the contribution of each resilience category as follows: 36% (very high); 7% (high); 34% (moderate); 23% (low). When looking at cumulative percentages of resilience, it is interesting to note that 77% of all of the populations are classified as moderate to very high resilience (Table 4.2).

Table 4.1. Current populations of dwarf-flowered heartleaf and associated resilience across the species range. Abundance and last observation date based on Natural Heritage Program data (2018).

Site Name	State	County	Last Observed	Total plants	Resilience
Glade Creek, Alex County	NC	Alexander	2017	>1000	very high
Catawba River: Hoyle Crk-Micol Crk	NC	Burke	2013	>1000	very high
Island Creek Heath Bluff	NC	Burke	2016	>1000	very high
Gunpowder Creek: South of Hudson	NC	Caldwell	2012	>1000	very high
Peaked Top Rare Plant Site/Foothills Landfill	NC	Caldwell	2014	>1000	very high
Jacob Fork West Corridor	NC	Catawba	2012	>1000	very high
Murrays Mill/Upper Balls Creek NA	NC	Catawba	2013	>1000	very high
NCDOT TIP: R-2824	NC	Catawba	2015	>1000	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	NC	Catawba	2013	>1000	very high
Cowpens NBF - Site 1	SC	Cherokee	2016	>1000	very high
Cliffside Steam Station	NC	Cleveland/Rutherford	2016	>1000	very high
Broad River/Sandy Run NA	NC	Cleveland	2012	>1000	very high
Broad River: Brushy Creek	NC	Cleveland	2016	>1000	very high
Buffalo Creek: Kings Mountain Res	NC	Cleveland	2016	>1000	very high
Buffalo Creek: Tributaries N and S of SR 2047	NC	Cleveland	2012	>1000	very high
Rhyne Conservation Preserve	NC	Lincoln	2016	>1000	very high
Mill Creek Forest and Seep	NC	Polk	2016	>1000	very high
New Hope Springhead Swamp	NC	Polk	2016	>1000	very high
Big Horse Creek Rare Plant Site	NC	Rutherford	2015	>1000	very high
Broad River: Floyds Creek	NC	Rutherford	2016	>1000	very high
Davenport Road/Mountain View Rare Plant Site	NC	Rutherford	2016	>1000	very high
Facebook Site	NC	Rutherford	2016	>1000	very high
Floyds Creek Tributray Rare Plant Site	NC	Rutherford	2012	>1000	very high
New Bethel Rare Plant Site	NC	Rutherford	2015	>1000	very high
Richardson Creek trib above Toms Lake	NC	Rutherford	2016	>1000	very high
DNR Peters Creek Heritage Preserve	SC	Spartanburg	2016	>1000	very high
Taylor Blalock Res	SC	Spartanburg	2016	>1000	very high
Leepers Creek Heartleaf Site	NC	Lincoln	2006	>1000	very high
Little Gunpowder Creek Rare Plant Site 1	NC	Caldwell	2015	500-1000	high
Little Gunpowder Creek Rare Plant Site 2	NC	Caldwell	2015	500-1000	high
Northern Catawba County	NC	Catawba	2017	500-1000	high

Site Name	State	County	Last Observed	Total plants	Resilience
Rock Barn Solar Farm	NC	Catawba	2010-2011	500-1000	high
Buffalo Creek Rare Plant Site	NC	Cleveland	2012	500-1000	high
Third Creek Rare Plant Site	NC	Alexander	2010	100-500	moderate
Hickory Area	NC	Burke/Catawba/Caldwell	2016	100-500	moderate
Burke County - Drowning Creek UT	NC	Burke	2017	100-500	moderate
Simms Hill/Little River Uplands	NC	Burke	2015	100-500	moderate
Smith Cliff/Henry Fork River	NC	Burke	2015	100-500	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	NC	Catawba	2016	100-500	moderate
NCDOT TIP R-2824	NC	Catawba	2015	100-500	moderate
South Fork Catawba River, Henry Fork	NC	Catawba	2007	100-500	moderate
Broad River/Sandy Run NA	NC	Cleveland	2012	100-500	moderate
Brushy Creek Headwaters	NC	Cleveland	2014	100-500	moderate
First Broad River: Crooked Run Creek	NC	Cleveland	2010	100-500	moderate
No Business Creek, Boyd Tract	NC	Cleveland	2007	100-500	moderate
West Shelby Mesic Slope	NC	Cleveland	2016	100-500	moderate
UT of Kings Mountain Res	NC	Gaston	2012	100-500	moderate
Buffalo Shoals Creek	NC	Iredell	2014	100-500	moderate
Cat Square Heartleaf Forest	NC	Lincoln	2012	100-500	moderate
Collinsville (Hughes) Creek Slopes	NC	Polk	2016	100-500	moderate
Fox Knoll Farm	NC	Polk	2016	100-500	moderate
Forest City: Adj to Isothermal CC	NC	Rutherford	2010	100-500	moderate
Jonas Road Rare Plant Site	NC	Rutherford	2014	100-500	moderate
Knob Creek NA	NC	Cleveland	2005	100-500	moderate
Buffalo Creek	NC	Cleveland	2005	100-500	moderate
Kross Keys NA	NC	Polk	2005	100-500	moderate
Catawba River: North Fork Mountain Creek	NC	Catawba	2005	100-500	moderate
Catawba River: Lake James	NC	Burke	2006	100-500	moderate
Hogpen Branch Transplant Site	NC	Rutherford	2005	100-500	moderate
NCDOT TIP R-3603A	NC	Alexander	2017	<100	low
South Mountains Pleasant Grove Uplands	NC	Burke	2016	<100	low
Gunpowder Creek	NC	Caldwell	2012	<100	low
Killian Crossroads	NC	Catawba	2010	<100	low
Pott Creek	NC	Catawba	2012	<100	low
Beaverdam Crk at First Broad River	NC	Cleveland	2011	<100	low
Buffalo Creek: Potts Creek	NC	Cleveland	2012	<100	low
Buffalo Creek: Ravine	NC	Cleveland	2007	<100	low
Hickory Creek - UT (Shelby High School)	NC	Cleveland	2016	<100	low
Boulder Creek Subdivision - Jordan Road	SC	Greenville	2016	<100	low
Gateway Elementary School	SC	Greenville	2017	<100	low
Fanjoy Road Site	NC	Iredell	2015	<100	low
Levan Family Farm	NC	Iredell	2013	<100	low

Site Name	State	County	Last Observed	Total plants	Resilience
Lincoln County, SR-1314	NC	Lincoln	2014	<100	low
Northeast Lincolnton: UT Walker Branch	NC	Lincoln	2009	<100	low
Sandy Spring Church Springhead Swamp	NC	Polk	2005	<100	low
First Broad River: Hickory Creek	NC	Cleveland	2006	<100	low
Smith Cliff/Henry Fork River	NC	Burke	2005	<100	low
First Broad River: Beaverdam Creek Tribs	NC	Cleveland	2006	<100	low

Table 4.2. Population resilience categories by county for dwarf-flowered heartleaf.

County	Very High	High	Moderate	Low	Totals
Alexander	1		1	1	3
Burke/Catawba/Caldwell			1		1
Burke	2		4	2	8
Caldwell	2	2		1	5
Catawba	4	2	4	2	12
Cherokee	1				1
Cleveland/Rutherford	1				1
Cleveland	4	1	7	6	18
Gaston			1		1
Greenville				2	2
Iredell			1	2	3
Lincoln	2		1	2	5
Polk	2		3	1	6
Rutherford	7		3		10
Spartanburg	2				2
Totals	**28**	**5**	**26**	**19**	**78**
% of total	*36*	*7*	*34*	*23*	*100*
Cumulative %	*40*	*43*	*77*	*100*	--

Population Trends

Although we lack an adequate past time series of abundance data for all populations to estimate growth rates or population trends, NCNHP conducted surveys of thirteen of the largest populations across the range of the species from 2012-2016. Table 4.3 shows the results of all of these surveys. Two populations show an increasing trend, nine show a stable trend, and two show a decreasing trend.

Table 4.3. Summary of population trends over 5 years of monitoring data for 13 of the largest populations of dwarf-flowered heartleaf across its range (from: Robinson and Padgett 2016).

Trend	Survey	Site	2016 estimated number of plants (Rosettes)	2016 area occupied (Acres)
Increasing	NCNHP	Cliffside Steam Station (EO 276)	39,535	52
	NCNHP	Broad River: Floyds Creek, Long Branch (EO 177)	12,687	5.67
Stable	NCNHP	Island Creek Bluff/Love Lady Site (EO 029)	50,481	61.76
	NCNHP	Rhyne Preserve (EO 302)	19,873	22.43
	NCNHP	Mills Creek Forest and Seep (EO 023)	1,733	1.39
	NCNHP	New Hope Springhead Swamp (EO 125)	12,235	5.03
	NCNHP	Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop (EO099)	106,940	83.39
	NCNHP	Broad River: Cleghorn Creek, US 221 (EO 176)	6,750	7.24
	NCNHP	Cowpens National Battlefield (SC EO 016, 017, 018)	2,823	6.05
	NCNHP	Peters Creek Preserve (SC EO 011)	3,306	8.98
	NCNHP	Blalock Reservoir (SC EO 007, 031)	3,505	7.59
Decreasing	NCNHP	Second Broad River (Forest City Industrial Complex) (EO 154)	2,576	4.74
	NCNHP	South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)	123	0.09

Current Species Representation

Representation describes the ability of a species to adapt to changing environmental conditions. We lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species.

Current Species Redundancy

For the dwarf-flowered heartleaf to maintain viability, the species also needs to exhibit some degree of redundancy. Species-level redundancy reflects the ability of a species to withstand catastrophic events, and is best achieved by having multiple, widely distributed populations relative to the spatial occurrence of catastrophic events. Redundancy for dwarf-flowered heartleaf is the total number and resilience of population segments and their distribution across the species range.

An important question when investigating redundancy for dwarf-flowered heartleaf is, "what exactly is a catastrophe?" We consider a catastrophe to be any population level disturbance that has the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, like hurricanes, and often with devastating effects, however they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010).

As stated previously, there are 78 populations of dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). The populations are spread across the range, although a majority occur in North Carolina. Although, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances, the species range is very small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

CHAPTER 5: INFLUENCES ON VIABILITY

Hexastylis naniflora populations occur in rapidly growing urban areas with expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. In addition to threats associated with residential, commercial, and industrial development, other documented threats include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of ponds, impacts from grazing cattle, ORV damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or siltation (NCNHP 2016, Robinson and Padgett 2016). Climate change may exacerbate these risk factors through changes in temperature and precipitation.

Threats were assessed for populations monitored by NCNHP during 2012-2016 (Robinson and Padgett 2016), and EOs were reviewed for other documented threats to populations. Indirect or direct threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank for each threat factor determines the overall value for each threat observed at each population. No significant changes in threats within populations were noted from 2012-2016. Threats observed during these years included development, incompatible forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and road construction.

Below, we summarize primary threats to the viability of dwarf-flowered heartleaf. Primary influences will be carried forward in our future projections in the next section.

Human Population Change

Increasing human populations drive development. With increases in population, there will be increasing conversion of open space to more impervious cover, with a subsequent increase in roads and other associated infrastructure. Increases in roads and impervious cover have the potential to lead to habitat loss and/or fragmentation, a primary risk factor for dwarf-flowered

heartleaf. Tables 5.1-5.2 and Figures 5.1-5.2 show the estimated human population increases for North Carolina and South Carolina counties within the range of the species. The most populous counties include Greenville and Spartanburg in South Carolina, and Catawba, Gaston and Iredell counties in North Carolina.

Table 5.1-Human population projections for North Carolina counties within the range of dwarf-flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

County	2018	2023	2028	2033	2037
Alexander	38,609	39,244	39,686	39,992	40,169
Burke	90,865	93,124	95,382	97,644	99,452
Caldwell	83,919	86,723	88,689	91,126	92,870
Catawba	157,424	159,799	162,175	164,549	166,447
Cleveland	98,862	99,685	100,004	100,128	100,170
Gaston	221,112	227,667	237,344	245,276	252,388
Iredell	179,740	195,623	211,501	227,383	240,088
Lincoln	84,494	91,034	96,865	103,069	107,858
Polk	21,273	21,823	22,288	22,681	22,955
Rutherford	67,880	68,154	68,283	68,341	68,368

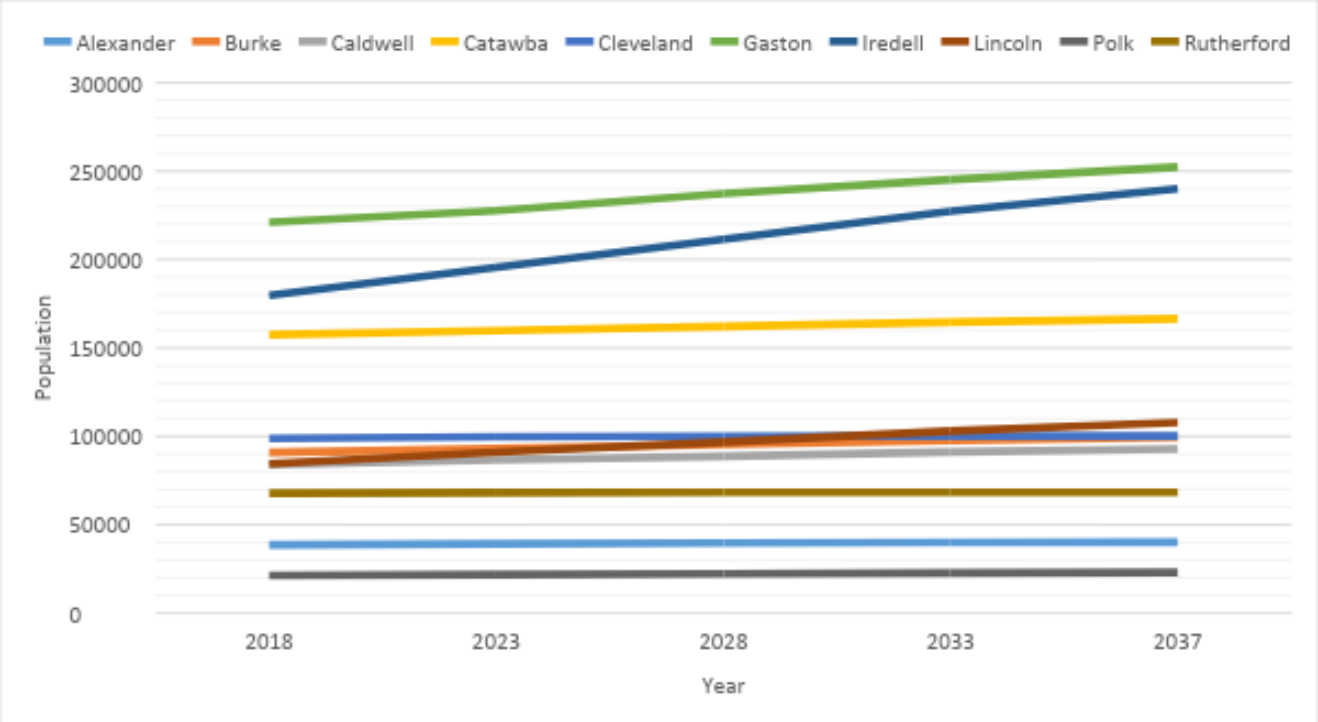


Figure 5.1- Human population projections for North Carolina counties within the range of dwarf-flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

Table 5.2- Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

County	2020	2025	2030	2035
Cherokee	61,760	64,760	67,350	70,170
Greenville	492,890	517,740	542,290	567,010
Spartanburg	310,220	323,550	336,810	350,110

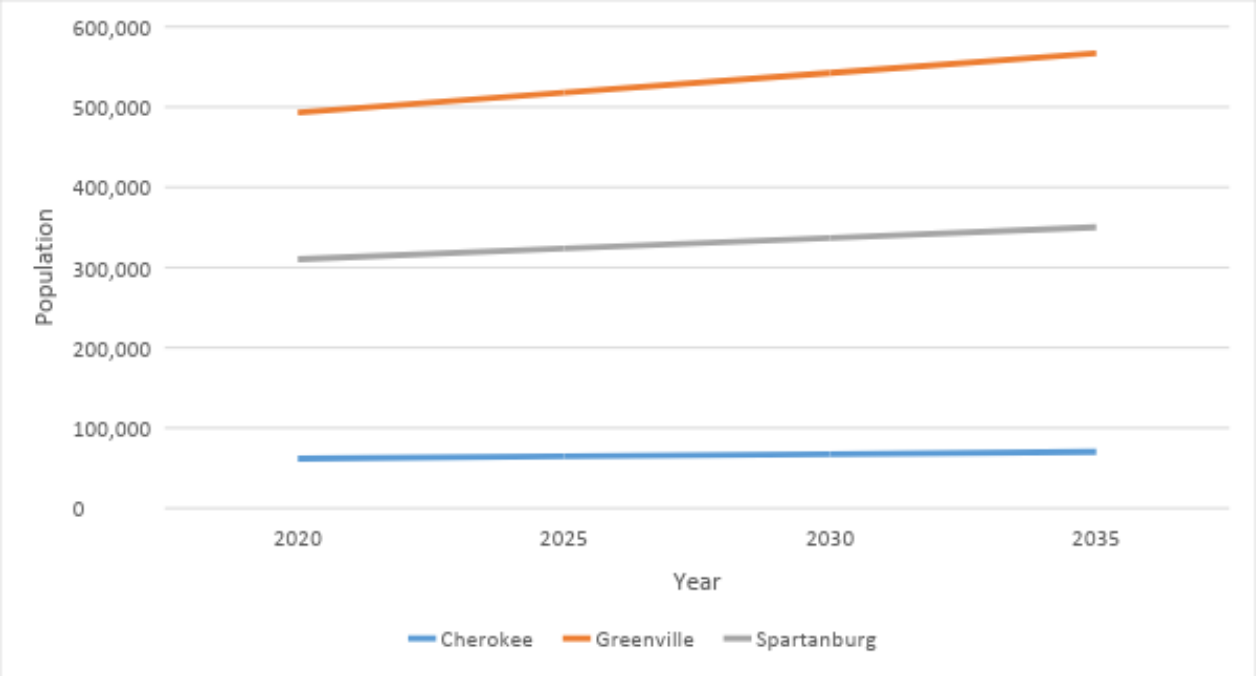


Figure 5.2. Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

Development

A large number of the known populations occur near expanding urban areas and are threatened by the residential, commercial, and industrial development associated with this growth. Populations occurring in more rural areas are threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds.

A 2010 review of existing NHP EOR data revealed that all or portions of 26 populations (24% of the total) had been directly or indirectly impacted through development projects or other causes such as trash disposal, expansion of residential lawns, cattle, or invasive exotics (NCNHP 2010; SCDNR 2010). Another 16 populations have been specifically reported to be threatened by one or more of these same sources. Therefore, threats have either occurred or are reasonably foreseeable within 42 of the 113 populations (corresponding to 37% of all known populations). Of these 42 populations, all or portions of 22 (50%) had been adversely impacted by activities

requiring ESA Section 7 consultation with the USFWS. The fact that nearly 20% of all known populations had been subject to formal Section 7 consultation illustrates the threats faced by the species.

In the same 2010 review, the most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving *H. naniflora* is road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations between the USFWS and the NCDOT. Collectively, these projects have adversely impacted or are currently expected to impact some 22,135 rosettes. In most cases the Section 7 process has resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection to those plants remaining (post-construction) within NCDOT right-of-way (ROW).

Other forms of economic development have also resulted in the destruction or modification of habitats occupied by *H. naniflora*; in many cases, these activities have also required Section 7 consultations with the USFWS. Examples of these activities include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities (in compliance with Federal Aviation Administration standards) at a regional airport. Collectively, these activities have involved the loss or relocation of several thousand rosettes.

Blalock Reservoir in Spartanburg County, South Carolina was once estimated to contain the largest population of *H. naniflora*, with over 11,000 rosettes reported here in 1997 (JJ&G, 1998). This population was the subject of a section 7 consultation as a result of a proposal to raise the elevation of Blalock Reservoir, which provides water supply storage to Spartanburg County and the City of Spartanburg (USFWS, 2001). Approximately one-third of this population was directly threatened by inundation, and the Federal agency committed to the relocation of some 3,054 rosettes to remaining areas of occupied habitat around the reservoir. At the conclusion of formal section 7 consultation, the USFWS anticipated that as many as 6,619 rosettes (assuming that all transplants survived) would be afforded protection through restrictive covenants placed on properties owned by the Spartanburg Water System (SWS) surrounding Blalock Reservoir.

However, this population was last reported to contain a mere 1,400 rosettes (Newberry, 2006), and has twice since been impacted by encroachments from adjacent landowners (Newberry, 2009; Schneider, 2006, and JJ&G, 2006). Some of these apparent declines could be partially an artifact of incomplete survey effort, in that the exhaustive surveys which led to the 1997 estimate (of 11,000 rosettes) have never been repeated. However, it seems unlikely that plants occurring on privately owned shoreline not subject to restrictive covenants would be any more stable than those occurring on properties specifically protected and managed for the species (by SWS).

Invasive Species and Woody Encroachment

Several of the known populations of dwarf-flowered heartleaf occur on steep ravine slopes which also support stands of mixed hardwoods with an understory of mountain laurel (*Kalmia latifolia*) or *Rhododendron spp*. These stands are often very dense and reduce the amount of light reaching the dwarf-flowered heartleaf plants growing below. Under these conditions the plants often show reduced vigor and reduced flower and fruit production. Careful, selective logging or natural tree fall and limited understory removal would open up these populations to more light. Additional light, if not accompanied by increased siltation from the intensive soil disturbances associated with forest clear-cutting, probably would benefit these populations (Gaddy 1981).

Invasive exotic plant species are rampantly spreading throughout riparian corridors and ravines across the range of this species (USFWS 2011). Invasive exotics such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum* spp.), Japanese honeysuckle (*Lonicera japonica*) and Japanese Nepal grass (*Microstegium vimineum*) are known to threaten several populations; however, the scope and magnitude of this threat has not been comprehensively assessed. This threat requires active management in order to be successfully abated. At present, the majority of protected populations are secured against habitat conversion, but lack designated managers with the technical expertise and available resources (funding and personnel) to address this threat.

Climate Change

There is a growing concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074; Golladay *et al.* 2004, p. 504; Cook *et al.* 2004, p. 1015). Because typical habitats for this species include moist soils adjacent to creeks, streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993), specific effects of climate change to the dwarf-flowered heartleaf are likely related to changes in soil moisture associated with potential increases in drought.

Warming in the Southeast is expected to be greatest in the summer (NCCV 2016) which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p.7; NCCV 2016). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p.7).

Despite the recognition of potential climate effects on ecosystem processes, there is uncertainty about what the exact climate future for the Southeastern US will be and how the ecosystems and species in this region will respond. Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. As a result, impacts from rapid urbanization in the region might be exacerbated under even a mild to moderate climate future.

Regardless of a pessimistic, optimistic, or status quo climate future, the following systematic changes are expected to be realized to varying degrees in the Southeastern US (IPCC 2013):

- More frequent drought
- More extreme heat (resulting in increases in air and water temperatures, Figure 5-3)

- Increased heavy precipitation events (e.g., flooding)
- More intense storms (e.g., frequency of major hurricanes increases)
- Rising sea level and accompanying storm surge

In recent years, the Southeast has experienced moderate to severe droughts that many observers have implicated in population declines and poor transplant survivorship (NCNHP, 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). The extent to which these climate changes will significantly affect populations of dwarf-flowered heartleaf is currently unknown.

Appendices 4a and 4b gives summary reports on historical and future predicted climate parameters from the USGS National Climate Change Viewer for both North Carolina and South Carolina. As discussed above, the trend for these States is consistent with the general trend in the Southeast: more frequent drought, more extreme heat, and increased precipitation events. If these predictions hold true, dwarf-flowered heartleaf habitat would likely be impacted through increased evaporative rates and decreased soil moisture (Appendices 4a and 4b), increased potential for catastrophic wildfire events, as well as potential disruption of stream bank morphology through increased flooding events. Our habitat model indicates a preferred temperature and precipitation range, indicating that the species would be sensitive to a changing climate.

Chapter 6: FUTURE CONDITION

Future Considerations

Our analysis of the past, current, and future influences on what the dwarf-flowered heartleaf needs for long term viability revealed that there are several influences that pose risks to future viability of the species. These risks are primarily related to habitat changes from development and long term climate change. We use projections of urban development to assess potential habitat loss and fragmentation. We also considered how climate change may exacerbate the impacts of development in a qualitative fashion using a narrative approach.

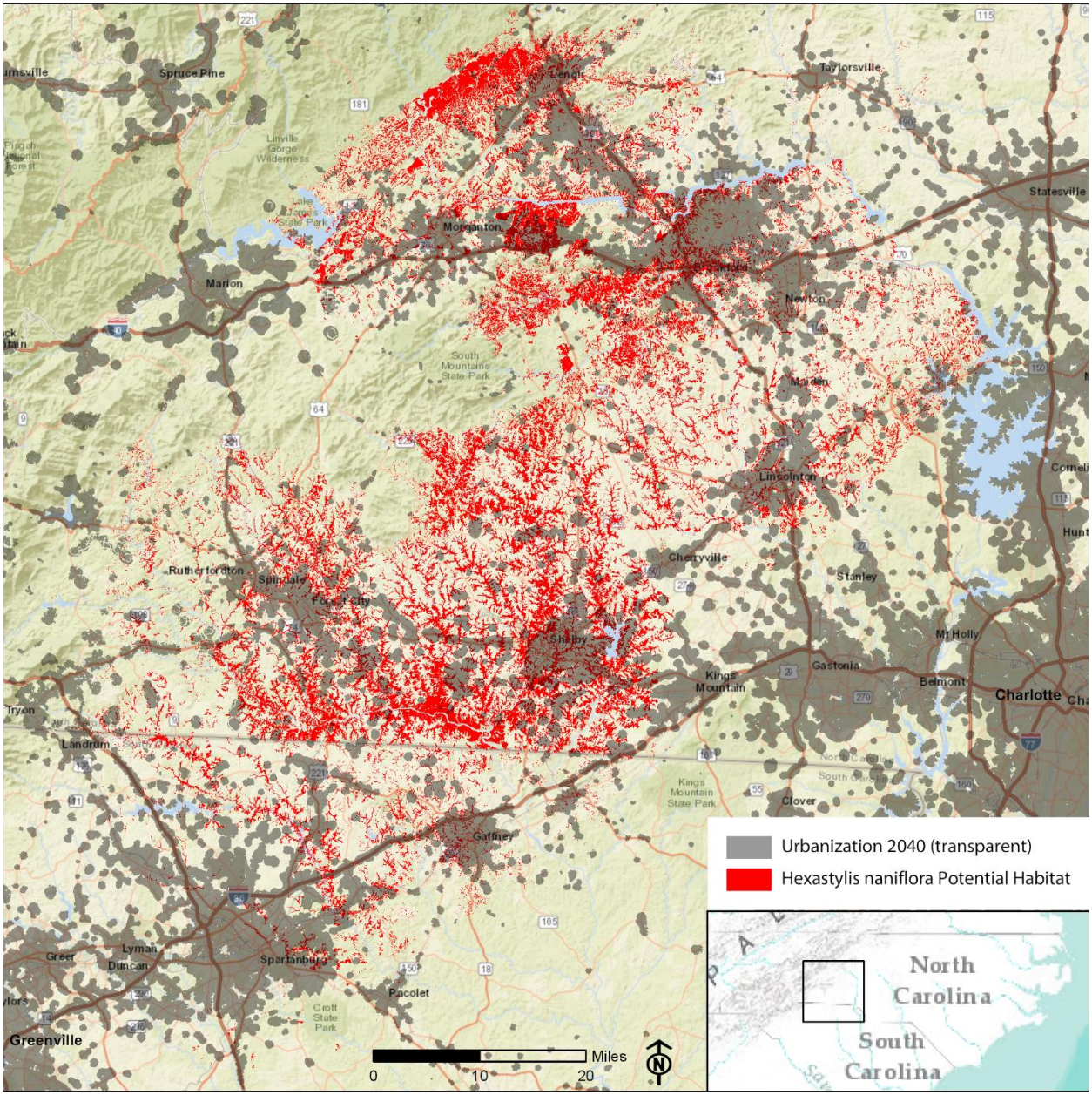
Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below. Based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape, we chose to project populations out to the year 2040 under each scenario, but no further.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040 (Figure 6.1). SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise

known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995).

Figure 6.1. Results of the SLEUTH model with *Hexastylis naniflora* potential habitat predicted by the MAXENT model overlaid.



The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and other SSAs, and this threshold represents a highly likely outlook for urbanization of the

landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations (from Current Conditions—68 populations)
- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There is no data available on the exact relationships between urbanization and the impacts to dwarf-flowered heartleaf. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative impacts; development increase of at least 50% was likely to have significant impacts to populations. We also assume that populations currently on protected lands are likely to see smaller impacts from urbanization compared to those that are not protected, but protection status (perpetuity vs non-perpetuity) matters. For example, Registered Heritage Areas are non-binding agreements with a land owner, and if the land changes ownership, or the owner decides not to continue with the agreement, then the Registry is no longer valid. Appendix 4 shows the protection status of each delineated population which helped to inform our assessment of resilience under each scenario.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. We believe this is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider for Current Conditions include detections that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to persist. Dwarf-flowered heartleaf is a long-lived perennial, and several EOs have been revisited

after more than 10 years and the species was present. For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future, was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resilience of that population.

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics including resilience category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resilience categories were assessed using last known abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score was calculated by taking the mean Maxent score of all potential habitat within the 1,000 foot buffer. The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 foot buffer that falls within the highest habitat class. Together, these two habitat metrics give

general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 foot buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-flowered heartleaf is likely to persist. Table 6.1 (North Carolina) and 6.2 (South Carolina) show all of the EOs we considered and the corresponding metrics associated with resilience categories, urban development, and habitat scores.

Table 6.1. North Carolina raw data for metrics assessed to investigate potential sites where dwarf-flowered heartleaf was historically found and is likely to persist. Resilience categories are based on last known abundance estimates as follows: 1 = low; 2 = moderate; 3 = high; 4 = very high. MAXENT Average Mean refers to the mean Maxent score of all potential habitat. % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat that falls within the highest habitat class. % Urban Development refers to the percentage of the 1,000 foot buffer around the EO that is projected to be urbanized in the year 2040.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	2	34	1	3
2				
3	2	22	0	10
4	2	22	0	7
5	2	21	0	0
6				
8	1	27	0	6
9	3	44	4	0
10	4	33	2	0
11				
12	4	54	10	0
13	1	31	1	30
14	2	61	16	7
15				
16	4	18	0	47
17	1	50	13	0
18	1	36	8	2
19				
20	2	22	1	88
21	2	34	4	54

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
23	4	15	0	8
25	1	47	15	30
27				
28	2	43	12	29
29	4	43	8	30
30	4	27	2	74
31	4	30	3	86
32	2	34	2	47
33	2	33	3	0
34	1	49	13	63
35	1	42	10	23
36	1	19	0	12
37	4	41	6	17
38	2	14	0	46
39	1	19	0	11
40	2	37	2	32
44	4	20	0	59
45	1	27	5	13
46	3	42	6	6
47	1	28	1	96
48	1	14	0	12
49	4	61	14	5
50				
51	4	52	11	18
52	2	46	4	0
53	1	35	4	24
54	1	35	1	10
55	4	30	0	0
56	2	40	2	6
57	2	21	0	80
58	1	42	5	0
59	2	11	0	49
60	1	25	0	2
61	3	41	0	0
62	2	34	0	0
63	1	27	0	6
64	2	39	9	11
69	2	46	11	19
70	2	38	1	0
71	2	30	2	0

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
72	2	52	14	0
73	4	60	17	1
74	3	65	14	4
75	4	47	6	9
76	4	42	4	10
77	3	31	1	27
79	2	39	1	0
80	1	43	4	15
83	2	17	0	11
84	2	13	0	1
85	2	42	4	5
87				
89	2	13	2	0
90	2	28	2	0
91	1	49	5	0
92	2	15	0	30
106	4	39	4	38
107	1	14	0	40
113	4	46	4	7
114				
115	2	37	3	26
118	3	42	0	9
121	2	41	5	0
122	1	12	0	39
124	1	12	0	9
125	4	15	0	41
130	2	17	0	24
149	4	64	17	3
151	2	16	0	27
154	4	30	1	22
157	2	20	0	0
158	3	36	7	5
159	4	62	24	60
160	3	62	24	32
161	4	64	28	30
162	1	32	2	58
163	2	15	0	56
164	3	18	0	52
165	1	13	0	56
166	1	14	0	40

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
167	4	30	0	20
168	4	19	0	34
169	1	30	0	12
170	2	17	0	40
172	1	39	3	7
173	2	30	1	48
174	1	42	4	16
175				
180	2	21	1	0
181	4	29	2	0
182	4	45	4	0
183	2	15	0	5
184	4	19	0	19
187	2	20	1	35
188	2	24	0	53
189	1	25	0	14
190				
191	2	34	2	0
192	2	35	3	0
193	2	36	7	6
194	4	51	14	18
195	1	21	0	96
196	1	23	4	67
197	4	35	8	38
198	2	32	6	25
199	2	29	5	43
200	1	26	2	87
201	1	39	4	63
202	4	35	4	85
203	1	43	4	49
204				
205	2	43	1	49
206	1	37	3	66
207	2	33	2	85
208	1	32	1	67
209	2	33	2	94
210				
212	1	37	3	85
213	1	36	4	72
219	1	32	1	4

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
222	2	23	3	7
223				
224	1	22	3	17
225	2	24	2	12
227	4	55	2	5
229	2	28	0	21
230	1	54	15	13
231	1	41	7	0
233	4	53	12	14
235	2	50	8	6
236	2	62	14	5
237	2	67	16	5
238	4	51	15	0
239	2	63	14	5
240	1	57	18	0
241	2	62	16	3
242	1	53	9	0
246	1	62	13	4
249	4	47	5	0
250	4	45	4	0
251	4	43	4	0
254	2	54	18	6
255				
256	2	54	15	13
258	3	19	0	51
259	4	25	0	0
262	4	29	2	50
263				
264				
265				
266				
267	2	29	1	0
268	1	33	2	0
269	2	49	17	0
270	1	46	18	1
271	1	26	7	0
272	1	33	0	71
273	2	28	2	0
274	2	50	8	0
275	2	12	0	0

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
276	4	42	5	21
277				
278				
279	1	32	4	89
280	2	64	30	30
281	1	64	31	36
282	1	64	31	51
283	1	65	34	59
284	1	64	35	45
286				
287	2	15	0	35
291	2	21	1	84
292	2	14	0	83
293	1	8	0	16
294	2	36	4	61
296	2	3	0	5
297				
298	2	16	0	1
299	1	12	0	0
300	1	9	0	18
303	2	31	0	0
304	2	31	0	0
305	1	30	2	0
306	1	4	0	53
308	2	15	0	3
309	1	5	0	0
310	4	58	26	35
311	2	15	0	0
312	4	17	0	57
313				
314				
315	1	36	4	61
317	1	15	0	53
318	2	34	4	52
319	4	43	4	10
320	4	41	6	98
321				

Min	1	3	0	0
Max	4	67	35	98

Table 6.2. South Carolina raw data for metrics assessed to investigate potential sites where dwarf-flowered heartleaf was historically found and is likely to persist. Resilience categories are based on last known abundance estimates as follows: 1 = low; 2 = moderate; 3 = high; 4 = very high. MAXENT Average Mean refers to the mean Maxent score of all potential habitat. % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat that falls within the highest habitat class. % Urban Development refers to the percentage of the 1,000 foot buffer around the EO that is projected to be urbanized in the year 2040.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	2	21	0	0
2	2	1	0	4
3				
4	1	13	0	10
5	2	0	0	64
6	1	0	0	36
7	4	27	0	35
8	2	0	0	14
9				
10				
11	4	14	0	52
12				
13	1	7	0	100
14	4	14	0	43
15	1	0	0	4
16	4	22	0	38
17	4	22	0	33
18	3	19	0	52
19	1	12	0	65
20	2	5	0	100
21	3	5	0	90
22	1	0	0	0
23				
24	1	4	0	3
25	1	14	0	48
26	4	12	0	65
27	4	18	1	40

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
28	4	19	1	49
29				
30	2	7	0	88
31	4	0	0	0
32	2	7	0	93
33	2	2	0	20
34	1	31	3	1
35	1	23	1	53
36	2	6	0	0
37	1	24	2	0
38	4	5	0	37
39	1	6	0	1
40	2	6	0	20
41	1	11	0	87
42	2	3	0	6
43	1	23	0	43
44				
45				
46	1	10	0	96
47				
48				
49	3	8	0	70
50	2	5	0	54
51	1	0	0	35
52	3	0	0	0
53	2	10	0	66
54	2	9	0	91
55	1	4	0	99
56	2	14	0	96
57	3	15	0	38
59	2	4	0	17
60	4	17	1	12

Min	1	0	0	0
Max	4	31	3	100

Next, we implemented a set of ranking rules using the data from Tables 6.1 and 6.2 to further assess which EOs had a higher likelihood of persistence on the landscape. We used SMART

methodology to quantify and implement our ranking rules. Because the metrics of interest vary in data type (i.e. categorical vs continuous) and range of values (i.e. not all continuous variables have the same maximum and minimum), our first step was to normalize all of the data on a scale of 0-100. Normalization techniques allow for aggregation of criteria with numerical and comparable data. We decided to analyze North and South Carolina data separately because the Maxent model predicts habitat differently across state lines due to differences in soil classification. We weighted each variable according to our opinion of the level of contribution each variable had to the probability of persistence of that particular EO. This resulted in abundance having the highest weight (100%), with habitat (as calculated by average Maxent score) and urbanization given relatively similar weighting (80%). The results of the normalization procedure and weighting can be found in Tables 6.3 and 6.4.

Table 6.3. Normalized scores for SMART analysis of North Carolina EOs and weighting scores. Resilience category represents the normalized scoring based on the last known abundance (0=low; 33=moderate; 67=high; 100=very high); MAXENT Mean is the normalized score of the average Maxent rank of all potential habitat; MAXENT percent 0.8-1 represents the normalized score of the percentage of potential habitat that falls within the highest rank category; 80% or greater SLEUTH Percent of Total is the total amount of current urbanization plus predicted urbanization at year 2040 (>80% probability) from the SLEUTH model.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	33	49	3	97
2				
3	33	30	0	90
4	33	29	0	93
5	33	28	1	100
6				
8	0	37	0	94
9	67	65	11	100
10	100	46	6	100
11				
12	100	80	28	100
13	0	43	2	69
14	33	90	44	93
15				

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
16	100	23	0	52
17	0	73	37	100
18	0	52	22	98
19				
20	33	30	3	11
21	33	48	12	45
23	100	19	0	92
25	0	68	42	69
27				
28	33	62	33	71
29	100	63	22	69
30	100	38	5	24
31	100	43	8	12
32	33	48	5	52
33	33	47	8	100
34	0	73	37	35
35	0	60	29	77
36	0	25	0	88
37	100	60	17	82
38	33	17	0	53
39	0	24	0	89
40	33	54	7	67
44	100	26	1	40
45	0	37	14	86
46	67	60	18	94
47	0	39	2	2
48	0	17	0	88
49	100	91	39	95
50				
51	100	77	31	82
52	33	68	11	100
53	0	50	11	76
54	0	49	1	90
55	100	43	0	100
56	33	58	7	94
57	33	28	0	19
58	0	60	15	100
59	33	12	0	50
60	0	34	1	98
61	67	59	1	100

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
62	33	49	0	100
63	0	38	0	94
64	33	56	24	88
69	33	67	31	80
70	33	55	3	100
71	33	42	5	100
72	33	77	41	100
73	100	89	48	99
74	67	97	41	95
75	100	69	16	91
76	100	61	11	89
77	67	43	2	72
79	33	56	4	100
80	0	62	11	85
83	33	22	0	89
84	33	15	0	99
85	33	61	10	95
87				
89	33	15	5	100
90	33	38	5	100
91	0	71	13	100
92	33	18	0	70
106	100	56	10	61
107	0	16	0	59
113	100	68	11	93
114				
115	33	53	8	74
118	67	61	1	91
121	33	59	13	100
122	0	14	0	60
124	0	13	0	91
125	100	19	0	58
130	33	22	0	76
149	100	95	49	97
151	33	20	0	72
154	100	41	2	78
157	33	26	0	100
158	67	51	20	95
159	100	92	69	39
160	67	92	69	68

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
161	100	95	79	69
162	0	45	7	41
163	33	18	0	43
164	67	24	0	47
165	0	16	0	43
166	0	16	0	59
167	100	41	0	79
168	100	25	0	65
169	0	42	0	88
170	33	22	0	60
172	0	56	8	93
173	33	42	3	52
174	0	62	12	84
175				
180	33	28	2	100
181	100	41	6	100
182	100	66	12	100
183	33	18	1	95
184	100	24	0	81
187	33	27	2	64
188	33	33	0	46
189	0	33	1	86
190				
191	33	48	7	100
192	33	49	10	100
193	33	51	19	94
194	100	75	40	81
195	0	28	0	3
196	0	30	10	32
197	100	50	24	61
198	33	45	18	74
199	33	41	14	56
200	0	35	6	11
201	0	56	11	36
202	100	49	11	13
203	0	62	11	50
204				
205	33	62	4	50
206	0	52	8	33
207	33	47	4	14

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
208	0	45	4	32
209	33	46	5	4
210				
212	0	53	9	14
213	0	52	11	27
219	0	45	2	96
222	33	31	9	92
223				
224	0	29	8	83
225	33	32	6	88
227	100	81	7	95
229	33	39	0	79
230	0	80	44	87
231	0	59	20	100
233	100	79	34	86
235	33	74	22	94
236	33	93	41	95
237	33	100	46	95
238	100	74	41	100
239	33	94	40	94
240	0	85	51	100
241	33	93	47	97
242	0	78	27	100
246	0	93	38	95
249	100	68	13	100
250	100	65	12	100
251	100	62	11	100
254	33	80	51	93
255				
256	33	80	44	87
258	67	25	0	48
259	100	34	0	100
262	100	41	6	49
263				
264				
265				
266				
267	33	41	3	100
268	0	46	7	100
269	33	72	49	100

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
270	0	67	52	99
271	0	35	19	100
272	0	47	0	28
273	33	39	7	100
274	33	73	23	100
275	33	14	0	100
276	100	61	14	79
277				
278				
279	0	46	11	9
280	33	95	85	70
281	0	95	88	64
282	0	96	88	48
283	0	97	95	40
284	0	95	100	54
286				
287	33	18	0	64
291	33	28	4	14
292	33	16	0	16
293	0	7	0	84
294	33	52	11	38
296	33	0	0	95
297				
298	33	20	0	99
299	0	13	0	100
300	0	9	0	82
303	33	44	1	100
304	33	43	0	100
305	0	42	5	100
306	0	1	0	46
308	33	18	0	97
309	0	3	0	100
310	100	86	75	64
311	33	19	0	100
312	100	22	0	42
313				
314				
315	0	51	10	38
317	0	19	0	46
318	33	48	12	47

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
319	100	63	12	89
320	100	60	17	0
321				

Weights			
100	60	20	80

Table 6.4. Normalized scores for SMART analysis of South Carolina EOs and weighting scores. Resilience category represents the normalized scoring based on the last known abundance (0=low; 33=moderate; 67=high; 100=very high); MAXENT Mean is the normalized score of the average Maxent rank of all potential habitat; MAXENT percent 0.8-1 represents the normalized score of the percentage of potential habitat that falls within the highest rank category; 80% or greater SLEUTH Percent of Total is the total amount of current urbanization plus predicted urbanization at year 2040 (>80% probability) from the SLEUTH model.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	33	67	14	100
2	33	2	0	96
3				
4	0	42	3	90
5	33	0	0	36
6	0	0	0	64
7	100	87	2	65
8	33	0	0	86
9				
10				
11	100	43	0	48
12				
13	0	23	0	0
14	100	43	0	57
15	0	0	0	96
16	100	72	1	62
17	100	70	1	67
18	67	62	0	48
19	0	37	0	35

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
20	33	16	0	0
21	67	15	0	10
22	0	1	0	100
23				
24	0	13	0	97
25	0	44	0	52
26	100	40	0	35
27	100	56	18	60
28	100	60	28	51
29				
30	33	22	0	12
31	100	0	0	100
32	33	23	0	7
33	33	5	0	80
34	0	100	100	99
35	0	75	34	47
36	33	18	0	100
37	0	78	66	100
38	100	16	0	63
39	0	19	0	99
40	33	18	0	80
41	0	36	0	13
42	33	10	0	94
43	0	72	0	57
44				
45				
46	0	32	0	4
47				
48				
49	67	27	0	30
50	33	16	0	46
51	0	1	0	65
52	67	0	0	100
53	33	33	0	34
54	33	29	0	9
55	0	13	0	1
56	33	43	0	4
57	67	47	8	62
59	33	13	0	83
60	100	53	21	88

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
	Weights			
	100	60	20	80

To determine a final rank for likelihood of persistence, we calculated a weighted sum for each EO. We then converted the weighted sum to a final rank value that ranged from 0-100. Finally, we determined the top 10% or 90th percentile, and top 25% or 75th percentile ranking for EOs in each state. Table 6.5 summarizes the final ranks and top 10% and 25% percentile ranks for North and South Carolina. We will include the top 10% in the status quo scenario, and the top 25% in the conservation scenario.

Table 6.5. Final Rank Scores for EOs in North and South Carolina. Dark green represents the top 10% of scores, and light green includes the top 25% of scores.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

South Carolina

EO_Code	Final Score
60	79
7	79
17	75
16	74
27	71
28	70
31	69
14	66
11	63
38	62
34	61
1	60
26	59
52	56
57	56
18	55
37	54
36	48
42	44

North Carolina

EO_Code	Final Score
149	94
73	93
49	92
12	90
238	90
161	88
227	87
249	86
233	86
182	85
250	85
251	84
194	84
51	84
310	84
75	84
113	84
319	81
76	81

2	43
40	42
59	41
49	41
8	39
33	39
4	37
39	35
35	34
43	34
24	33
21	32
22	31
53	31
50	31
15	30
25	26
56	24
5	24
54	22
30	22
32	20
51	20
6	20
19	19
20	17
41	12
46	8
13	5
55	3
3	0
9	0
10	0
12	0
23	0
29	0
44	0
45	0
47	0
48	0

74	81
10	80
181	79
55	79
37	79
276	78
259	77
159	77
29	76
160	73
167	72
9	72
154	72
23	71
106	71
197	71
61	70
46	70
184	69
237	69
158	68
118	68
241	68
239	67
236	66
14	66
72	64
168	64
254	64
269	64
262	64
280	63
274	62
256	62
125	61
235	60
52	60
16	60
121	58
77	58
85	57

79	57
44	57
70	57
312	56
192	56
56	56
69	55
33	55
30	55
191	55
193	55
64	55
62	55
202	55
240	54
1	54
303	54
246	54
71	54
320	54
304	54
267	53
273	53
90	53
31	53
28	51
242	51
17	51
5	50
180	50
270	50
157	50
222	49
230	49
115	48
281	48
91	48
4	48
298	48
311	48
225	48

198	47
89	47
3	47
84	47
308	47
275	47
183	46
40	46
284	46
258	46
231	46
229	46
58	46
164	46
83	45
282	44
18	44
205	43
172	42
296	42
283	42
268	42
80	41
130	41
174	41
305	41
199	41
271	40
25	40
32	40
219	40
35	40
151	40
54	39
318	39
187	39
173	39
92	39
21	39
60	38
63	38

8	38
294	37
169	37
287	37
170	36
45	36
53	36
188	34
189	34
299	34
38	33
224	33
39	33
36	33
13	32
309	31
124	31
59	31
48	31
34	30
203	30
163	30
207	28
293	27
300	27
57	25
209	25
201	25
315	24
291	24
162	23
20	23
206	23
107	22
166	22
122	22
292	21
213	21
208	20
272	20
317	19

196	18
212	17
165	17
306	14
279	14
200	12
47	10
195	7
2	0
6	0
11	0
15	0
19	0
27	0
50	0
87	0
114	0
175	0
190	0
204	0
210	0
223	0
255	0
263	0
264	0
265	0
266	0
277	0
278	0
286	0
297	0
313	0
314	0
321	0

Below we describe how we integrated potential positive and negative influences across the scenarios. We can assume there is some tipping point at which an area becomes so urbanized it is unsuitable for dwarf-flowered heartleaf, but we don't know exactly what that tipping point is. Similarly, we can assume additional populations are likely to be found or rediscovered across the

range, but there is no clear way to predict the exact number or location of these populations. Although there is great uncertainty associated with how the species will be influenced by these factors, the three scenarios are intended to capture the range of this uncertainty. Note, changes in climate have potential to exacerbate the effects of urbanization, but these effects are not likely to occur within our projection window (e.g. 2040).

Status Quo Scenario

Under the status quo scenario, we assume a few populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the % increase in urban development and whether a population is protected or not. We assessed population resilience under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no negative impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

High Development Scenario

Under the high development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization that are relatively high, and are also affected by whether a population is protected or not. We assessed population resilience under the following assumptions:

- No additional populations are identified as persisting
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
        - Voluntary protection/non-perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold; extirpation of populations if % increase in urbanization exceeds >90% threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we assume it is likely several additional populations (i.e. more than status quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resilience under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold

- Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

Future Resilience

Our focus on future resilience of dwarf-flowered heartleaf is on the potential impacts from urbanization. Table 6.6 shows a summary of currently delineated populations and the predicted urban development to occur within each of the populations. The table only includes those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Populations not included in this table are not predicted to be urbanized at all, so for the purposes of future analysis, will be assumed to retain the same resilience category as current. For those populations included in the table, we focus on those populations that are anticipated to increase in urbanization beyond a threshold value, depending on the scenario, but thresholds include >25% and >50% increases. Also taken into account is whether or not a population is on protected lands, and if so, whether the population is protected in perpetuity or not. Below is a summary of projected future resilience under each of the three scenarios.

Table 6.6. Results of the SLEUTH model. Populations consist of both stand-alone EOs and aggregates of multiple EOs following the definition of delineating demographic populations from Chapter 4. Included are only those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Red cells indicate populations that are predicted to increase >50% in urbanization. Orange cells indicate populations that are predicted to increase >25% in urbanization.

Population Number	Total Area (sq m)	Already classed Urban	80% chance	90% chance	95% chance	97.5% chance	100% chance	>80%
206	17346.37096	0.40%	0.00%	0.00%	0.00%	6.24%	93.41%	99.65%
306	7804.656249	0.00%	15.11%	49.91%	7.83%	0.00%	22.40%	95.24%
208	55360.86786	17.31%	0.00%	0.00%	0.00%	0.00%	82.69%	82.69%
279	1951.661571	0.00%	0.00%	0.00%	0.00%	0.00%	80.85%	80.85%
214	15043.2984	0.00%	0.00%	1.44%	10.97%	0.00%	55.72%	68.13%
248	25486.15611	28.80%	0.00%	3.22%	0.02%	0.02%	53.03%	56.30%
316	43177.79587	20.06%	0.00%	16.68%	7.08%	0.00%	20.67%	44.43%
247	49898.17159	5.87%	0.00%	6.37%	0.00%	0.00%	23.35%	29.73%
291	11666.76374	35.39%	12.28%	13.53%	2.43%	0.00%	0.23%	28.47%
287	7901.775408	0.00%	0.00%	11.50%	0.00%	0.00%	14.25%	25.75%
312	6535.273235	0.00%	25.28%	0.00%	0.00%	0.00%	0.00%	25.28%
32	31220.60253	60.74%	0.00%	20.39%	0.00%	0.00%	0.00%	20.39%
177	26954.54153	25.34%	12.19%	0.92%	0.10%	5.31%	0.13%	18.66%
292	15611.18205	0.00%	0.00%	0.00%	0.00%	0.00%	18.40%	18.40%
261	21644.22924	0.00%	0.00%	13.21%	3.35%	0.00%	0.00%	16.56%
295	23486.00987	18.20%	0.00%	3.41%	11.99%	0.25%	0.00%	15.65%
125	20742.3249	0.00%	1.02%	5.65%	0.00%	6.67%	0.00%	13.34%
59	8172.007769	0.00%	13.09%	0.00%	0.00%	0.00%	0.00%	13.09%
302	120342.0641	1.46%	2.55%	2.55%	0.77%	2.33%	3.98%	12.19%
178	376781.2214	28.59%	2.79%	2.40%	0.68%	0.59%	2.64%	9.11%
93	43754.11642	0.19%	0.00%	0.00%	0.00%	0.00%	7.82%	7.82%
77	6044.427562	0.00%	1.51%	6.14%	0.00%	0.00%	0.00%	7.64%
179	15145.19453	85.06%	1.14%	0.00%	5.12%	0.00%	0.49%	6.75%
44	15081.76951	61.17%	0.27%	0.00%	0.00%	0.00%	4.68%	4.95%
252	39595.93143	63.47%	0.00%	3.80%	0.00%	0.00%	0.00%	3.80%
100	423621.7376	9.01%	1.32%	1.10%	0.72%	0.14%	0.00%	3.27%
276	123688.7819	0.61%	0.36%	1.87%	0.01%	0.00%	0.00%	2.24%
216	66424.06073	0.00%	0.91%	0.00%	0.00%	0.00%	0.00%	0.91%
154	33924.92259	0.00%	0.00%	0.37%	0.00%	0.00%	0.00%	0.37%
29	249998.8742	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.05%
1	30711.68144	0.41%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2	36339.91976	11.32%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3	24498.03483	24.77%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
31	42929.76479	100.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
96	95947.32128	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
130	1168.240433	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
176	39787.48373	0.89%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
195	7805.599588	99.94%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
317	584.7346337	99.70%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
318	5396.859208	99.74%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
320	125.5182447	98.79%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Status Quo Scenario

In the Status Quo scenario, there are predicted to be 75 populations of dwarf-flowered heartleaf on the landscape (Table 6.7). The predicted resilience of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the seven additional populations predicted to persist under this scenario, four are in South Carolina, and three in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), and moderate (4).

Table 6.7. Predicted resilience categories for *Hexastylis naniflora* populations under the Status Quo scenario, and comparison to current condition.

Site Name	Current Resilience	Status Quo
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	high

Site Name	Current Resilience	Status Quo
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributray Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	high
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate

Site Name	Current Resilience	Status Quo
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	low
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low
First Broad River (North Carolina)	n/a	present
Cherokee Creek/Bonner and Robin School Roads	n/a	present

High Development Scenario

In the High Development scenario, there are predicted to be 72 populations of dwarf-flowered heartleaf on the landscape (Table 6.8). The predicted resilience of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No new future populations are predicted to be discovered. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to moderate resilience; one high resilience population is predicted to drop to moderate; two moderate populations are predicted to drop to low resilience; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Table 6.8. Predicted resilience categories for *Hexastylis naniflora* populations under the High Development scenario, and comparison to current condition.

Site Name	Current Resilience	High Development
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	moderate
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributary Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	moderate
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate

Site Name	Current Resilience	High Development
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	extirpated
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low

Site Name	Current Resilience	High Development
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low

Targeted Conservation Scenario

In the Targeted Conservation scenario, there are predicted to be 79 populations of dwarf-flowered heartleaf on the landscape (Table 6.9). The predicted resilience of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations discovered to persist, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the sixteen additional populations predicted to persist under this scenario, ten are in South Carolina, and six in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), moderate (11), and low (2).

Table 6.9. Predicted resilience categories for *Hexastylis naniflora* populations under the Targeted Conservation scenario, and comparison to current condition.

Site Name	Current Resilience	Targeted Conservation
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high

Site Name	Current Resilience	Targeted Conservation
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	high
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributray Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	high
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate

Site Name	Current Resilience	Targeted Conservation
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	low
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low
First Broad River (North Carolina)	n/a	present
First Broad Hop-Hornbeam NA	n/a	present
Big Island Carolina Hemlock Bluff	n/a	present
Cherokee Creek/Bonner and Robin School Roads	n/a	present
Arrowood Branch	n/a	present
Cherokee Creek/SC 11	n/a	present

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resilience and extirpation of a few populations

is offset by the fact that several additional populations were found to persist in the Status Quo and Targeted Conservation scenarios. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resilience in several additional populations. Regardless of the scenario, the majority of the populations expected to persist on the landscape in 2040 are of at least moderate resilience.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances, however the species range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

Given that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where we have relatively few current populations. As discussed below, we believe there are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, we believe our scenarios do not predict declines in species representation.

Table 6.10. Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	CURRENT	STATUS QUO	HIGH DEVELOPMENT	TARGETED CONSERVATION
VERY HIGH	28	27	27	27
HIGH	5	6	4	6
MODERATE	26	23	25	23
LOW	19	17	16	17
EXTIRPATED	n/a	5	6	5
PERSISTING	n/a	2	0	6
TOTAL	**78**	**75**	**72**	**79**

Opportunities for Additional Conservation

Although our scenarios focus on areas where dwarf-flowered heartleaf have been found in the past, the Maxent model identifies a number of areas as high quality potential habitat for the species that falls outside the immediately known occurrence areas. A few of these areas are detailed below (Figure 6.2).

1. West of the city of Lenoir, south of Highway 90/Adako Rd., north of Highway 64 within Caldwell County. This area identifies a large block of potential habitat. This area falls just outside the administrative boundary of the Pisgah National Forest. The bluffs and tributaries along the Johns River are identified as the best habitat, but there is also ample habitat identified along the forested areas of Celia, Husband, Abingdon and Greasy Creeks. The only known occurrence within this area is associated with Abingdon Creek and is under a conservation easement.

2. Henry Fork River bluffs and tributaries east of Highway 18 within Burke County. A historic element occurrence is present by the Burke County line, but the entire area is identified as good quality potential habitat for the species where forested habitats remain.

3. South West corner of Catawba County west of Highway 321. Several disjointed patches of high quality potential habitat are identified in this region associated with the river and creek slopes. Rock Creek, Jacob Fork River, Pott Creek, and their associated tributaries all contain blocks of potential habitat. A number of element occurrences are identified within this area, but additional habitat is identified both upstream and downstream of the known occurrences.

4. Clark, Pinch Gut, Maiden, and Allen Creeks, north of the town of Maiden. The slopes along these creeks all contain quality potential habitat. Known element occurrences are in the general area, but none are situated within the creeks listed.

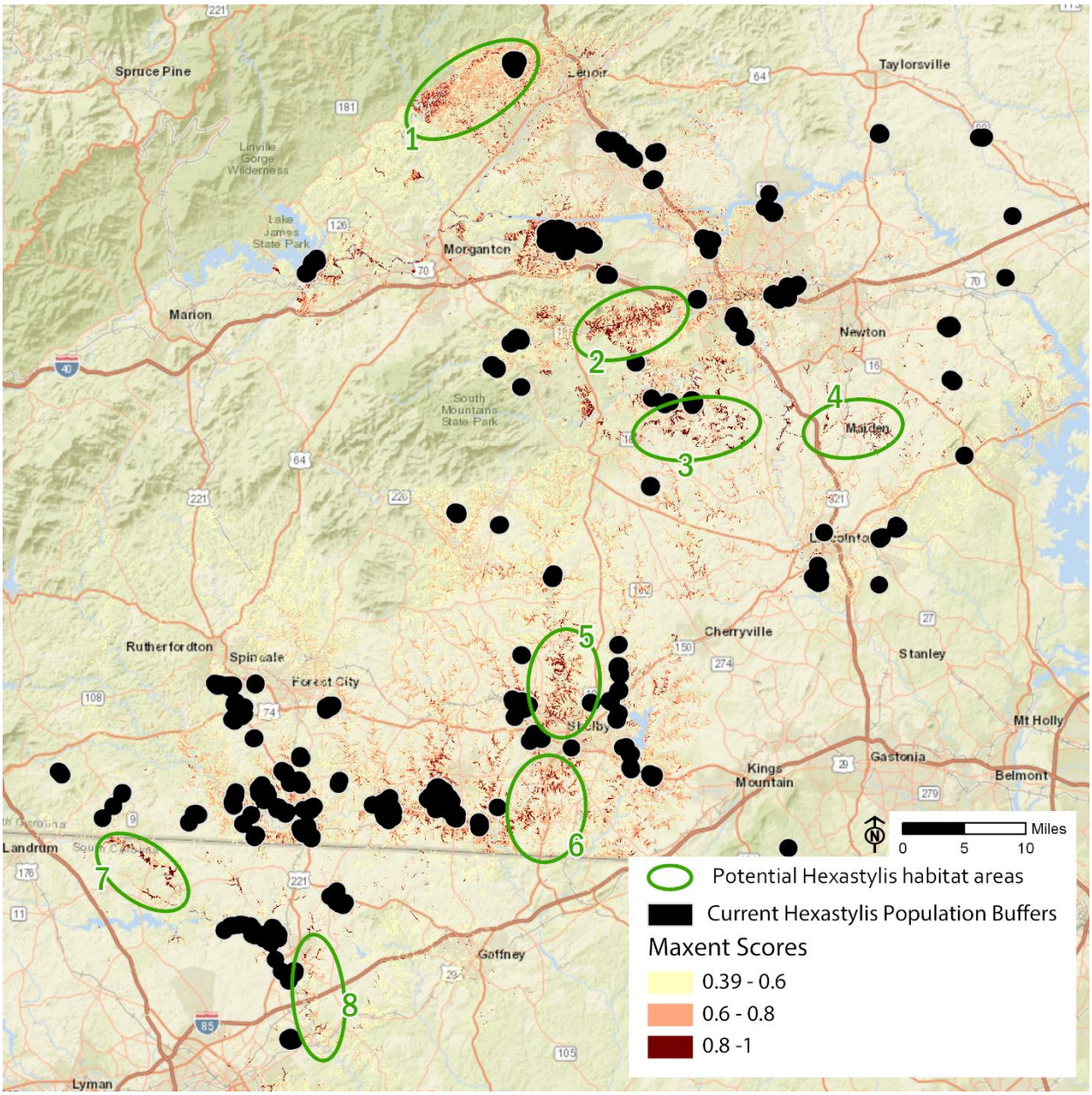
5. First Broad River North of Highway 74, Rutherford County. Two older element occurrences are located within this area, however, the forested bluffs along the First Broad River and associated tributaries are identified as good quality potential habitat in many additional upstream and downstream areas in this system.

6. Hickory Creek, Sulphur Springs Branch (Little Hickory), Shoal Creek, and tributaries draining into First Broad River South of the Town of Shelby, north of the South Carolina border. The town of Shelby has likely disconnected this site from area 5 listed above. Here, slopes along the creeks and tributaries draining into the First Broad River are identified as potential habitat more so than the slopes along the First Broad River themselves. There in only a single element occurrence known upstream along Hickory Creek.

7. North Pacolet River and Obed Creek, north of where they join. The majority of potential habitat falls along the slopes of the North Pacolet River. Two older element occurrences (1991 last observation) are found in the tributaries draining into the North Pacolet River, and many occurrences are found further upstream. The habitat model suggests that additional undiscovered habitat areas are present.

8. Pacolet River and Island Creek, north of Peters Creek, downstream of the Pacolet River dam. This area displays limited amounts of good quality potential habitat. Recent element occurrences are present in the upper headwaters of Peters and Zekial Creeks (Zekial Creek drains into Peters Creek) and in areas north of the Pacolet River dam, but none are known along the areas identified in this immediate area.

Figure 6.2. Areas identified as high quality potential habitat by Maxent model for *Hexastylis naniflora* that fall outside the immediately known occurrence areas.



Literature Cited

Amoroso, J.L. 2016. *Hexastylis naniflora* status meeting with USFWS, NCNHP, ASU, and NCDOT [meeting minutes]. North Carolina Department of Natural and Cultural Resources office, Asheville, NC, 11 May 2016.

Baldwin, R.A. 2009. Use of maximum entropy modeling in wildlife research. Entropy. 11:854-866.

Barringer, K. 1993. New combinations in North American *Asarum* (Aristolochiaceae). Novon 3:225-227.

Blomquist, H.L. 1957. A Revision of *Hexastylis* in North America. Brittonia 8:255-281.

Clarke, K.C., Riggan, P., and Brass, J.A., 1995. A cellular automaton model of wildfire propagation and extinction, Photogram. Eng. Rem S. 60, 1355-1367.

Dobzhansky, T. 1937. Genetics and the origin of species. Columbia University Press, New York, NY.

DeWan, A., N. Dubois, K. Theoharides, and J. Boshoven. 2010. Understanding the impacts of climate change on fish and wildlife in North Carolina.

Flora of North America 1997. Flora of North America north of Mexico. Volume 3, Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York, NY. 590 pp. Contains Whittemore and Gaddy's treatment of *Asarum* and *Hexastylis*.

Gaddy, L.L. 1980. Status Report on *Hexastylis naniflora* Blomquist. Prepared for and submitted to USFWS, Endangered Species Office, Region 4, Atlanta, Georgia. July 1980.

Gaddy, L.L. 1981. The status of *Hexastlylis naniflora* Blomquist in North Carolina. Unpublished report prepared under contract to the Plant Conservation Program, North Carolina Department of
Agriculture, Raleigh.

Gaddy, L. 1986. Twelve new ant-dispersed species from the southern Appalachians. *Bulletin of the Torrey Botanical Club* 113: 247-251.

Gaddy, L.L. 1987. A review of the taxonomy and biogeography of *Hexastylis* (Aristolochiaceae). Castanea 52(3):186-196.

Golder Associates, Inc. 2009. Year 5 Monitoring Report, *Hexastylis naniflora*, Foothills Conservation Area, Caldwell County, North Carolina. Submitted to: Republic Services of North Carolina, LLC; copies (per cover letter) distributed to US Army Corps of Engineers, Asheville Regulatory Office and USFWS Asheville ES Office. June 26, 2009.

Golladay SW, Gagnon P, Kearns M, Battle JM. Hicks DW. Response of freshwater mussel assemblages (Bivalvia: Unionidae) to a record drought in the Gulf Coastal Plain of southwest Georgia. J. N. Am. Benthol. Soc. 2004;23:494–506.

Gonzalez, V. C. 1972. The ecology of *Hexastylis arifolia*, an evergreen herb in the North Carolina deciduous forest. Ph.D. disseration, Duke University. Durham, North Carolina, USA. HDR. 2005. Identification of *Hexastylis naniflora*. Notes on characteristics and field observations provided to the North Carolina Natural Heritage Program, Raleigh.

IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

Jones M.S., T. H. Jones, and J. J. English. 2014. The Pollination of *Hexastylis naniflora* in Cleveland County, North Carolina. Castanea: June 2014, Vol. 79, No. 2, pp. 74-77.

Jordan, Jones and Goulding (JJ&G), Inc. 1998. Section 404 Application and Conceptual Mitigation Plan, Lake Blalock Expansion Project. USFWS Log number 4-6-97-358. ACOE Project # 80-97-1732 (S). Section 9: *Hexastylis naniflora* Biological Assessment. Received by the Asheville Field Office July 16, 1998.

Jordan, Jones and Goulding (JJ&G), Inc. 2006. Lake Blalock Buffer Disturbance – Vicinity of Casey Creek Road. Memorandum to: Eddie Dearbury, Spartanburg Water Systems. Date: October 25, 2006.

Karl, T. R., Melillo, J. M., & Peterson, T. C. (Eds.). (2009). Global Climate Change Impacts in the United States. Washington, DC: U.S. Global Change Research Program.

Kelly, L. M. 1997. A Cladistic Analysis of *Asarum* (Aristolochiaceae) and Implications for the Evolution of Herkogamy. American Journal of Botany 84:1752-1765.

Kelly, L. M. 1998. Phylogenetic Relationships in *Asarum* (Aristolochiaceae) Based on Morphology and ITS Sequences. American Journal of Botany 85:1454-1467.

Kelly, L. M. 2001. Taxonomy of *Asarum* Section *Asarum* (Aristolochiaceae). Systematic Botany 26:17-53.

Lengyel, S., A. D. Gove, A. M. Latimer, J. D. Majer, and R. R. Dunn. 2010. Convergent evolution of seed dispersal by ants, and phylogeny and biogeography in flowering plants: A global survey. *Perspectives in Plant Ecology, Evolution and Systematic*s 12: 43-55.

McLaughlin, J.F. et al. (2002). Climate change hastens population extinctions. Proceedings of the National Academy of Sciences 99(9): 6070–6074.

Murrell, Z. et al. 2007. Ecological, Morphological, Micromorphological and Molecular Analyses of the Species in the *Hexastylis heterophylla* Complex. A report to the North Carolina Department of Transportation. NCDOT and CTE Joint Project 2002-2004, FHWA/NC/2004-01. May 2007.

Murrell, Z. 2015. Development of molecular and morphological tools to circumscribe and identify the Dwarf Flowered Heartleaf (*Hexastylis naniflora*). Report to the North Carolina Department of Transportation, NCDOT Project 2012-2111, July 2015.

National Climate Change Viewer. 2016. USGS. Accessed at https://www2.usgs.gov/climate_landuse/clu_rd/nccv.asp, January 2018.

NatureServe. 2002. Element Occurrence Data Standard, 6 February 2002. NatureServe, Arlington, Virginia. Accessed at http://www.natureserve.org/library/deliminting_plant_eos_Oct_2004.pdf, August 2016.

NCOSBM. North Carolina Budget and Management County and State Population Projections. Accessed at https://www.osbm.nc.gov/demog/county-projections, March 2018.

Newberry, G. 2006. South Carolina Populations of *Hexastylis naniflora*: 2006 updates. Received by the USFWS Asheville Field Office, September 7, 2006.

Newberry, G. 2009. University of South Carolina at Spartanburg. Evaluation of damage to *Hexastylis naniflora* plants on acreage bordering the hunt club. Letter to Jon Morgan, Lake Warden, Spartanburg Water Systems. Dated February 24, 2009.

North Carolina Natural Heritage Program (NCNHP). 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: August 5, 2016.

North Carolina Natural Heritage Program (NCNHP). 2018. Natural Heritage Element Occurrences. Accessed at https://www.ncnhp.org/activities/conservation/natural-heritage-element-occurrences, January 2018.

Newberry, G. 1993. Progress Report on Monitoring Studies of *Hexastylis naniflora*. Unpublished report. Copy submitted to the USFWS Asheville Field Office, on September 7, 2006.

Niedenberger, B.A. 2010. Molecular phylogeny and comparative pollen morphology of the genus *Hexastylis* (Aristolochiaceae). M.S. thesis. Appalachian State University, Boone, NC.

Otte, D. 1977. The pollination biology of *Hexastylis arifolia* (Michx.) Small var. *arifolia* and *H. minor* (Ashe) Blomquist (Aristolochiaceae) in the area of Chapel Hill, North Carolina. M.S. Thesis, University of North Carolina Chapel Hill, Chapel Hill, North Carolina, USA.

Padgett, J. E. 2004. Biogeographical, ecological, morphological, and micromorphological analyses of the species in the *Hexastylis heterophylla* complex. M.S. thesis. Appalachian State University, Boone, NC.

Phillips, S. J. 2018. A Brief Tutorial on Maxent. Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-02/21.

Renninger, H. 2010. North Carolina Department of Transportation (NCDOT). E-mail communication to Carolyn Wells, USFWS Asheville Field Office. Date: May 28, 2010. Subject: Dwarf-flowered heartleaf research proposal.

Robinson L.G. 2016. Dwarf-flowered Heartleaf range-wide status report. Final report to U.S. Department of Interior—U.S. Fish and Wildlife Service by North Carolina Natural Heritage Program. August 2016.

Robinson, L.G. and J.E. Padgett. 2016. Dwarf-flowered Heartleaf (*Hexastylis naniflora*) comprehensive review and monitoring report. Final report to the U.S. Department of Interior—U.S. Fish and Wildlife Service by the North Carolina Natural Heritage Program. August 2016.

Schneider, S. 2006. Spartanburg Water System (SWS) & Sanitary Sewer District, Assistant General Manager. E-mail communication to Lora Zimmerman, USFWS (formerly with the Charleston Field Office), dated December 18, 2006. Subject: Meeting at SWS on December 21, 2006 [to discuss Lake Blalock Buffer Disturbance].

South Carolina Department of Natural Resources (SCDNR) Heritage Trust. 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: February 4, 2016.

USFWS. 2001. Biological Opinion for Spartanburg Water System, Lake Blalock, P/N 2000-IP-194-W, USFWS log number 4-6-01-F-115. May 10, 2001.

USFWS. 2010. Draft Five Year Review for *Hexastylis naniflora* (dwarf flowered heartleaf). September 30, 2010. Submitted to the USFWS Southeast Regional Office September 30, 2010.

USFWS. 2015, August. Fact sheet for *Hexastylis naniflora*. Retrieved from https://www.fws.gov/raleigh/species/es_dwarf-flowered_heartleaf.html.

USFWS. 2016. USFWS species status assessment framework: an integrated analytical framework for conservation. Version 3.4.8, August 2016.

Wagner, J. 2013. Developing new morphological, geographic, and molecular tools to circumscribe *Hexastylis naniflora*. M.S. thesis. Appalachian State University, Boone, NC.

Walker, J. et al. 2009. What are the effects of prescribed fire on *Hexastylis naniflora*, a federally protected plant species? Unpublished final report prepared by U.S. Forest Service, Southern Research Station, Clemson University, Clemson, SC. Submitted to Timothy Stone, Superintendent, Cowpens National Battlefield. In partial fulfillment for Agreement 04-IA-11330138-234, between the NPS and USFS Southern Research Station. Revised March 19, 2009.

Warren II, R. J., 2008. Mechanisms driving understory evergreen herb distributions across slope aspects: as derived from landscape position. *Plant Ecology* 198: 297-308.

Weakley, A. 2010. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at

Chapel Hill. Working Draft as of March 8, 2010.
Weakley, A. 2015. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Working Draft as of 21 May 2015.

Whittemore, A. T., and L. L. Gaddy. 1997. Hexastylis. In Flora of North America Editorial Committee [Eds.], Flora of North America north of Mexico, vol. 3, 54–58. Oxford University Press, New York, New York, USA.
Wolf. S., B. Hartl, C. Carroll, M.C. Neel, and D.N. Greenwald. 2015. Beyond PVA: why recovery under the Endangered Species Act is more than population viability. BioScience 65:200-207.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Chapter 1: INTRODUCTION

The dwarf-flowered heartleaf (*Hexastylis naniflora*) is a species of plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. The dwarf-flowered heartleaf has been listed as threatened under the Endangered Species Act of 1973, as amended (Act), since 1989 (FR 54 14964-14967). The Species Status Assessment (SSA) framework (USFWS 2016, entire) summarizes the information compiled and reviewed by the US Fish and Wildlife Service (Service), incorporating the best available scientific and commercial data, to conduct an in-depth review of the species' biology and threats, evaluate its biological status, and assess the resources and conditions needed to maintain long-term viability. The intent is for the SSA to be easily updated as new information becomes available and to support all functions of the Endangered Species Program from listing to consultations to recovery.

A Recovery Plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to make significant progress toward recovery of the species. The Service is initiating this SSA to aid in determining the appropriateness of reclassifying the species. In the event that the SSA does not support reclassification, the SSA will be used to inform the development of a Recovery Plan. Importantly, the SSA does not result in a decision by the Service on whether this species should be proposed for reclassification under the Act. Instead, this SSA provides a review of the available information strictly related to the biological status of the dwarf-flowered heartleaf. The reclassification decision will be made by the Service after reviewing this document and all relevant laws, regulations, and policies. The results of a proposed decision will be announced in the *Federal Register*, with appropriate opportunities for public input.

For the purpose of this assessment, we generally define viability as the ability of the species to sustain populations in its natural systems over time. Using the SSA framework (Figure 1.1), we consider what the species needs to maintain viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation (Wolf *et al.* 2015, entire).

- **Resiliency** describes the ability of populations to withstand stochastic events (arising from random factors). We can measure resiliency based on metrics of population health;

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

for example, birth versus death rates and population size. Highly resilient populations are better able to withstand disturbances such as random fluctuations in birth rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic activities.

- **Redundancy** describes the ability of a species to withstand catastrophic events. Measured by the number of populations, their resiliency, and their distribution (and connectivity), redundancy gauges the probability that the species has a margin of safety to withstand or can bounce back from catastrophic events (such as a rare destructive natural event or episode involving many populations).
- **Representation** describes the ability of a species to adapt to changing environmental conditions. Representation can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. The more representation, or diversity, a species has, the more it is capable of adapting to changes (natural or human caused) in its environment. In the absence of species-specific genetic and ecological diversity information, we evaluate representation based on the extent and variability of habitat characteristics across the geographical range.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

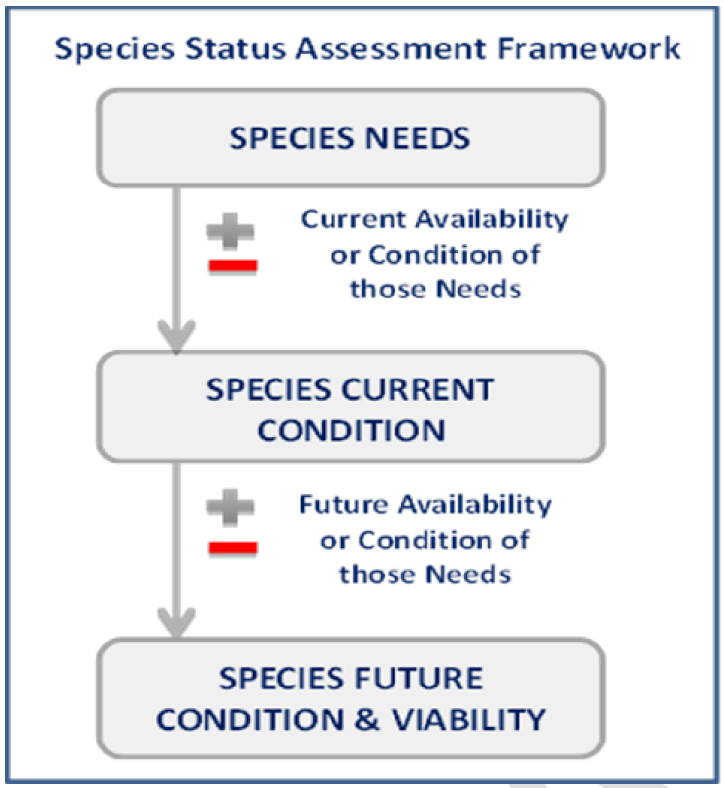


Figure 1.1. Species Status Assessment Framework

To evaluate the biological status of the dwarf-flowered heartleaf, both currently and into the future, we assessed a range of conditions to allow us to consider the species' resiliency, redundancy, and representation (together, the 3Rs). This SSA provides a thorough assessment of biology and natural history, and assesses demographic risks, stressors, and limiting factors in the context of determining the viability and risks of extinction for the species.

The format for this SSA includes: (1) Biology and Species Needs, (2) Current Conditions, (3) Influences on Viability, and (4) Future Conditions. This document is a compilation of the best available scientific and commercial information, and a description of past, present, and likely future risk factors to the dwarf-flowered heartleaf.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Chapter 2: SPECIES BIOLOGY

In this chapter, we provide basic biological information about the dwarf-flowered heartleaf, including its taxonomic history, species description, distribution, life history traits, and habitat characteristics. We then use this information to outline the resource needs within various life stages of dwarf-flowered heartleaf. Here we report those aspects of the life history of the dwarf-flowered heartleaf that are important to our analysis.

Taxonomy and species description

Dwarf-flowered heartleaf is a rare, low growing herbaceous plant in the birthwort family (Aristolochiaceae). The species was described by Blomquist (1957) in his revision of the North American members of the genus *Hexastylis*. The dwarf-flowered heartleaf has been recognized as part of the Virginica Group, and this group was further subdivided into three Subgroups: Virginica, Shuttleworthii, and Heterophylla (Blomquist 1957; Whittemore and Gaddy 1997). Three species have been recognized in the Heterophylla complex, *Hexastylis naniflora, H. heterophylla* and *H. minor*, and field biologist have generally recognized that considerable morphological overlap occurs (Murrell et al. 2007). One of the main concerns regarding this complex was the inability to distinguish between species without access to fresh flowers. Even with fresh flowers, Blomquist (1957) and Gaddy (1987) still recognized considerable overlap in flower morphology making species delineation difficult.

Murell et al. 2007, conducted a comparative genetic analysis using Inter Simple Sequence Repeats, and were unable to find banding patterns that could be used to separate *H. naniflora* from the other members within the complex. However, based on biogeographical, ecological, molecular, morphological, as well as micromorphological work, their results show that *H. naniflora* is a well-defined species.

Although there has been considerable disagreement on the generic distinctiveness of *Hexastylis* and *Asarum* (Barringer 1993 and Kelly 1997, 1998, 2001), a recent phylogeny estimate using chloroplast genes supports that *Hexastylis* is a monophyletic clade and therefore should be

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

recognized as a genus (Niedenberger 2010). Additionally, most North American publications recognize *Hexastylis* at the generic level (Flora of North America 1997, Weakley 2015).

The Service is not aware of any proposed changes in taxonomy that would affect the continued legal status of *H. naniflora* under the Act. However, within the range of *H. naniflora* there are populations which fall outside of the range of published values for key floral characteristics, overlapping with values described for *H. heterophylla* or *H. minor* (Figure 2.1; Weakley, 2010; Murrell et al. 2007; Gaddy 1987). These geographic areas of overlap in key characters have been the focus of recent genetic analyses (Murrell et al. 2007; Renninger, 2010; Murrell, 2015).

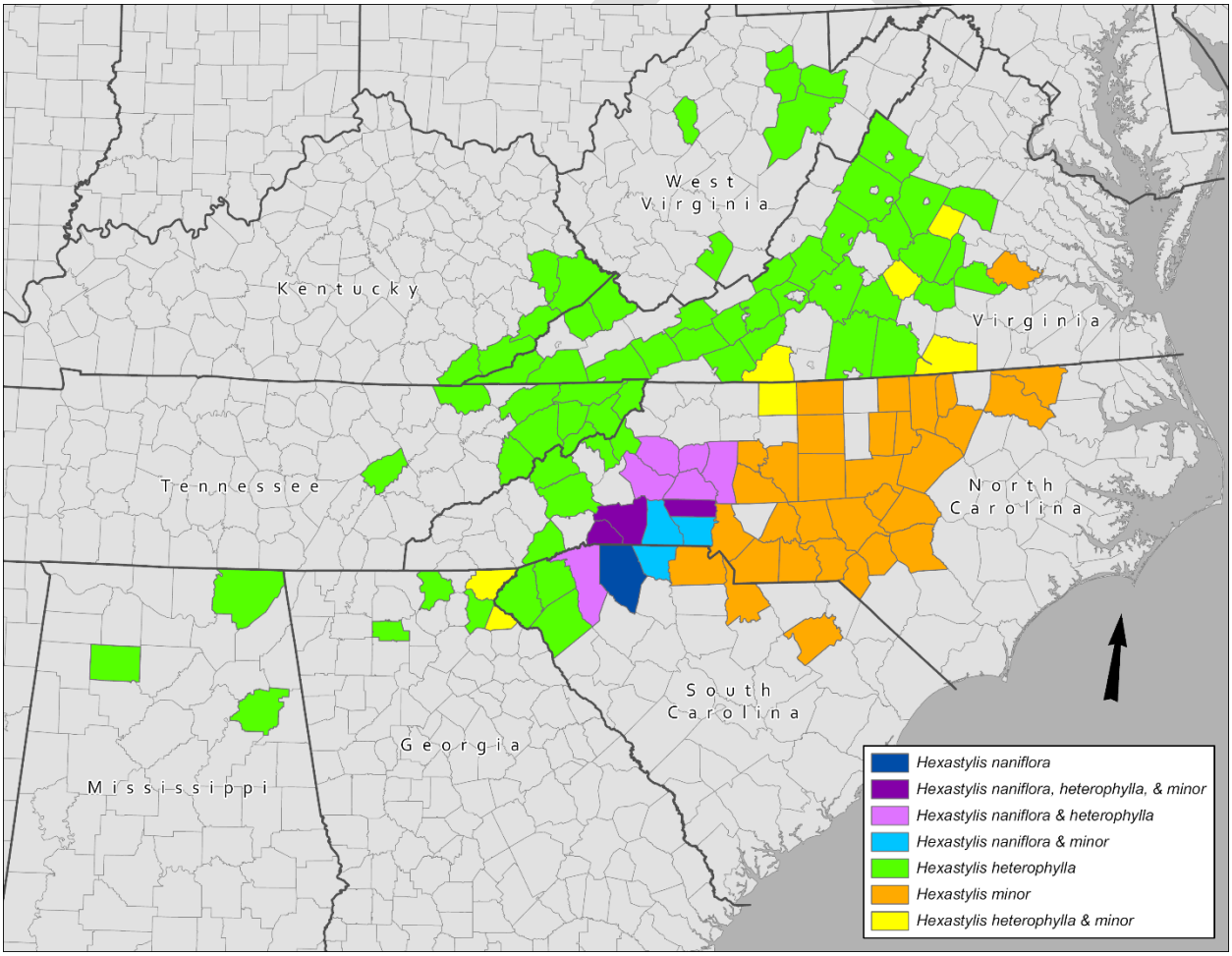


Figure 2.1. Distribution map showing county records for the three species in the *H. heterophylla* complex. Data was gathered from herbarium specimens, Element Occurrence Records (EORs) sheets and field studies. *Based on Murrell et al. 2007.*

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The most outstanding characteristic of this species is the small flowers, which are one of the smallest of any species in North America (Blomquist 1957). The plant's heart shaped leaves are dark green in color, evergreen, and leathery, and are supported by long thin petioles from a subsurface rhizome. The shape of the leaf blades, their pattern of variegation, and the ridged reticulation inside the calyx-tube, place this species inside the Virginica group. It differs from all the other members of this group, aside from the small flowers, in having no flare in the calyx-tube. Maximum height rarely exceeds 15 centimeters (cm). The jug shaped flowers are usually beige to dark brown in color and appear from mid-March to early June. The flowers are small and inconspicuous and are found near the base of the petioles. The fruit matures from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981). Characteristics that distinguish it from other *Hexastylis* species are found in floral structures and pollen characters (Gaddy 1987, Padgett 2004, Niedenberger 2010). *H. naniflora* has a smaller calyx tube orifice, which is typically 5mm or less (sometimes up to 7mm) and the ovary is half-inferior, rather than superior (Blomquist 1957, Gaddy 1987, Padgett 2004, HDR 2005). Pollen surface features have also been shown to be an effective character to identify *H. naniflora*, as it has a microporate surface and, unlike any other *Hexastylis* species, lacks gemmae entirely (Padgett 2004, Niedenberger 2010).

Distribution

Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (USFWS 2010, NCNHP 2016). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include four additional counties in North Carolina. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is in Cherokee, Greenville, and Spartanburg Counties. As of 2016, the distribution of this species consisted of 113 populations distributed across 13 counties in these two states (Figure 2.2).

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

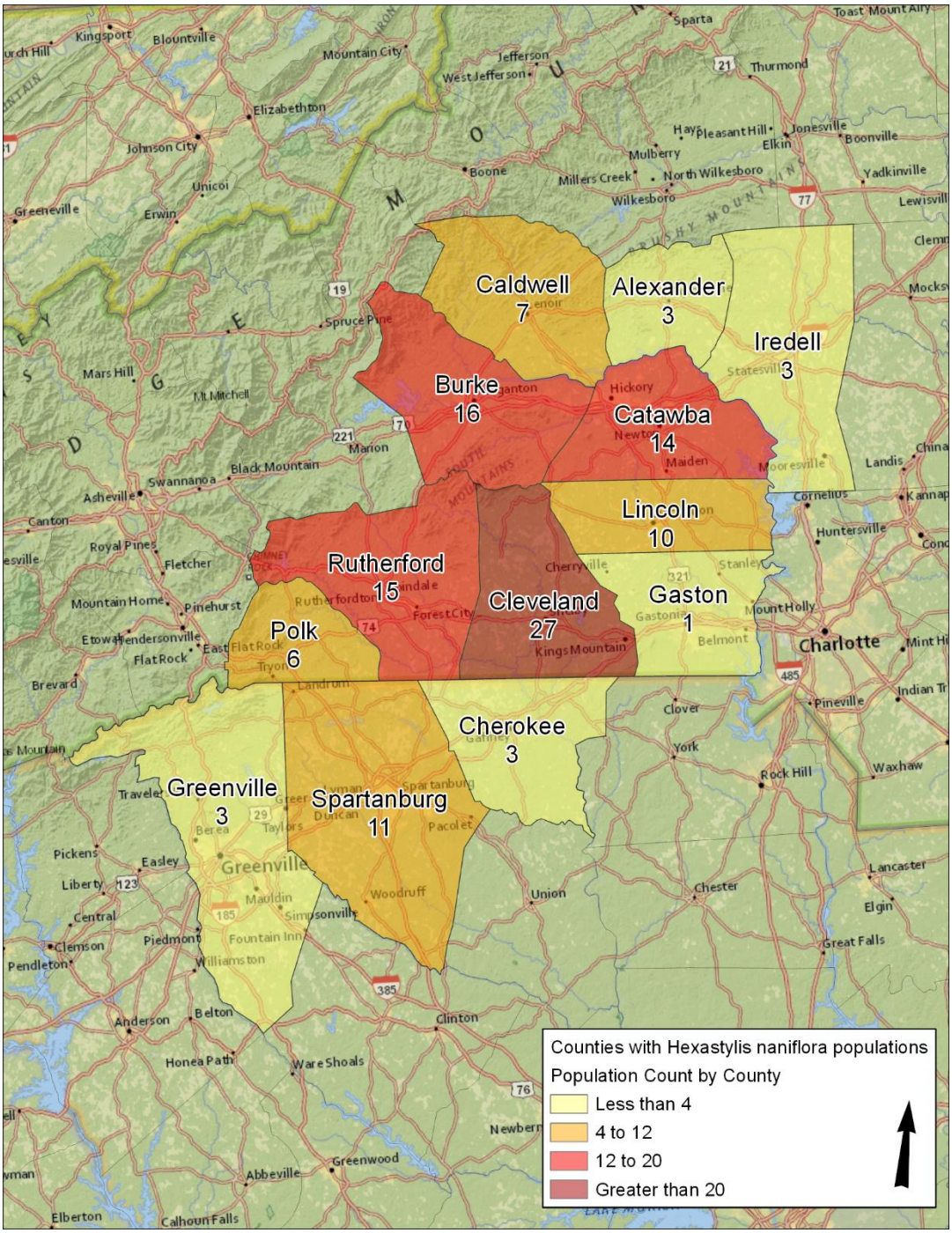


Figure 2.2. Current county distribution for dwarf-flowered heartleaf, with associated number of known populations within each county.

Many of those working with *Hexastylis naniflora* have used the terms “sub site”, “site”, “location”, “occurrence” (often, but not always, in reference to Natural Heritage Program Element Occurrence (EO) Records), “subpopulation” and “population” interchangeably. Others

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

have aggregated smaller sites into populations according to subjective criteria which have never been explicitly defined. This generates discrepancies among sources with respect to the abundance and distribution of the species, with the net result being that available data are usually not comparable from one source to the next. We describe how the numerous small, site-specific locations containing *H. naniflora* have been aggregated into proxies for 119 biological populations for purposes of this review, using mapping standards devised by NatureServe and its network of Natural Heritage Programs, in the Species Needs section of this report.

Life History

Demographics

The Service is aware of a single effort to collect demographic-level data (survivorship and recruitment of tagged individuals) for dwarf-flowered heartleaf. This effort was conducted during the 1990-1991 field seasons, within a portion of the Peters Creek population in Spartanburg County, SC (Newberry, 1993). This study demonstrated a 96.1% survival rate over these two consecutive seasons, with 50% of the mortality occurring in plants located at the highest position on the forested slope (away from the adjacent floodplain). Mortality was highest in small plants bearing fewer than four leaves. Plant size was variable, with the largest plant bearing 45 leaves and 33 flowers, and situated in the floodplain. In general, plants located in the floodplain were larger than plants located on adjacent slopes. The percentage of flowering plants averaged 70%, with the highest frequency of flowering occurring among plants situated in the floodplain (USFWS 2010).

Pollination and Dispersal

The pollination of *Hexastylis* has not been well studied but the genus was thought to be pollinated by insects including flies, wasps, and thrips (Otte 1977). Additionally, Lengyel et al. (2010) described how, within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal by ants). This supports Gaddy's work (1986), which found

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

three species within the Hexastylis Heterophylla subgroup (*H. heterophylla, H. naniflora, and H. minor*), which employ myrmecochory as a method for seed dispersal.

Ants appear to be a primary dispersal agent for the dwarf-flowered heartleaf (Gaddy 1986; Jones et al. 2014). All diaspores of *Hexastylis naniflora* presented to ants (*Aphaenogaster rudis*) were quickly removed (Gaddy, 1986). This is not to say that they are not occasionally, or even frequently, dispersed and/or pollinated by other means. Jones et al. (2014) suggests that the pollination mechanism is facultative, benefiting from more than one method of pollination/fertilization. Ants were the pollinators in a controlled experiment, and their data supports that when outside molesting forces/pollinators (biotic and abiotic) were limited by their caging procedure, the efficiency of pollination decreased by almost 50%, however, caged flowers did produce seeds, indicating pollination occurred via some alternative method.

Habitat

Dwarf-flowered heartleaf appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Wagner 2013). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of a given population. With the limited range and size in populations, questions arise regarding gene flow among populations. How much is occurring and how often does it occur? It is due, in part, to narrow habitat requirements that conservation measures have been implemented for the protection of the species. Any efforts made to protect this species must consider giving protection to the available habitat.

Dwarf-flowered heartleaf occurs on piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, Weakley 2015, USFWS 2015), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993).

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Wagner (2013) conducted a habitat suitability study to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants.

Soils

The species appears to be restricted to Pacolet sandy loam, Madison gravelly sandy loam, and Musella fine sandy loam soils (Gaddy 1981,1987). The species grows in acidic soils along bluffs and adjacent slopes, in boggy areas next to streams and creekheads, and along the slopes of nearby hillsides and ravines (Gaddy 1980, 1981). The plant is primarily found inhabiting north- to northwest-facing slopes, bluffs, and ravines in close proximity to creeks or streams. Within these areas exists the soil type required for *H. naniflora* to grow. It grows primarily on well-drained, sandy, acidic soils, and will not grow in heavy clay (Gaddy 1981).

The results of soil samples analyzed at the Clemson Soil Lab suggest that major differences in soil chemistry exist between the species in the *H. heterophylla* complex (Murrell et al. 2007). Statistical analysis of the soil samples showed that many of the basic elements were significantly different among the three species. Those significant differences occurred in Phosphorous (P), Potassium (K), Magnesium (Mg), Zinc (Zn), Manganese (Mn), (Na), Sodium, and Cation Exchange Capacity (CEC). Slightly significant differences were seen in Buffer pH (Bu pH), and Acidity.

Soil chemistry showed marked differences between the species in the complex (Murrell et al. 2007). The results indicated that soil chemistry is very different between *H. naniflora* and *H. minor* localities. The results also show that *H. heterophylla* and *H. naniflora* are found in soils where the chemistry is more similar, but still showed significant differences. It would appear that differentiation in soil types could be used as a proxy for species delineation. The soil analysis also indicates that soils must be considered when trying to select sites for relocation of imperiled populations of *H. naniflora*.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Thirteen population sites in North Carolina and South Carolina were examined using the Carolina Vegetation Survey (CVS) method to compare species richness between the three species of the *Hexastylis heterophylla* complex (Murrell et al. 2007). The analysis did not show statistically significant differences among the three species in the *H. heterophylla* complex. However, *H. naniflora* appears to have an association with three oak species that is lacking in the other two species in the complex. There are a number of oak species (*Q. coccinea*, *Q. prinus* (*Q. montana*), and *Q. velutina*), that tend to co-occur with only *H. naniflora*, but are not present with the other two species in the complex. This may be the result of some microbial need or specific soil nutrient required for those species to occur in the same habitat.

Fire

There are little data on the response to fire by *Hexastylis naniflora*, however, prescribed burns have been conducted within the population at Cowpens National Battlefield in Cherokee County, SC. Preliminary data at this site and recent annual monitoring data of this population support the theory that moderate controlled burns do not negatively affect this population (Walker et al. 2009). Additionally, a dormant season wildfire in Caldwell County did not show evidence of negative impacts to a population in Caldwell County (USFWS 2010). Fire suppression could be a hazard to *H. naniflora* by allowing fire intolerant, nonnative and invasive plants to thrive, as well as the accumulation of thick duff or leaf litter that may shade low growing species (Wagner 2013).

Genetics

Analyses on ecology, morphology, soil chemistry, pollen, and molecular genetics have been evaluated for *Hexastylis naniflora* to determine the boundaries within the *Hexastylis heterophylla* complex, which consists of *H. heterophylla*, *H. minor*, and *H. naniflora* (Murrell 2015, Wagner 2013, Niedenburger 2010, USFWS 2010, Murrell et al. 2007, Padgett 2004). These analyses support the continued recognition of these taxa as well-defined, discrete species. Scanning electron microscopy (SEM) consistently distinguished *H. naniflora* from other members of the *H. heterophylla* complex based on pollen microscopy. Principal Components

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Analysis of floral characters and soil chemistry also consistently distinguished *H. naniflora* from *H. minor* and *H. heterophylla*. However, efforts to obtain consistently distinct banding patterns using Inter Simple Sequence Repeats (ISSRs) were unsuccessful at distinguishing *H. naniflora* from other members of this group (Murrell et al., 2007). These results were based upon an extremely small sample size (n=10 *H. naniflora* individuals), and therefore warrant further investigation.

Field observations demonstrate that there are some populations of dwarf-flowered heartleaf with morphological characteristics that do not fit within the range of published values for key traits, overlapping with values for *H. heterophylla* or *H. minor* (Gaddy 1987, Murrell et al. 2007, USFWS 2010, Weakley 2015). These populations with overlap in key characteristics were the focus of a genetic analysis conducted at Appalachian State University (ASU) through funding provided by NCDOT (Murrell 2015). In some populations, floral characteristics are highly variable, which suggests the potential for hybridization or individuals with highly variable flower size and shape (Murrell 2015). Additionally, no vegetative characters were previously known to consistently distinguish *Hexastylis naniflora* from other close relatives. Given the difficulties with field identification of the species, particularly when not in flower, this study sought to develop a microsatellite library of molecular markers to resolve variation in populations of dwarf-flowered heartleaf and apply the markers to populations with highly variable characters, as identified by NCDOT biologists. The morphological and micromorphological information from those variable populations were compared to molecular results with morphological, micromophological, and distributional data to determine genetic structure, biological boundaries, and placement of putative hybrids or intermediate populations of *H. naniflora* (Murrell 2015).

The preliminary findings of this study suggest that populations in the southern range of dwarf-flowered heartleaf exhibit a more uniform genetic pattern, with some possible hybridization with *H. minor*. Populations in the northern part of the range appear to have hybridized with both *H. heterophylla* and *H. minor*, although there are still individuals with "pure" *H. naniflora* genotypes in the northern range (Murrell 2015). It is critical to note that although these data provide anecdotal evidence of hybridization with the *Hexastylis heterophylla* group, intraspecific variation may be caused by forces other than hybridization, such as convergent morphological

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

evolution (Dobzhansky 1937), or the species is in the process of speciation and this study shows a case of incomplete speciation (Murrell 2015), and/or other environmental factors are at play (Wagner 2013). On May 11, 2016, a meeting was held with USFWS, NCNHP, NCDOT, and ASU to discuss the status of *H. naniflora* and the current work being conducted among the agencies (Amoroso 2016). Based on discussions during this meeting, the results of this study reported by ASU to NCDOT in 2015 are preliminary. Dr. Matt Estep (ASU) provided additional preliminary results to NCNHP in May 2016, showing which populations were sampled, sample size, and percent of samples that show evidence of hybridization, and hybridizing with which species. ASU continues to work towards a more definitive explanation of the variation in the *H. heterophylla* complex (Murrell 2015, Amoroso 2016).

CHAPTER 3: SPECIES NEEDS

For the purpose of this report, we define viability as the ability of the species to sustain populations in the wild over time. Species with greater numbers (redundancy) of healthy populations (resiliency), encompassing a broad array of ecological and genetic diversity in a spatial arrangement that maintains adequate gene flow (representation), are more likely to be viable. Using the Species Status Assessment framework, we describe the species' viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation.

Delineating Populations

As stated in the USFWS five-year review, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to Natural Heritage Program Element Occurrence Records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This has generated considerable discrepancies among sources with respect to the number of known populations within a given area (or across the species' range), to the extent that numbers are not comparable from one source to the next. The tendency, in the past, to treat each location as a separate population also artificially inflated the actual number of populations known.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The Natural Heritage Program collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member Natural Heritage Programs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2002). Since USFWS does not maintain its own database of known locations of *Hexastylis naniflora*, it regards the NHP databases as the best repository for this information (USFWS 2010).

We delineate populations for the purposes of this SSA according to the NatureServe (2002) convention. Separation distances are a key component to delineating populations from EO records. For the dwarf-flowered heartleaf, we used the EO Data Standard which provides a Default Separation Distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several dwarf-flowered heartleaf populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Population Resiliency

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

heartleaf ecology that determine whether populations can grow to maximize habitat occupancy, thereby increasing resiliency of populations. These factors and habitat elements are discussed below (Figure 3.1).

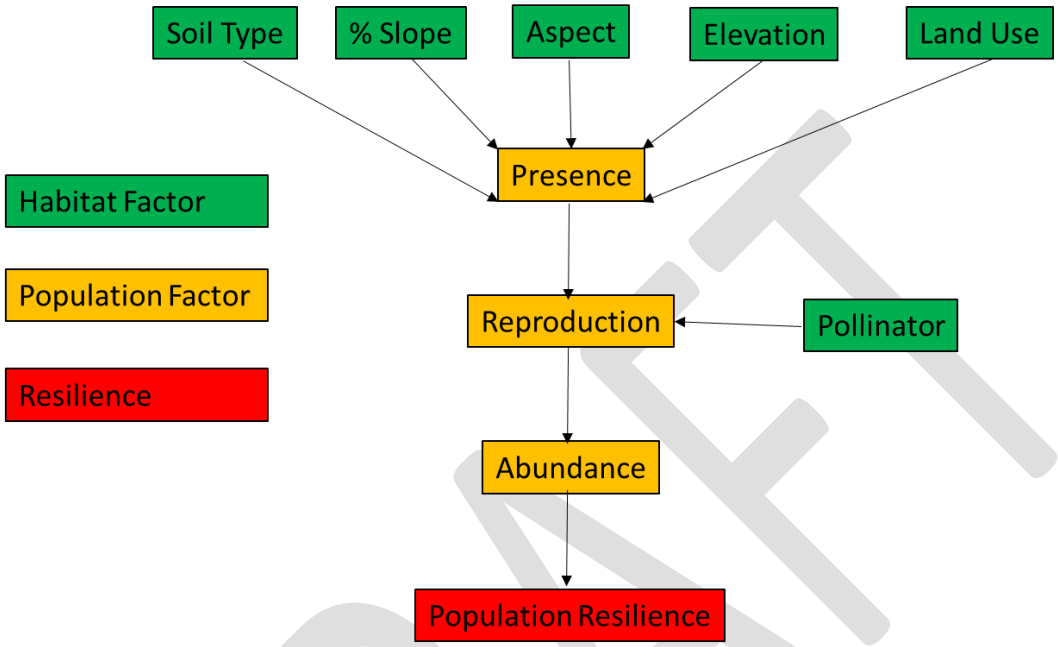


Figure 3.1. Conceptual diagram describing population and habitat factors influencing population resilience for dwarf-flowered heartleaf.

Habitat Factors: Slope, Aspect, Elevation, Soil, and Forest Type

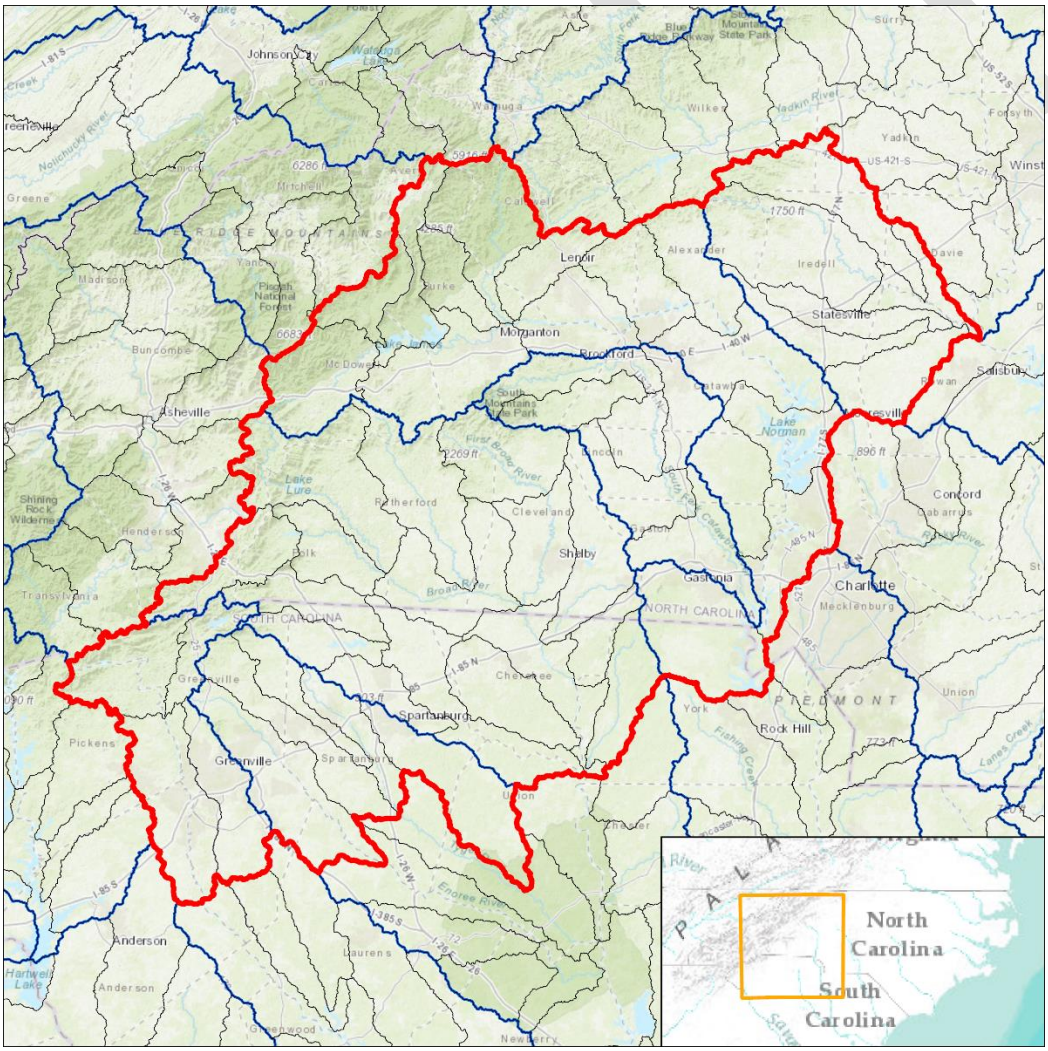
A previous habitat suitability study attempted to quantify the habitat requirements for dwarf-flowered heartleaf (Wagner 2013). With this model in mind, and the input of species experts as to important habitat factors for the species, we used updated habitat data, as well as inclusion of updated EOs, to create a new habitat model to identify potential habitat throughout the species range. All source datasets and variables created are described in Appendix 3.

Source Data and Model Variables

Fifty-three, 10-digit hydrologic units (HUC) comprise the analysis extent (Figure 3.2). In North Carolina, it includes all 10-digit HUC that fall within the boundaries of 8-digit HUC with known occurrence of *Hexastylis naniflora*. In South Carolina, we also included all 10-digit HUC that

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

382 fell within the boundaries of 8-digit HUC with known occurrence of *Hexastylis naniflora*, but
383 excluded the southern portions of the HUC-8 areas due to the boundaries being exceedingly large
384 and far away from any known occurrences.
385 *Hexastylis naniflora* element occurrence data was obtained from the North Carolina Natural
386 Heritage Program and the South Carolina Heritage Trust Program. Current populations of
387 *Hexastylis naniflora* were identified by reviewing the last observed data in the database and
388 excluding all populations that have not been observed since 2005 to remain consistent in our
389 approach of assessing resiliency described previously. To represent these current population
390 areas in Maxent, a raster cell center was retained for every 30 x 30 meter pixel that was situated
391 within the current element occurrence data polygons.
392
393



Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Figure 3.2. Analysis extent of the habitat model for *Hexastylis naniflora*. Red line indicates Maxent analysis extent, blue lines are 8-digit HUC boundaries, black lines are 10-digit HUC boundaries. The orange line in the inset map indicates where the analysis extent is situated in North and South Carolina

Model Development

We used Maxent software (version 3.4.1) for species habitat modeling (Philips et al., 2018). An initial single model Maxent run was done to determine which variables could be excluded due to limited percent contribution to the model. Any variable that contributed less than 1% to the single model run results was excluded in the final model. The following variables were excluded: landcover diversity, canopy height, SSURGO drainage class, SSURGO hydrologic group, aspect 9-class, aspect 5-class, slope, solar radiation, and maximum annual temperature. It is interesting to note that a previous habitat modelling effort (Wagner 2013) included aspect and slope, whereas the Maxent model excluded these variables. This does not mean these variables are not important components of dwarf-flowered heartleaf habitat, but rather these variables did not significantly improve the model. Also, landform data was included, and perhaps landform, which includes components of aspect and slope combined is a more meaningful variable than aspect or slope independently.

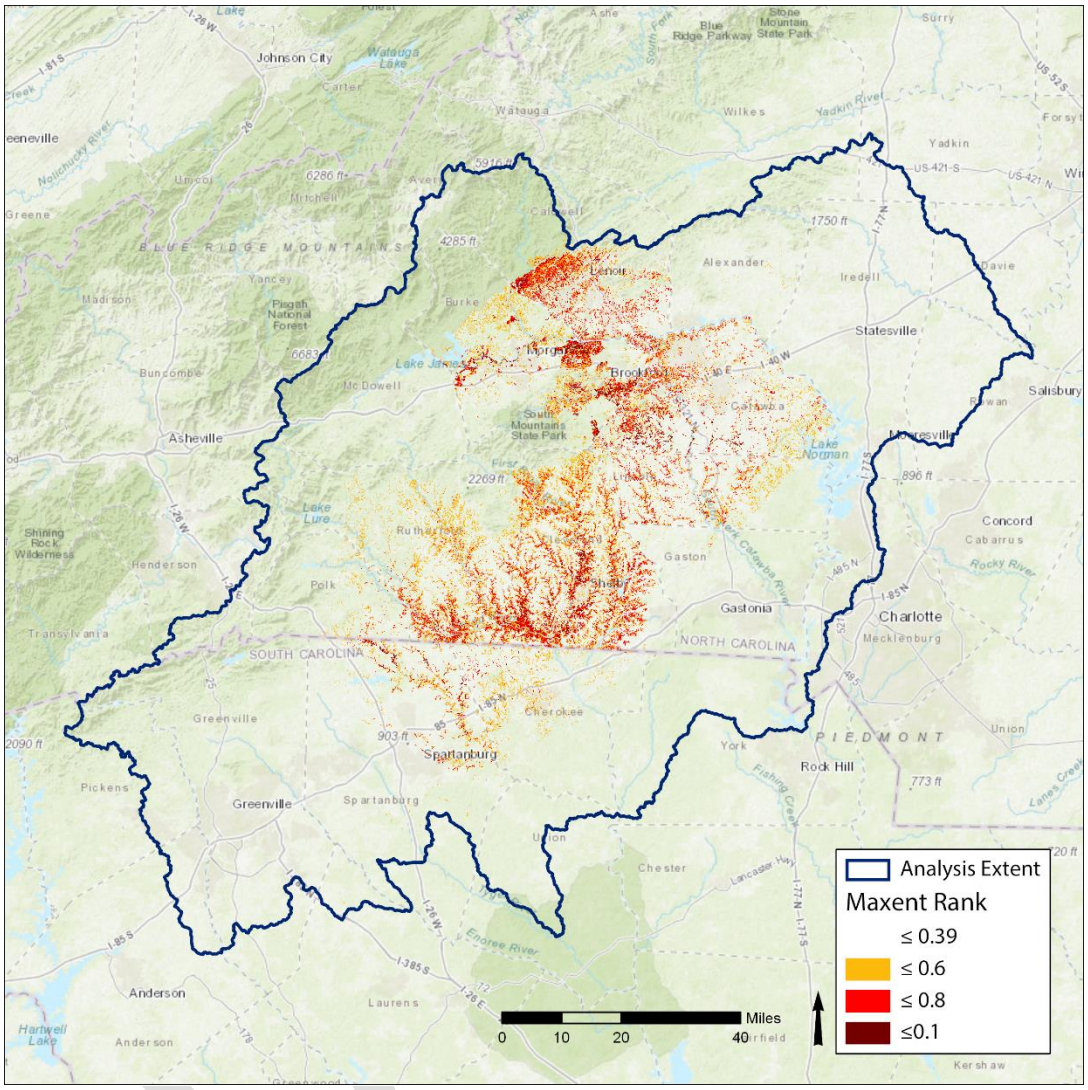
For the final model, a 10-run replicate Maxent model was created using cross-validation. For replicate models, the occurrence data is randomly split into a number of equal-sized groups called “folds”, and separate models are created leaving out each fold in turn. The individual model runs are then averaged together to derive the final model.

Results

Figure 3.3 shows the model output. The minimum cutoff value (to determine if an area is considered potential habitat for a species) of 0.39 was determined by using the average 10th percentile training presence. The 10th percentile training presence uses the suitability threshold associated with the presence record that occurs at the 10th percentile of presence records (Phillips 2018). This value excludes some of the outlier population areas in the Maxent

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

425 predictions to focus on the typical habitat conditions for this species. The total area ranked
426 greater than 0.39 in the Maxent model was just 6.00% of the total analysis area (Table 3.1).



427

428 **Figure 3.3.** Maxent model output map

429

430 **Table 3.1**-Area estimates of the Maxent model

Maxent Score	Acres	Square Miles	Percent of Total
0.39 and greater	302,834.13	473.18	6.02%
0.6 and greater	128,273.52	200.43	2.55%
0.8 and greater	22,115.97	34.56	0.44%

431

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The average area-under-curve (AUC) score for the replicate Maxent model is 0.86. The AUC is calculated from the receiver operating characteristic (ROC) plot. This value has a range of 0 – 1 and may be interpreted as a single test statistic that assesses model performance, indicating the ability of the model to correctly classify the occurrence data used. The model performed well in its predictions, with a mean AUC of 0.86 (AUC value of 0.5 is no better than random; AUC<0.5 is worse than random; AUC>0.5 is greater predictive power than random; Baldwin 2009).

The Maxent output supplies estimates of the relative contributions of the environmental variables to the Maxent model (Table 3.2). SSURGO map unit key) is the top contributing variable. One hundred and thirty-five individual soil types are present within the polygon boundaries of the *Hexastylis naniflora* element occurrences. Many of these individual soil types are part of soil complexes and are separated by things such as percent slope, erosion, how stony/rocky, and amount of clay. The most common individual soil type was Meadowfield-Rhodhiss complex, 25 to 60 percent slopes, very stony (14.1% of total). However, collectively the Meadowfield soils only comprised 14.3% of all soils). The individual Pacolet soil types were very common and collectively comprise 36% of all soil types present. Woolwine, Rion, and Fairview soils were also collectively common, comprising 10.4%, 9.7%, and 8.8% of all soils present respectively.

Table 3.2. Percent contribution of the environmental variables

Environmental Variable	Percent Contribution
SSURGO map unit key	23.5%
Minimum Annual Temperature	17.8%
Average Annual Precipitation	15.7%
Landcover	12.9%
Landcover Majority	12.0%
Landcover Hexastylis Grouping	5.4%
Geomorphons	4.9%
Elevation	4.6%
Canopy Cover	3.2%

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The minimum annual average temperature range in the analysis extent is 39 – 51 degrees Fahrenheit. The majority of the *Hexastylis naniflora* element occurrences (89%) are found at the 47 and 48 degrees. The average annual precipitation range in the analysis extent is 42 – 81 inches per year. The majority of the *Hexastylis naniflora* element occurrences (82%) are found in the 47 – 49 inches per year range.

Piedmont forested landcover habitats dominate the land area of the element occurrences. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier (53%), Southern Piedmont Mesic Forest (9%), Southern Piedmont Dry Oak-Pine Forest (5.2%), Southern Piedmont Small Floodplain and Riparian Forest (4.4%), and collectively comprise 71% of the element occurrences area. Evergreen Plantation or Managed Pine (9%), Harvested Forest (7.2%), Developed, Open Space (5%), Pasture/Hay (2.1%) collectively comprise 22% of the total element occurrence area. The remaining 6 percent of element occurrence area is comprised of a mix of 14 other natural and disturbed landcover classes, but each at small percentages. The landcover majority classification scheme reduces the total number of landcover classes present in the analysis extent from 23 to 11. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier is still the dominant landcover class (58%). However disturbed categories are increased in area (sum total of 35%). Evergreen plantation or managed pine (12%) and Pasture/Hay (12%) are the only other categories that have at least 10% or greater area. The increase in disturbed landcover area representation in the landcover majority layer suggests that many *Hexastylis naniflora* population areas are situated in areas impacted by disturbed landcover. This is likely due to urban encroachment and increasing fragmentation of habitats. The landcover *Hexastylis naniflora* grouping reveals the amount of disturbance present in *Hexastylis naniflora* population areas. Landcover classes grouped as disturbed comprises 27% of the total area. Mixed forest (deciduous and evergreen) comprises 58%, pasture/hay 12%, and hardwood forest 2%. Open water, evergreen and barren landcover groupings are all at less than 1% each.

Geomorphons revealed that the majority of *Hexastylis naniflora* element occurrence areas are situated in concave landforms. Geomorphon categories hollow (13%), valley (46%), and

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

depression (10%) collectively comprise 69% of all *Hexastylis naniflora* population areas. Flat landforms comprise 15.5% of the area and convex landforms the remaining 15.5%.

Within the analysis extent, the range of elevation present is 335 – 5,265 feet. For *Hexastylis naniflora*, the prime elevation range is from 666 – 908 feet (53% of total element occurrence area). A lesser elevation range is present from 935 – 1,184 (37% of total element occurrence area).

Canopy cover for the *Hexastylis naniflora* populations are dominated by Tree Cover 70-80% (20.2%) and Tree Cover 80-90% (63.9%). The rest of the canopy cover categories are 2% or less.

We performed a Kruskal-Wallis 1-way non-parametric Analysis of Variance (ANOVA) to investigate the relationship between Maxent scores and current resilience of populations (Table 3.3). There are significant differences in the average Maxent scores between the four resilience categories ($p = 0.04$) and the mean Maxent score increases as population resilience increases from low to very high. The model gives us some predictive ability regarding habitat suitability where higher Maxent scores, on average, result in higher population resilience.

Table 3.3 Results of the Kruskal-Wallis 1-way non-parametric ANOVA investigating relationships between Maxent scores and current resilience groups for dwarf-flowered heartleaf.

Groups	*Count*	*Mean Rank*
low	13	30.7
moderate	25	30.7
high	5	42.8
very high	28	45.7

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	4375.7	4	1093.92	2.65	0.0404

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Within Groups	28036.3	68	412.30
Total	32412.0	72	

Reproduction and Presence of Pollinators

The pollination of *Hexastylis* has not been well studied but the genus is thought to be pollinated by insects including flies, wasps, and thrips (Otte 1977). Additionally, Lengyel et al. (2010) described how, within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal via ants). This supports Gaddy's work (1986), which found three species within the Hexastylis Heterophylla subgroup (*H. heterophylla, H. naniflora, and H. minor*), which employ myrmecochory as a method for seed dispersal.

Because the flower for this species is oftentimes partially or completely covered with soil and leaf litter, possibly inhibiting pollinator activity (Gonzalez 1972), there is still uncertainty in the pollination mechanism for dwarf-flowered heartleaf. Otte (1977) suggests that a variety of possible pollinators reside in this leaf litter, however, the calyx opening is considered to be far too small for efficient pollinating (Gaddy 1981). There are, however, invertebrates within this proposed size limit that could theoretically act as pollinators. It is possible that the species employs self-pollination, with or without a vector, or that cross-pollination occurs by a number of invertebrates. Jones et al. (2014) investigated pollination of dwarf-flowered heartleaf under a manipulative experimental design, and found that while insects may play a significant role in pollination, even without them, flowers managed to produce a partial seed set. However, two points need to be considered here. First, although flowers managed to produce seeds in the absence of insect pollinators, the efficiency of pollination decreased by almost 50%. Also, even if successful pollination occurs in the absence of insect vectors, the dispersal of plants amongst populations would be limited, and could result in decreased resilience due to genetic concerns such as limited gene flow and issues associated with potential inbreeding depression.

Abundance

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The influence of stochastic variation in demographic (reproductive and mortality) rates is much higher for small populations than large ones. Stochastic variation in demographic rates causes small populations to fluctuate randomly in size. In general, the smaller the population, the greater the probability that fluctuations will lead to extinction. There are also genetic concerns with small populations, including reduced availability of compatible mates, genetic drift, and inbreeding depression. Small populations of dwarf-flowered heartleaf have low resilience, leaving them particularly vulnerable to stochastic events.

As of 2016, the combined databases of the NCNHP and SCDNR contain 239 Element Occurrence Records (EORs) for *H. naniflora* (NCNHP 2016, SCDNR 2016). These EORs depict roughly 113 locations which are sufficiently geographically distinct to be regarded as proxies for populations of the species (See *Delineating Populations*). Thus, the total number of populations has increased more than four-fold (from 24 to 113) since the species was listed in 1989.

At this time, the largest known populations have been monitored by NCNHP and NCDOT. The estimates for entire populations are based on a consistent monitoring methodology developed by NCDOT, USFWS, and NCNHP with monitoring plots representing roughly 10% of a population. Populations were delineated to get a more accurate boundary and size of the area occupied. All rosettes are counted annually in each monitoring plot to estimate an extrapolated population size, based on the number and density in the plots. As a result of these efforts, better estimates of population sizes for the largest known populations are available, compared to when the last five-year review was completed in 2010 (Robinson and Padgett 2016).

The 113 EORs have been estimated to contain anywhere from a single rosette to over 100,000 rosettes. Appendix 1 was created by NCNHP (2016) to replicate the same format and population data as Table B2 of the most recent USFWS five-year review of *H. naniflora* (USFWS 2010), for comparison of changes since 2010, and summarizes the largest occurrences of *H. naniflora*, with the size of the population based on the number of rosettes it was last estimated to contain. The number of populations estimated to contain over 1,000 rosettes is 26. This is approximately 23%

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

of the total known populations and many of these populations contain well over 1,000 individuals.

There are, however, 13 populations (12% of all known) that are simply known to be extant, with no available estimate of population size (NCNHP 2016, SCDNR 2016). If the most recent population estimates for each EOR are compiled across years of observation, the 113 populations could conservatively be estimated to contain a collective total of more than 300,000 rosettes (NCNHP 2016, SCDNR 2016).

Population Trends

Although abundance is critical in assessing the resilience of dwarf-flowered heartleaf, trends in population growth can also be informative. Long-term growth trends are typically defined as the degree of change in population size over 200 years, whereas short-term growth is typically measured as that degree of change over a 10 year period. We lack a robust data set to assess trends at either of these time scales. However, from 2012-2016, NCNHP conducted systematic annual surveys of thirteen of the largest populations across the range.

Based on the results of the five-year monitoring efforts completed in 2016, nine out of thirteen populations remain stable during the five years of data collection (Robinson and Padgett 2016). The largest known population, Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop in Rutherford County, NC, is estimated to have over 100,000 rosettes (Robinson and Padgett 2016). This large population consists of many scattered subpopulations on private property; two of the subpopulations are protected as a Registered Heritage Area, although Registry is a non-binding agreement with landowners that can be cancelled at any time (NCNHP 2018).

Two of the thirteen populations increased in numbers from 2012-2016: Cliffside Steam Station and Broad River: Floyds Creek, Long Branch. The Cliffside Steam Station is protected with a voluntary agreement with Duke Energy and was estimated to contain over 39,000 rosettes in 2016. The Broad River: Floyds Creek, Long Branch population is not at all protected, but was last estimated to consist of over 12,000 individuals in 2016 (Robinson and Padgett 2016).

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Based on the results of recent surveys and a review of all known populations of *Hexastylis naniflora*, the overall trend over approximately 30 years is estimated to be declining 10-30%. This is estimated by a combination of documented declines of some populations, while many others appear to be remaining relatively stable, and some have increased.

Chapter 4: CURRENT CONDITIONS

Below we assess current resilience, representation, and redundancy as they relate to population and habitat factors known to be important for species viability. Based off of recent reports (Robinson and Padgett 2016; Robinson 2016), the species consists of 119 populations distributed across 12 counties in North Carolina and South Carolina. Populations are composed of both multiple EOs and stand-alone EO records. Recent genetic research discussed in Chapter 2, suggests that dwarf-flowered heartleaf, as originally described, is found in the southern portion of its presumed range based on current EO locations, and the northern portion could be a currently undescribed species (Figure 4.1; Estep pers. Comm. 2018). The genetic analysis to support this is complete, but a review of the morphology is ongoing and a new species has not yet been described (Estep pers. Comm. 2018). For the purpose of this SSA, we assume all EO detections are *H. naniflora*, and represent the best currently available scientific data.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

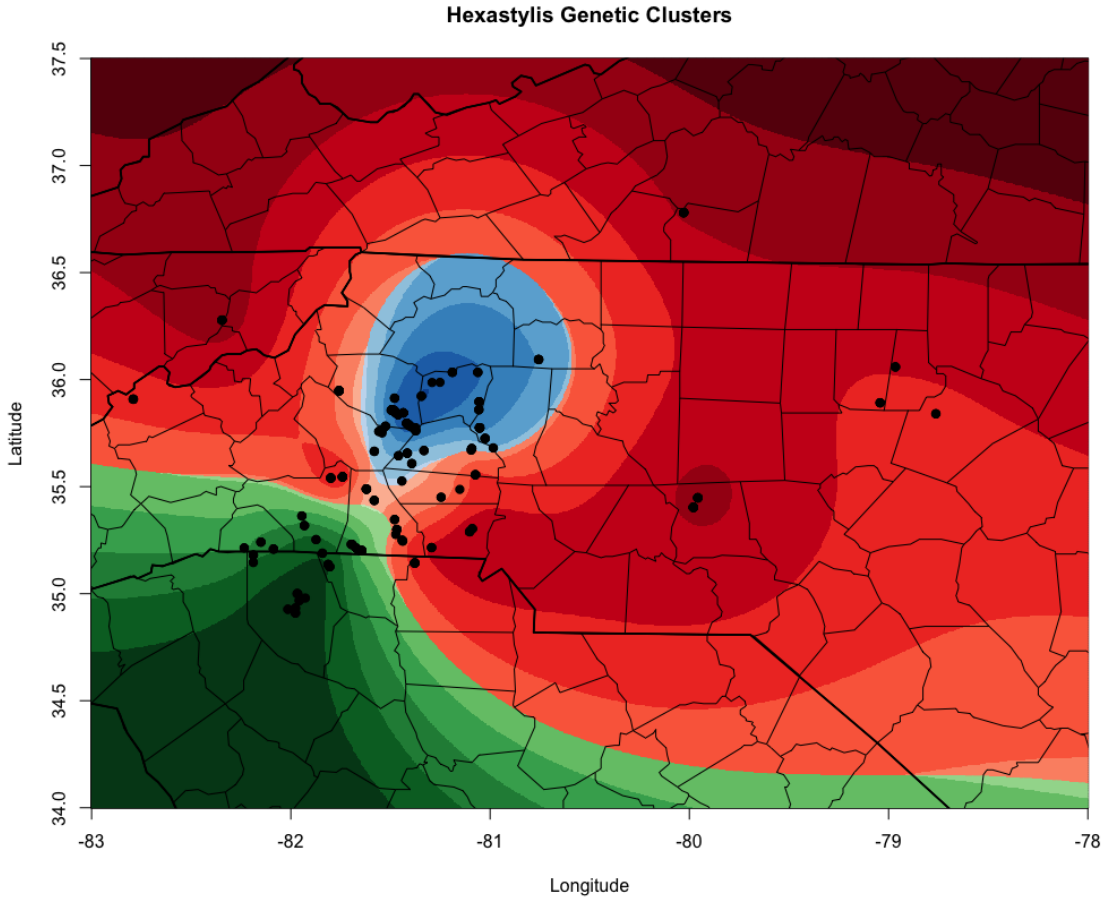


Figure 4.1. Recent genetic analyses detailing clustering of the genus Hexastylis. Black dots represent GIS locations of individual plants included in the genetic analysis. Green areas represent "true" *H. naniflora*; Blue represents a possible new species; Red represents other species in the genus (*H. minor*, *H. heterophylla*, etc.).

Current Population Resilience

Categorizing Resilience

For the purposes of this SSA, we use population size as the main driver of population resilience. The unit of measurement for population size in this species is a "clump" (rosette). As discussed previously, populations in North Carolina were delineated by NCNHP, whereas the Service defined populations in South Carolina. These delineations were based off of NatureServe criteria such as EO separation distance and intervening landscape matrix. EO data included a wide range

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

of years since the species was last observed at a given location (1964-2017), so although recent reports suggest the species consists of 113 populations, some of that data is fairly outdated. For the purposes of this SSA, we only used EOs that were observed since 2005. We did this for several reasons. First, we did not want to go back too far and assume a population was still present. Second, we wanted to be consistent in what we considered "current" for both categorizing resilience and use in the habitat model (discussed later). Also, experts concurred that records as old as 12 years are still likely to persist. Finally, there was a natural break in the data at the year 2005, coinciding with the year the last five-year review was initiated, where the number of EOs dropped off significantly in the years 2004 and earlier. It is important to note that many of the populations that we excluded from our analysis may still persist on the landscape. In fact, many EOs for this species have persisted for decades, despite not having intervening surveys to confirm their persistence.

Based on the criteria (excluding EOs prior to 2005), there are currently 78 populations distributed across the range of dwarf-flowered heartleaf, although this may be an underestimate as discussed above.

To determine overall resilience for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resilience categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are also incorporated secondarily. Appendix 2 shows the NCNHP EO rank specifications for dwarf-flowered heartleaf. The EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, given there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, depending on habitat conditions; poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016; Robinson and Padgett 2016) focus monitoring studies on populations with greater than 1,000 individuals, populations that are assumed to be very viable. Because we do not have habitat level information for every population we assessed, we synthesized all of the above population size information and created four resilience categories as follows:

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Occupancy and Abundance

There are 78 populations of dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). Table 4.2 shows the contribution of each resilience category as follows: 36% (very high); 7% (high); 34% (moderate); 23% (low). When looking at cumulative percentages of resilience, it is interesting to note that 77% of all of the populations are classified as moderate to very high resilience (Table 4.2).

Table 4.1. Current populations of dwarf-flowered heartleaf and associated resilience across the species range. Abundance and last observation date based on Natural Heritage Program data (2018).

Site Name	State	County	Last Observed	Total plants	Resilience
Glade Creek, Alex County	NC	Alexander	2017	>1000	very high
Catawba River: Hoyle Crk-Micol Crk	NC	Burke	2013	>1000	very high
Island Creek Heath Bluff	NC	Burke	2016	>1000	very high
Gunpowder Creek: South of Hudson	NC	Caldwell	2012	>1000	very high
Peaked Top Rare Plant Site/Foothills Landfill	NC	Caldwell	2014	>1000	very high
Jacob Fork West Corridor	NC	Catawba	2012	>1000	very high
Murrays Mill/Upper Balls Creek NA	NC	Catawba	2013	>1000	very high
NCDOT TIP: R-2824	NC	Catawba	2015	>1000	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	NC	Catawba	2013	>1000	very high
Cowpens NBF - Site 1	SC	Cherokee	2016	>1000	very high

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	State	County	Last Observed	Total plants	Resilience
Cliffside Steam Station	NC	Cleveland/Rutherford	2016	>1000	very high
Broad River/Sandy Run NA	NC	Cleveland	2012	>1000	very high
Broad River: Brushy Creek	NC	Cleveland	2016	>1000	very high
Buffalo Creek: Kings Mountain Res	NC	Cleveland	2016	>1000	very high
Buffalo Creek: Tributaries N and S of SR 2047	NC	Cleveland	2012	>1000	very high
Rhyne Conservation Preserve	NC	Lincoln	2016	>1000	very high
Mill Creek Forest and Seep	NC	Polk	2016	>1000	very high
New Hope Springhead Swamp	NC	Polk	2016	>1000	very high
Big Horse Creek Rare Plant Site	NC	Rutherford	2015	>1000	very high
Broad River: Floyds Creek	NC	Rutherford	2016	>1000	very high
Davenport Road/Mountain View Rare Plant Site	NC	Rutherford	2016	>1000	very high
Facebook Site	NC	Rutherford	2016	>1000	very high
Floyds Creek Tributray Rare Plant Site	NC	Rutherford	2012	>1000	very high
New Bethel Rare Plant Site	NC	Rutherford	2015	>1000	very high
Richardson Creek trib above Toms Lake	NC	Rutherford	2016	>1000	very high
DNR Peters Creek Heritage Preserve	SC	Spartanburg	2016	>1000	very high
Taylor Blalock Res	SC	Spartanburg	2016	>1000	very high
Leepers Creek Heartleaf Site	NC	Lincoln	2006	>1000	very high
Little Gunpowder Creek Rare Plant Site 1	NC	Caldwell	2015	500-1000	high
Little Gunpowder Creek Rare Plant Site 2	NC	Caldwell	2015	500-1000	high
Northern Catawba County	NC	Catawba	2017	500-1000	high
Rock Barn Solar Farm	NC	Catawba	2010-2011	500-1000	high
Buffalo Creek Rare Plant Site	NC	Cleveland	2012	500-1000	high
Third Creek Rare Plant Site	NC	Alexander	2010	100-500	moderate
Hickory Area	NC	Burke/Catawba/Caldwell	2016	100-500	moderate
Burke County - Drowning Creek UT	NC	Burke	2017	100-500	moderate
Simms Hill/Little River Uplands	NC	Burke	2015	100-500	moderate
Smith Cliff/Henry Fork River	NC	Burke	2015	100-500	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	NC	Catawba	2016	100-500	moderate
NCDOT TIP R-2824	NC	Catawba	2015	100-500	moderate
South Fork Catawba River, Henry Fork	NC	Catawba	2007	100-500	moderate
Broad River/Sandy Run NA	NC	Cleveland	2012	100-500	moderate
Brushy Creek Headwaters	NC	Cleveland	2014	100-500	moderate
First Broad River: Crooked Run Creek	NC	Cleveland	2010	100-500	moderate
No Business Creek, Boyd Tract	NC	Cleveland	2007	100-500	moderate

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	State	County	Last Observed	Total plants	Resilience
West Shelby Mesic Slope	NC	Cleveland	2016	100-500	moderate
UT of Kings Mountain Res	NC	Gaston	2012	100-500	moderate
Buffalo Shoals Creek	NC	Iredell	2014	100-500	moderate
Cat Square Heartleaf Forest	NC	Lincoln	2012	100-500	moderate
Collinsville (Hughes) Creek Slopes	NC	Polk	2016	100-500	moderate
Fox Knoll Farm	NC	Polk	2016	100-500	moderate
Forest City: Adj to Isothermal CC	NC	Rutherford	2010	100-500	moderate
Jonas Road Rare Plant Site	NC	Rutherford	2014	100-500	moderate
Knob Creek NA	NC	Cleveland	2005	100-500	moderate
Buffalo Creek	NC	Cleveland	2005	100-500	moderate
Kross Keys NA	NC	Polk	2005	100-500	moderate
Catawba River: North Fork Mountain Creek	NC	Catawba	2005	100-500	moderate
Catawba River: Lake James	NC	Burke	2006	100-500	moderate
Hogpen Branch Transplant Site	NC	Rutherford	2005	100-500	moderate
NCDOT TIP R-3603A	NC	Alexander	2017	<100	low
South Mountains Pleasant Grove Uplands	NC	Burke	2016	<100	low
Gunpowder Creek	NC	Caldwell	2012	<100	low
Killian Crossroads	NC	Catawba	2010	<100	low
Pott Creek	NC	Catawba	2012	<100	low
Beaverdam Crk at First Broad River	NC	Cleveland	2011	<100	low
Buffalo Creek: Potts Creek	NC	Cleveland	2012	<100	low
Buffalo Creek: Ravine	NC	Cleveland	2007	<100	low
Hickory Creek - UT (Shelby High School)	NC	Cleveland	2016	<100	low
Boulder Creek Subdivision - Jordan Road	SC	Greenville	2016	<100	low
Gateway Elementary School	SC	Greenville	2017	<100	low
Fanjoy Road Site	NC	Iredell	2015	<100	low
Levan Family Farm	NC	Iredell	2013	<100	low
Lincoln County, SR-1314	NC	Lincoln	2014	<100	low
Northeast Lincolnton: UT Walker Branch	NC	Lincoln	2009	<100	low
Sandy Spring Church Springhead Swamp	NC	Polk	2005	<100	low
First Broad River: Hickory Creek	NC	Cleveland	2006	<100	low
Smith Cliff/Henry Fork River	NC	Burke	2005	<100	low
First Broad River: Beaverdam Creek Tribs	NC	Cleveland	2006	<100	low

Table 4.2. Population resilience categories by county for dwarf-flowered heartleaf.

County	Very High	High	Moderate	Low	Totals
Alexander	1		1	1	3
Burke/Catawba/Caldwell			1		1
Burke	2		4	2	8
Caldwell	2	2		1	5
Catawba	4	2	4	2	12

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Cherokee	1				1
Cleveland/Rutherford	1				1
Cleveland	4	1	7	6	18
Gaston			1		1
Greenville				2	2
Iredell			1	2	3
Lincoln	2		1	2	5
Polk	2		3	1	6
Rutherford	7		3		10
Spartanburg	2				2
Totals	**28**	**5**	**26**	**19**	**78**
% of total	*36*	*7*	*34*	*23*	*100*
Cumulative %	*40*	*43*	*77*	*100*	--

Population Trends

Although we lack an adequate past time series of abundance data for all populations to estimate growth rates or population trends, NCNHP conducted surveys of thirteen of the largest populations across the range of the species from 2012-2016. Table 4.3 shows the results of all of these surveys. Two populations show an increasing trend, nine show a stable trend, and two show a decreasing trend.

Table 4.3. Summary of population trends over 5 years of monitoring data for 13 of the largest populations of dwarf-flowered heartleaf across its range (from: Robinson and Padgett 2016).

Trend	Survey	Site	2016 estimated number of plants (Rosettes)	2016 area occupied (Acres)
Increasing	NCNHP	Cliffside Steam Station (EO 276)	39,535	52
	NCNHP	Broad River: Floyds Creek, Long Branch (EO 177)	12,687	5.67
Stable	NCNHP	Island Creek Bluff/Love Lady Site (EO 029)	50,481	61.76
	NCNHP	Rhyne Preserve (EO 302)	19,873	22.43
	NCNHP	Mills Creek Forest and Seep (EO 023)	1,733	1.39
	NCNHP	New Hope Springhead Swamp (EO 125)	12,235	5.03

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

	NCNHP	Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop (EO099)	106,940	83.39
	NCNHP	Broad River: Cleghorn Creek, US 221 (EO 176)	6,750	7.24
	NCNHP	Cowpens National Battlefield (SC EO 016, 017, 018)	2,823	6.05
	NCNHP	Peters Creek Preserve (SC EO 011)	3,306	8.98
	NCNHP	Blalock Reservoir (SC EO 007, 031)	3,505	7.59
Decreasing	NCNHP	Second Broad River (Forest City Industrial Complex) (EO 154)	2,576	4.74
	NCNHP	South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)	123	0.09

Current Species Representation

Representation describes the ability of a species to adapt to changing environmental conditions. We lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species.

Current Species Redundancy

For the dwarf-flowered heartleaf to maintain viability, the species also needs to exhibit some degree of redundancy. Species-level redundancy reflects the ability of a species to withstand catastrophic events, and is best achieved by having multiple, widely distributed populations relative to the spatial occurrence of catastrophic events. Redundancy for dwarf-flowered heartleaf is the total number and resilience of population segments and their distribution across the species range.

An important question when investigating redundancy for dwarf-flowered heartleaf is, "what exactly is a catastrophe?" We consider a catastrophe to be any population level disturbance that

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

has the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, like hurricanes, and often with devastating effects, however they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010).

As stated previously, there are 78 populations of dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). The populations are spread across the range, although a majority occur in North Carolina. Although, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances, the species range is very small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

CHAPTER 5: INFLUENCES ON VIABILITY

Hexastylis naniflora populations occur in rapidly growing urban areas with expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. In addition to threats associated with residential, commercial, and industrial development, other documented threats include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of ponds, impacts from grazing cattle, ORV damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

752 siltation (NCNHP 2016, Robinson and Padgett 2016). Climate change may exacerbate these risk
753 factors through changes in temperature and precipitation.
754
755 Threats were assessed for populations monitored by NCNHP during 2012-2016 (Robinson and
756 Padgett 2016), and EOs were reviewed for other documented threats to populations. Indirect or
757 direct threats that were observed, inferred, or suspected to have an impact on populations were
758 recorded and assigned a ranking based on their severity, scope, and immediacy from field
759 observations. The rank for each threat factor determines the overall value for each threat
760 observed at each population. No significant changes in threats within populations were noted
761 from 2012-2016. Threats observed during these years included development, incompatible
762 forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and
763 road construction.
764
765 Below, we summarize primary threats to the viability of dwarf-flowered heartleaf. Primary
766 influences will be carried forward in our future projections in the next section.
767
768 ***Human Population Change***
769 Increasing human populations drive development. With increases in population, there will be
770 increasing conversion of open space to more impervious cover, with a subsequent increase in
771 roads and other associated infrastructure. Increases in roads and impervious cover have the
772 potential to lead to habitat loss and/or fragmentation, a primary risk factor for dwarf-flowered
773 heartleaf. Tables 5.1-5.2 and Figures 5.1-5.2 show the estimated human population increases for
774 North Carolina and South Carolina counties within the range of the species. The most populous
775 counties include Greenville and Spartanburg in South Carolina, and Catawba, Gaston and Iredell
776 counties in North Carolina.
777
778 **Table 5.1**-Human population projections for North Carolina counties within the range of dwarf-
779 flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

County	2018	2023	2028	2033	2037
Alexander	38,609	39,244	39,686	39,992	40,169
Burke	90,865	93,124	95,382	97,644	99,452

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Caldwell	83,919	86,723	88,689	91,126	92,870
Catawba	157,424	159,799	162,175	164,549	166,447
Cleveland	98,862	99,685	100,004	100,128	100,170
Gaston	221,112	227,667	237,344	245,276	252,388
Iredell	179,740	195,623	211,501	227,383	240,088
Lincoln	84,494	91,034	96,865	103,069	107,858
Polk	21,273	21,823	22,288	22,681	22,955
Rutherford	67,880	68,154	68,283	68,341	68,368

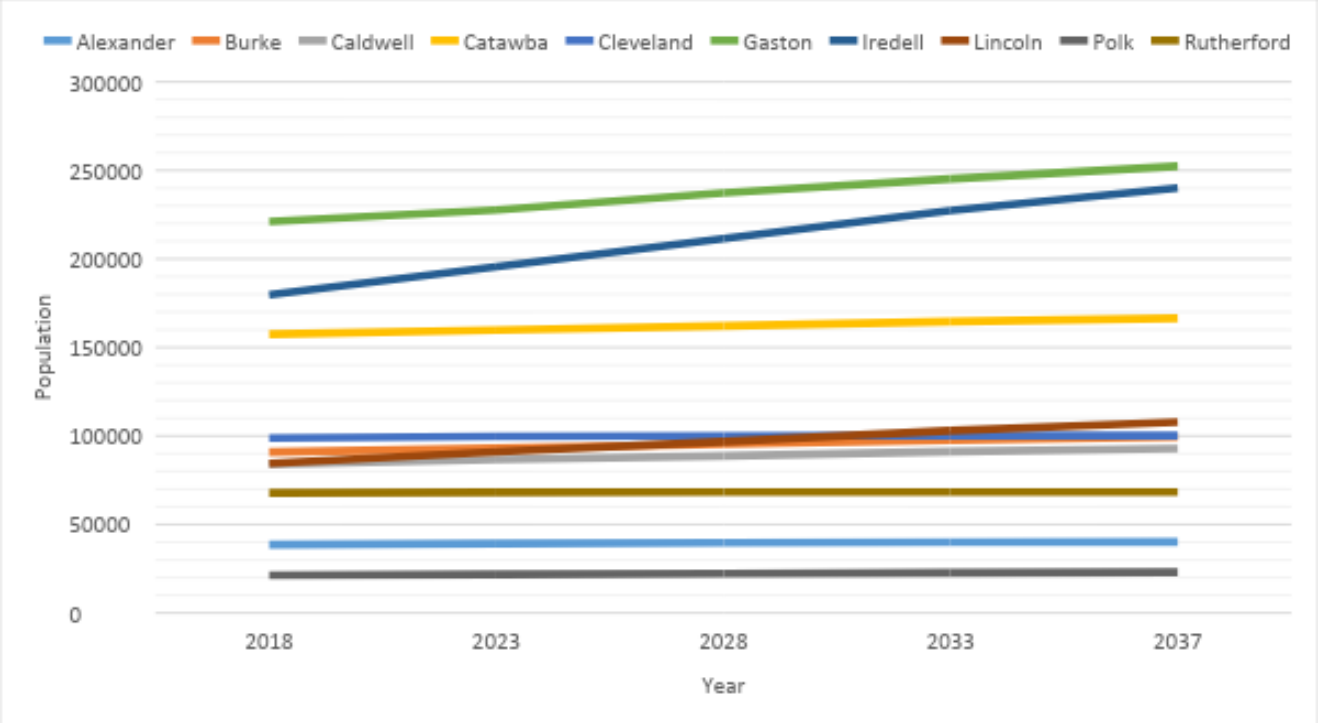


Figure 5.1- Human population projections for North Carolina counties within the range of dwarf-flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

Table 5.2- Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

County	2020	2025	2030	2035
Cherokee	61,760	64,760	67,350	70,170

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Greenville	492,890	517,740	542,290	567,010
Spartanburg	310,220	323,550	336,810	350,110

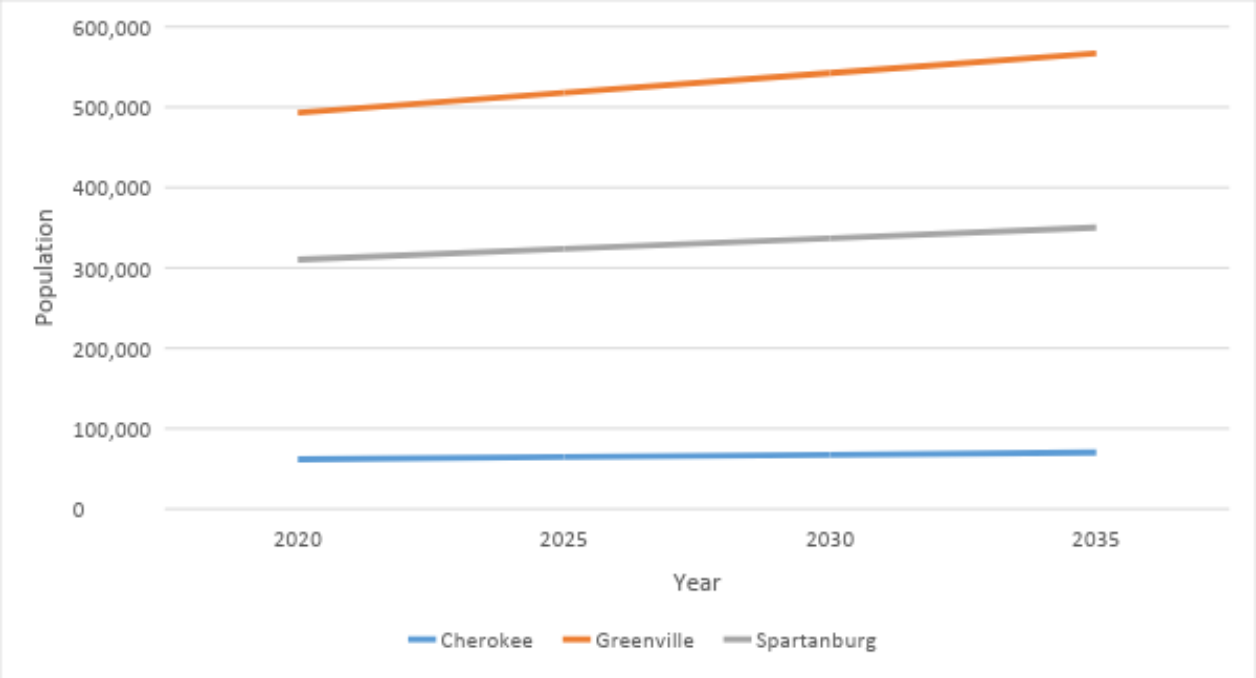


Figure 5.2. Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

Development

A large number of the known populations occur near expanding urban areas and are threatened by the residential, commercial, and industrial development associated with this growth. Populations occurring in more rural areas are threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds.

A 2010 review of existing NHP EOR data revealed that all or portions of 26 populations (24% of the total) had been directly or indirectly impacted through development projects or other causes such as trash disposal, expansion of residential lawns, cattle, or invasive exotics (NCNHP 2010;

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

SCDNR 2010). Another 16 populations have been specifically reported to be threatened by one or more of these same sources. Therefore, threats have either occurred or are reasonably foreseeable within 42 of the 113 populations (corresponding to 37% of all known populations). Of these 42 populations, all or portions of 22 (50%) had been adversely impacted by activities requiring ESA Section 7 consultation with the USFWS. The fact that nearly 20% of all known populations had been subject to formal Section 7 consultation illustrates the threats faced by the species.

In the same 2010 review, the most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving *H. naniflora* is road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations between the USFWS and the NCDOT. Collectively, these projects have adversely impacted or are currently expected to impact some 22,135 rosettes. In most cases the Section 7 process has resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection to those plants remaining (post-construction) within NCDOT right-of-way (ROW).

Other forms of economic development have also resulted in the destruction or modification of habitats occupied by *H. naniflora*; in many cases, these activities have also required Section 7 consultations with the USFWS. Examples of these activities include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities (in compliance with Federal Aviation Administration standards) at a regional airport. Collectively, these activities have involved the loss or relocation of several thousand rosettes.

Blalock Reservoir in Spartanburg County, South Carolina was once estimated to contain the largest population of *H. naniflora*, with over 11,000 rosettes reported here in 1997 (JJ&G, 1998). This population was the subject of a section 7 consultation as a result of a proposal to raise the elevation of Blalock Reservoir, which provides water supply storage to Spartanburg County and the City of Spartanburg (USFWS, 2001). Approximately one-third of this population was directly threatened by inundation, and the Federal agency committed to the relocation of some

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

3,054 rosettes to remaining areas of occupied habitat around the reservoir. At the conclusion of formal section 7 consultation, the USFWS anticipated that as many as 6,619 rosettes (assuming that all transplants survived) would be afforded protection through restrictive covenants placed on properties owned by the Spartanburg Water System (SWS) surrounding Blalock Reservoir. However, this population was last reported to contain a mere 1,400 rosettes (Newberry, 2006), and has twice since been impacted by encroachments from adjacent landowners (Newberry, 2009; Schneider, 2006, and JJ&G, 2006). Some of these apparent declines could be partially an artifact of incomplete survey effort, in that the exhaustive surveys which led to the 1997 estimate (of 11,000 rosettes) have never been repeated. However, it seems unlikely that plants occurring on privately owned shoreline not subject to restrictive covenants would be any more stable than those occurring on properties specifically protected and managed for the species (by SWS).

Invasive Species and Woody Encroachment

Several of the known populations of dwarf-flowered heartleaf occur on steep ravine slopes which also support stands of mixed hardwoods with an understory of mountain laurel (*Kalmia latifolia*) or *Rhododendron spp*. These stands are often very dense and reduce the amount of light reaching the dwarf-flowered heartleaf plants growing below. Under these conditions the plants often show reduced vigor and reduced flower and fruit production. Careful, selective logging or natural tree fall and limited understory removal would open up these populations to more light. Additional light, if not accompanied by increased siltation from the intensive soil disturbances associated with forest clear-cutting, probably would benefit these populations (Gaddy 1981).

Invasive exotic plant species are rampantly spreading throughout riparian corridors and ravines across the range of this species (USFWS 2011). Invasive exotics such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum* spp.), Japanese honeysuckle (*Lonicera japonica*) and Japanese Nepal grass (*Microstegium vimineum*) are known to threaten several populations; however, the scope and magnitude of this threat has not been comprehensively assessed. This threat requires active management in order to be successfully abated. At present, the majority of protected

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

870 populations are secured against habitat conversion, but lack designated managers with the
871 technical expertise and available resources (funding and personnel) to address this threat.
872
873
874
875 ***Climate Change***
876
877 There is a growing concern that climate change may lead to increased frequency of severe storms
878 and droughts (McLaughlin *et al.* 2002, p. 6074; Golladay *et al.* 2004, p. 504; Cook *et al.* 2004, p.
879 1015). Because typical habitats for this species include moist soils adjacent to creeks,
880 streamheads, or along lakes and rivers, and plants have been observed to grow larger and have
881 more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993),
882 specific effects of climate change to the dwarf-flowered heartleaf are likely related to changes in
883 soil moisture associated with potential increases in drought.
884
885 Warming in the Southeast is expected to be greatest in the summer (NCCV 2016) which is
886 predicted to increase drought frequency, while annual mean precipitation is expected to increase
887 slightly, leading to increased flooding events (IPCC 2013, p.7; NCCV 2016). Changes in
888 climate may affect ecosystem processes and communities by altering the abiotic conditions
889 experienced by biotic assemblages resulting in potential effects on community composition and
890 individual species interactions (DeWan et al. 2010, p.7).
891
892 Despite the recognition of potential climate effects on ecosystem processes, there is uncertainty
893 about what the exact climate future for the Southeastern US will be and how the ecosystems and
894 species in this region will respond. Although climate change was not a factor leading to the
895 original listing of the species, it should be recognized that the greatest threat from climate change
896 may come from synergistic effects. That is, factors associated with a changing climate may act as
897 risk multipliers by increasing the risk and severity of more imminent threats. As a result, impacts
898 from rapid urbanization in the region might be exacerbated under even a mild to moderate
899 climate future.
900

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Regardless of a pessimistic, optimistic, or status quo climate future, the following systematic changes are expected to be realized to varying degrees in the Southeastern US (IPCC 2013):

- More frequent drought
- More extreme heat (resulting in increases in air and water temperatures, Figure 5-3)
- Increased heavy precipitation events (e.g., flooding)
- More intense storms (e.g., frequency of major hurricanes increases)
- Rising sea level and accompanying storm surge

In recent years, the Southeast has experienced moderate to severe droughts that many observers have implicated in population declines and poor transplant survivorship (NCNHP, 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). The extent to which these climate changes will significantly affect populations of dwarf-flowered heartleaf is currently unknown.

Appendices 4a and 4b gives summary reports on historical and future predicted climate parameters from the USGS National Climate Change Viewer for both North Carolina and South Carolina. As discussed above, the trend for these States is consistent with the general trend in the Southeast: more frequent drought, more extreme heat, and increased precipitation events. If these predictions hold true, dwarf-flowered heartleaf habitat would likely be impacted through increased evaporative rates and decreased soil moisture (Appendices 4a and 4b), increased potential for catastrophic wildfire events, as well as potential disruption of stream bank morphology through increased flooding events. Our habitat model indicates a preferred temperature and precipitation range, indicating that the species would be sensitive to a changing climate.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Chapter 6: FUTURE CONDITION

Future Considerations

Our analysis of the past, current, and future influences on what the dwarf-flowered heartleaf needs for long term viability revealed that there are several influences that pose risks to future viability of the species. These risks are primarily related to habitat changes from development and long term climate change. We use projections of urban development to assess potential habitat loss and fragmentation. We also considered how climate change may exacerbate the impacts of development in a qualitative fashion using a narrative approach.

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below. Based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape, we chose to project populations out to the year 2040 under each scenario, but no further.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

DRAFT

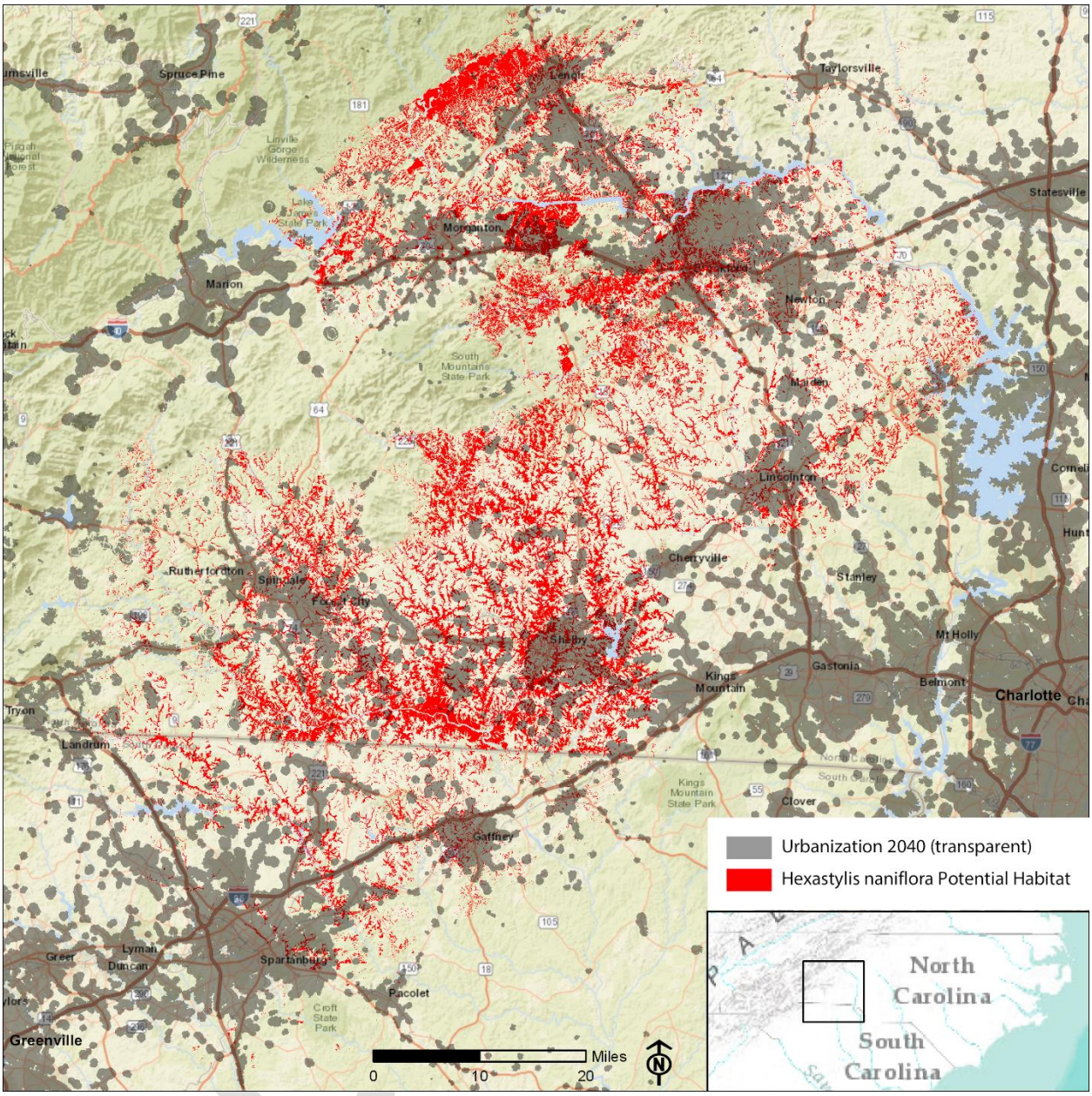
Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040 (Figure 6.1). SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995).

Figure 6.1. Results of the SLEUTH model with *Hexastylis naniflora* potential habitat predicted by the MAXENT model overlaid.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.



The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations (from Current Conditions—68 populations)

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There is no data available on the exact relationships between urbanization and the impacts to dwarf-flowered heartleaf. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative impacts; development increase of at least 50% was likely to have significant impacts to populations. We also assume that populations currently on protected lands are likely to see smaller impacts from urbanization compared to those that are not protected, but protection status (perpetuity vs non-perpetuity) matters. For example, Registered Heritage Areas are non-binding agreements with a land owner, and if the land changes ownership, or the owner decides not to continue with the agreement, then the Registry is no longer valid. Appendix 4 shows the protection status of each delineated population which helped to inform our assessment of resilience under each scenario.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. We believe this is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider for Current Conditions include detections that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to persist. Dwarf-flowered heartleaf is a long-lived perennial, and several EOs have been revisited after more than 10 years and the species was present. For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

habitat present within older EOs based on the Maxent model predictions that were not included as current populations.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future, was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resilience of that population.

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics including resilience category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resilience categories were assessed using last known abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score was calculated by taking the mean Maxent score of all potential habitat within the 1,000 foot buffer. The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 foot buffer that falls within the highest habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 foot buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

1047 flowered heartleaf is likely to persist. Table 6.1 (North Carolina) and 6.2 (South Carolina) show
1048 all of the EOs we considered and the corresponding metrics associated with resilience categories,
1049 urban development, and habitat scores.
1050
1051 **Table 6.1.** North Carolina raw data for metrics assessed to investigate potential sites where
1052 dwarf-flowered heartleaf was historically found and is likely to persist. Resilience categories are
1053 based on last known abundance estimates as follows: 1 = low; 2 = moderate; 3 = high; 4 = very
1054 high. MAXENT Average Mean refers to the mean Maxent score of all potential habitat. %
1055 Maxent classified as 0.8-1.0 represents the percentage of all potential habitat that falls within the
1056 highest habitat class. % Urban Development refers to the percentage of the 1,000 foot buffer
1057 around the EO that is projected to be urbanized in the year 2040.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

1058

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	2	34	1	3
2				
3	2	22	0	10
4	2	22	0	7
5	2	21	0	0
6				
8	1	27	0	6
9	3	44	4	0
10	4	33	2	0
11				
12	4	54	10	0
13	1	31	1	30
14	2	61	16	7
15				
16	4	18	0	47
17	1	50	13	0
18	1	36	8	2
19				
20	2	22	1	88
21	2	34	4	54
23	4	15	0	8
25	1	47	15	30
27				

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
28	2	43	12	29
29	4	43	8	30
30	4	27	2	74
31	4	30	3	86
32	2	34	2	47
33	2	33	3	0
34	1	49	13	63
35	1	42	10	23
36	1	19	0	12
37	4	41	6	17
38	2	14	0	46
39	1	19	0	11
40	2	37	2	32
44	4	20	0	59
45	1	27	5	13
46	3	42	6	6
47	1	28	1	96
48	1	14	0	12
49	4	61	14	5
50				
51	4	52	11	18
52	2	46	4	0
53	1	35	4	24
54	1	35	1	10
55	4	30	0	0
56	2	40	2	6
57	2	21	0	80
58	1	42	5	0
59	2	11	0	49
60	1	25	0	2
61	3	41	0	0
62	2	34	0	0
63	1	27	0	6
64	2	39	9	11
69	2	46	11	19
70	2	38	1	0
71	2	30	2	0
72	2	52	14	0
73	4	60	17	1

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
74	3	65	14	4
75	4	47	6	9
76	4	42	4	10
77	3	31	1	27
79	2	39	1	0
80	1	43	4	15
83	2	17	0	11
84	2	13	0	1
85	2	42	4	5
87				
89	2	13	2	0
90	2	28	2	0
91	1	49	5	0
92	2	15	0	30
106	4	39	4	38
107	1	14	0	40
113	4	46	4	7
114				
115	2	37	3	26
118	3	42	0	9
121	2	41	5	0
122	1	12	0	39
124	1	12	0	9
125	4	15	0	41
130	2	17	0	24
149	4	64	17	3
151	2	16	0	27
154	4	30	1	22
157	2	20	0	0
158	3	36	7	5
159	4	62	24	60
160	3	62	24	32
161	4	64	28	30
162	1	32	2	58
163	2	15	0	56
164	3	18	0	52
165	1	13	0	56
166	1	14	0	40
167	4	30	0	20

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
168	4	19	0	34
169	1	30	0	12
170	2	17	0	40
172	1	39	3	7
173	2	30	1	48
174	1	42	4	16
175				
180	2	21	1	0
181	4	29	2	0
182	4	45	4	0
183	2	15	0	5
184	4	19	0	19
187	2	20	1	35
188	2	24	0	53
189	1	25	0	14
190				
191	2	34	2	0
192	2	35	3	0
193	2	36	7	6
194	4	51	14	18
195	1	21	0	96
196	1	23	4	67
197	4	35	8	38
198	2	32	6	25
199	2	29	5	43
200	1	26	2	87
201	1	39	4	63
202	4	35	4	85
203	1	43	4	49
204				
205	2	43	1	49
206	1	37	3	66
207	2	33	2	85
208	1	32	1	67
209	2	33	2	94
210				
212	1	37	3	85
213	1	36	4	72
219	1	32	1	4

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
222	2	23	3	7
223				
224	1	22	3	17
225	2	24	2	12
227	4	55	2	5
229	2	28	0	21
230	1	54	15	13
231	1	41	7	0
233	4	53	12	14
235	2	50	8	6
236	2	62	14	5
237	2	67	16	5
238	4	51	15	0
239	2	63	14	5
240	1	57	18	0
241	2	62	16	3
242	1	53	9	0
246	1	62	13	4
249	4	47	5	0
250	4	45	4	0
251	4	43	4	0
254	2	54	18	6
255				
256	2	54	15	13
258	3	19	0	51
259	4	25	0	0
262	4	29	2	50
263				
264				
265				
266				
267	2	29	1	0
268	1	33	2	0
269	2	49	17	0
270	1	46	18	1
271	1	26	7	0
272	1	33	0	71
273	2	28	2	0
274	2	50	8	0

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
275	2	12	0	0
276	4	42	5	21
277				
278				
279	1	32	4	89
280	2	64	30	30
281	1	64	31	36
282	1	64	31	51
283	1	65	34	59
284	1	64	35	45
286				
287	2	15	0	35
291	2	21	1	84
292	2	14	0	83
293	1	8	0	16
294	2	36	4	61
296	2	3	0	5
297				
298	2	16	0	1
299	1	12	0	0
300	1	9	0	18
303	2	31	0	0
304	2	31	0	0
305	1	30	2	0
306	1	4	0	53
308	2	15	0	3
309	1	5	0	0
310	4	58	26	35
311	2	15	0	0
312	4	17	0	57
313				
314				
315	1	36	4	61
317	1	15	0	53
318	2	34	4	52
319	4	43	4	10
320	4	41	6	98
321				

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
Min	1	3	0	0
Max	4	67	35	98

Table 6.2. South Carolina raw data for metrics assessed to investigate potential sites where dwarf-flowered heartleaf was historically found and is likely to persist. Resilience categories are based on last known abundance estimates as follows: 1 = low; 2 = moderate; 3 = high; 4 = very high. MAXENT Average Mean refers to the mean Maxent score of all potential habitat. % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat that falls within the highest habitat class. % Urban Development refers to the percentage of the 1,000 foot buffer around the EO that is projected to be urbanized in the year 2040.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	2	21	0	0
2	2	1	0	4
3				
4	1	13	0	10
5	2	0	0	64
6	1	0	0	36
7	4	27	0	35
8	2	0	0	14
9				
10				
11	4	14	0	52
12				
13	1	7	0	100
14	4	14	0	43
15	1	0	0	4
16	4	22	0	38
17	4	22	0	33
18	3	19	0	52
19	1	12	0	65
20	2	5	0	100
21	3	5	0	90
22	1	0	0	0
23				

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
24	1	4	0	3
25	1	14	0	48
26	4	12	0	65
27	4	18	1	40
28	4	19	1	49
29				
30	2	7	0	88
31	4	0	0	0
32	2	7	0	93
33	2	2	0	20
34	1	31	3	1
35	1	23	1	53
36	2	6	0	0
37	1	24	2	0
38	4	5	0	37
39	1	6	0	1
40	2	6	0	20
41	1	11	0	87
42	2	3	0	6
43	1	23	0	43
44				
45				
46	1	10	0	96
47				
48				
49	3	8	0	70
50	2	5	0	54
51	1	0	0	35
52	3	0	0	0
53	2	10	0	66
54	2	9	0	91
55	1	4	0	99
56	2	14	0	96
57	3	15	0	38
59	2	4	0	17
60	4	17	1	12

Min	1	0	0	0
Max	4	31	3	100

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development

Next, we implemented a set of ranking rules using the data from Tables 6.1 and 6.2 to further assess which EOs had a higher likelihood of persistence on the landscape. We used SMART methodology to quantify and implement our ranking rules. Because the metrics of interest vary in data type (i.e. categorical vs continuous) and range of values (i.e. not all continuous variables have the same maximum and minimum), our first step was to normalize all of the data on a scale of 0-100. Normalization techniques allow for aggregation of criteria with numerical and comparable data. We decided to analyze North and South Carolina data separately because the Maxent model predicts habitat differently across state lines due to differences in soil classification. We weighted each variable according to our opinion of the level of contribution each variable had to the probability of persistence of that particular EO. This resulted in abundance having the highest weight (100%), with habitat (as calculated by average Maxent score) and urbanization given relatively similar weighting (80%). The results of the normalization procedure and weighting can be found in Tables 6.3 and 6.4.

Table 6.3. Normalized scores for SMART analysis of North Carolina EOs and weighting scores. Resilience category represents the normalized scoring based on the last known abundance (0=low; 33=moderate; 67=high; 100=very high); MAXENT Mean is the normalized score of the average Maxent rank of all potential habitat; MAXENT percent 0.8-1 represents the normalized score of the percentage of potential habitat that falls within the highest rank category; 80% or greater SLEUTH Percent of Total is the total amount of current urbanization plus predicted urbanization at year 2040 (>80% probability) from the SLEUTH model.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	33	49	3	97
2				
3	33	30	0	90
4	33	29	0	93
5	33	28	1	100
6				

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
8	0	37	0	94
9	67	65	11	100
10	100	46	6	100
11				
12	100	80	28	100
13	0	43	2	69
14	33	90	44	93
15				
16	100	23	0	52
17	0	73	37	100
18	0	52	22	98
19				
20	33	30	3	11
21	33	48	12	45
23	100	19	0	92
25	0	68	42	69
27				
28	33	62	33	71
29	100	63	22	69
30	100	38	5	24
31	100	43	8	12
32	33	48	5	52
33	33	47	8	100
34	0	73	37	35
35	0	60	29	77
36	0	25	0	88
37	100	60	17	82
38	33	17	0	53
39	0	24	0	89
40	33	54	7	67
44	100	26	1	40
45	0	37	14	86
46	67	60	18	94
47	0	39	2	2
48	0	17	0	88
49	100	91	39	95
50				
51	100	77	31	82
52	33	68	11	100

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
53	0	50	11	76
54	0	49	1	90
55	100	43	0	100
56	33	58	7	94
57	33	28	0	19
58	0	60	15	100
59	33	12	0	50
60	0	34	1	98
61	67	59	1	100
62	33	49	0	100
63	0	38	0	94
64	33	56	24	88
69	33	67	31	80
70	33	55	3	100
71	33	42	5	100
72	33	77	41	100
73	100	89	48	99
74	67	97	41	95
75	100	69	16	91
76	100	61	11	89
77	67	43	2	72
79	33	56	4	100
80	0	62	11	85
83	33	22	0	89
84	33	15	0	99
85	33	61	10	95
87				
89	33	15	5	100
90	33	38	5	100
91	0	71	13	100
92	33	18	0	70
106	100	56	10	61
107	0	16	0	59
113	100	68	11	93
114				
115	33	53	8	74
118	67	61	1	91
121	33	59	13	100
122	0	14	0	60

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
124	0	13	0	91
125	100	19	0	58
130	33	22	0	76
149	100	95	49	97
151	33	20	0	72
154	100	41	2	78
157	33	26	0	100
158	67	51	20	95
159	100	92	69	39
160	67	92	69	68
161	100	95	79	69
162	0	45	7	41
163	33	18	0	43
164	67	24	0	47
165	0	16	0	43
166	0	16	0	59
167	100	41	0	79
168	100	25	0	65
169	0	42	0	88
170	33	22	0	60
172	0	56	8	93
173	33	42	3	52
174	0	62	12	84
175				
180	33	28	2	100
181	100	41	6	100
182	100	66	12	100
183	33	18	1	95
184	100	24	0	81
187	33	27	2	64
188	33	33	0	46
189	0	33	1	86
190				
191	33	48	7	100
192	33	49	10	100
193	33	51	19	94
194	100	75	40	81
195	0	28	0	3
196	0	30	10	32

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
197	100	50	24	61
198	33	45	18	74
199	33	41	14	56
200	0	35	6	11
201	0	56	11	36
202	100	49	11	13
203	0	62	11	50
204				
205	33	62	4	50
206	0	52	8	33
207	33	47	4	14
208	0	45	4	32
209	33	46	5	4
210				
212	0	53	9	14
213	0	52	11	27
219	0	45	2	96
222	33	31	9	92
223				
224	0	29	8	83
225	33	32	6	88
227	100	81	7	95
229	33	39	0	79
230	0	80	44	87
231	0	59	20	100
233	100	79	34	86
235	33	74	22	94
236	33	93	41	95
237	33	100	46	95
238	100	74	41	100
239	33	94	40	94
240	0	85	51	100
241	33	93	47	97
242	0	78	27	100
246	0	93	38	95
249	100	68	13	100
250	100	65	12	100
251	100	62	11	100
254	33	80	51	93

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
255				
256	33	80	44	87
258	67	25	0	48
259	100	34	0	100
262	100	41	6	49
263				
264				
265				
266				
267	33	41	3	100
268	0	46	7	100
269	33	72	49	100
270	0	67	52	99
271	0	35	19	100
272	0	47	0	28
273	33	39	7	100
274	33	73	23	100
275	33	14	0	100
276	100	61	14	79
277				
278				
279	0	46	11	9
280	33	95	85	70
281	0	95	88	64
282	0	96	88	48
283	0	97	95	40
284	0	95	100	54
286				
287	33	18	0	64
291	33	28	4	14
292	33	16	0	16
293	0	7	0	84
294	33	52	11	38
296	33	0	0	95
297				
298	33	20	0	99
299	0	13	0	100
300	0	9	0	82
303	33	44	1	100

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
304	33	43	0	100
305	0	42	5	100
306	0	1	0	46
308	33	18	0	97
309	0	3	0	100
310	100	86	75	64
311	33	19	0	100
312	100	22	0	42
313				
314				
315	0	51	10	38
317	0	19	0	46
318	33	48	12	47
319	100	63	12	89
320	100	60	17	0
321				

Weights			
100	60	20	80

Table 6.4. Normalized scores for SMART analysis of South Carolina EOs and weighting scores. Resilience category represents the normalized scoring based on the last known abundance (0=low; 33=moderate; 67=high; 100=very high); MAXENT Mean is the normalized score of the average Maxent rank of all potential habitat; MAXENT percent 0.8-1 represents the normalized score of the percentage of potential habitat that falls within the highest rank category; 80% or greater SLEUTH Percent of Total is the total amount of current urbanization plus predicted urbanization at year 2040 (>80% probability) from the SLEUTH model.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	33	67	14	100
2	33	2	0	96
3				
4	0	42	3	90
5	33	0	0	36

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
6	0	0	0	64
7	100	87	2	65
8	33	0	0	86
9				
10				
11	100	43	0	48
12				
13	0	23	0	0
14	100	43	0	57
15	0	0	0	96
16	100	72	1	62
17	100	70	1	67
18	67	62	0	48
19	0	37	0	35
20	33	16	0	0
21	67	15	0	10
22	0	1	0	100
23				
24	0	13	0	97
25	0	44	0	52
26	100	40	0	35
27	100	56	18	60
28	100	60	28	51
29				
30	33	22	0	12
31	100	0	0	100
32	33	23	0	7
33	33	5	0	80
34	0	100	100	99
35	0	75	34	47
36	33	18	0	100
37	0	78	66	100
38	100	16	0	63
39	0	19	0	99
40	33	18	0	80
41	0	36	0	13
42	33	10	0	94
43	0	72	0	57
44				

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
45				
46	0	32	0	4
47				
48				
49	67	27	0	30
50	33	16	0	46
51	0	1	0	65
52	67	0	0	100
53	33	33	0	34
54	33	29	0	9
55	0	13	0	1
56	33	43	0	4
57	67	47	8	62
59	33	13	0	83
60	100	53	21	88

Weights			
100	60	20	80

To determine a final rank for likelihood of persistence, we calculated a weighted sum for each EO. We then converted the weighted sum to a final rank value that ranged from 0-100. Finally, we determined the top 10% or 90th percentile, and top 25% or 75th percentile ranking for EOs in each state. Table 6.5 summarizes the final ranks and top 10% and 25% percentile ranks for North and South Carolina. We will include the top 10% in the status quo scenario, and the top 25% in the conservation scenario.

Table 6.5. Final Rank Scores for EOs in North and South Carolina. Dark green represents the top 10% of scores, and light green includes the top 25% of scores.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

South Carolina

EO_Code	Final Score
60	79
7	79
17	75

North Carolina

EO_Code	Final Score
149	94
73	93
49	92

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

16	74
27	71
28	70
31	69
14	66
11	63
38	62
34	61
1	60
26	59
52	56
57	56
18	55
37	54
36	48
42	44
2	43
40	42
59	41
49	41
8	39
33	39
4	37
39	35
35	34
43	34
24	33
21	32
22	31
53	31
50	31
15	30
25	26
56	24
5	24
54	22
30	22
32	20
51	20
6	20
19	19

12	90
238	90
161	88
227	87
249	86
233	86
182	85
250	85
251	84
194	84
51	84
310	84
75	84
113	84
319	81
76	81
74	81
10	80
181	79
55	79
37	79
276	78
259	77
159	77
29	76
160	73
167	72
9	72
154	72
23	71
106	71
197	71
61	70
46	70
184	69
237	69
158	68
118	68
241	68
239	67
236	66

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

20	17
41	12
46	8
13	5
55	3
3	0
9	0
10	0
12	0
23	0
29	0
44	0
45	0
47	0
48	0

14	66
72	64
168	64
254	64
269	64
262	64
280	63
274	62
256	62
125	61
235	60
52	60
16	60
121	58
77	58
85	57
79	57
44	57
70	57
312	56
192	56
56	56
69	55
33	55
30	55
191	55
193	55
64	55
62	55
202	55
240	54
1	54
303	54
246	54
71	54
320	54
304	54
267	53
273	53
90	53
31	53

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

28	51
242	51
17	51
5	50
180	50
270	50
157	50
222	49
230	49
115	48
281	48
91	48
4	48
298	48
311	48
225	48
198	47
89	47
3	47
84	47
308	47
275	47
183	46
40	46
284	46
258	46
231	46
229	46
58	46
164	46
83	45
282	44
18	44
205	43
172	42
296	42
283	42
268	42
80	41
130	41
174	41

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

305	41
199	41
271	40
25	40
32	40
219	40
35	40
151	40
54	39
318	39
187	39
173	39
92	39
21	39
60	38
63	38
8	38
294	37
169	37
287	37
170	36
45	36
53	36
188	34
189	34
299	34
38	33
224	33
39	33
36	33
13	32
309	31
124	31
59	31
48	31
34	30
203	30
163	30
207	28
293	27
300	27

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

57	25
209	25
201	25
315	24
291	24
162	23
20	23
206	23
107	22
166	22
122	22
292	21
213	21
208	20
272	20
317	19
196	18
212	17
165	17
306	14
279	14
200	12
47	10
195	7
2	0
6	0
11	0
15	0
19	0
27	0
50	0
87	0
114	0
175	0
190	0
204	0
210	0
223	0
255	0
263	0
264	0

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

265	0
266	0
277	0
278	0
286	0
297	0
313	0
314	0
321	0

Below we describe how we integrated potential positive and negative influences across the scenarios. We can assume there is some tipping point at which an area becomes so urbanized it is unsuitable for dwarf-flowered heartleaf, but we don't know exactly what that tipping point is. Similarly, we can assume additional populations are likely to be found or rediscovered across the range, but there is no clear way to predict the exact number or location of these populations. Although there is great uncertainty associated with how the species will be influenced by these factors, the three scenarios are intended to capture the range of this uncertainty. Note, changes in climate have potential to exacerbate the effects of urbanization, but these effects are not likely to occur within our projection window (e.g. 2040).

Status Quo Scenario

Under the status quo scenario, we assume a few populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the % increase in urban development and whether a population is protected or not. We assessed population resilience under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

1137 ▪ Protected in perpetuity—no negative impacts from urbanization
1138 ▪ Voluntary protection/non-perpetuity—population drops 1 resilience rank if
1139 % increase in urbanization exceeds >50% threshold
1140 o Non-protected—population drops 1 resilience rank if % increase in urbanization
1141 exceeds >25% threshold; population drops 2 resilience ranks if % increase in
1142 urbanization exceeds >50% threshold
1143

1144 *High Development Scenario*

1145 Under the high development scenario, we assume no additional populations will be identified as
1146 persisting throughout the range, and that impacts from urbanization that are relatively high, and
1147 are also affected by whether a population is protected or not. We assessed population resilience
1148 under the following assumptions:

1149 ● No additional populations are identified as persisting
1150 ● Potential impacts of urban development based on SLEUTH Model projections focused on
1151 current delineated populations:
1152 o Protected areas
1153 ▪ Protected in perpetuity— population drops 1 resilience rank if % increase
1154 in urbanization exceeds >50% threshold
1155 ▪ Voluntary protection/non-perpetuity— population drops 1 resilience rank
1156 if % increase in urbanization exceeds >25% threshold; population drops 2
1157 resilience ranks if % increase in urbanization exceeds >50% threshold
1158 o Non-protected—population drops 1 resilience rank if % increase in urbanization
1159 exceeds >25% threshold; population drops 2 resilience ranks if % increase in
1160 urbanization exceeds >50% threshold; extirpation of populations if % increase in
1161 urbanization exceeds >90% threshold.
1162

1163 *Targeted Conservation Scenario*

1164 Under the targeted conservation scenario, we assume it is likely several additional populations
1165 (i.e. more than status quo scenario) will be identified as persisting throughout the range. The

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resilience under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

Future Resilience

Our focus on future resilience of dwarf-flowered heartleaf is on the potential impacts from urbanization. Table 6.6 shows a summary of currently delineated populations and the predicted urban development to occur within each of the populations. The table only includes those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Populations not included in this table are not predicted to be urbanized at all, so for the purposes of future analysis, will be assumed to retain the same resilience category as current. For those populations included in the table, we focus on those populations that are anticipated to increase in urbanization beyond a threshold value, depending on the scenario, but thresholds include >25% and >50% increases. Also taken into account is whether or not a population is on protected lands, and if so, whether the population is protected in perpetuity or not. Below is a summary of projected future resilience under each of the three scenarios.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Table 6.6. Results of the SLEUTH model. Populations consist of both stand-alone EOs and aggregates of multiple EOs following the definition of delineating demographic populations from Chapter 4. Included are only those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Red cells indicate populations that are predicted to increase >50% in urbanization. Orange cells indicate populations that are predicted to increase >25% in urbanization.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Population Number	Total Area (sq m)	Already classed Urban	80% chance	90% chance	95% chance	97.5% chance	100% chance	>80%
206	17346.37096	0.40%	0.00%	0.00%	0.00%	6.24%	93.41%	99.65%
306	7804.656249	0.00%	15.11%	49.91%	7.83%	0.00%	22.40%	95.24%
208	55360.86786	17.31%	0.00%	0.00%	0.00%	0.00%	82.69%	82.69%
279	1951.661571	0.00%	0.00%	0.00%	0.00%	0.00%	80.85%	80.85%
214	15043.2984	0.00%	0.00%	1.44%	10.97%	0.00%	55.72%	68.13%
248	25486.15611	28.80%	0.00%	3.22%	0.02%	0.02%	53.03%	56.30%
316	43177.79587	20.06%	0.00%	16.68%	7.08%	0.00%	20.67%	44.43%
247	49898.17159	5.87%	0.00%	6.37%	0.00%	0.00%	23.35%	29.73%
291	11666.76374	35.39%	12.28%	13.53%	2.43%	0.00%	0.23%	28.47%
287	7901.775408	0.00%	0.00%	11.50%	0.00%	0.00%	14.25%	25.75%
312	6535.273235	0.00%	25.28%	0.00%	0.00%	0.00%	0.00%	25.28%
32	31220.60253	60.74%	0.00%	20.39%	0.00%	0.00%	0.00%	20.39%
177	26954.54153	25.34%	12.19%	0.92%	0.10%	5.31%	0.13%	18.66%
292	15611.18205	0.00%	0.00%	0.00%	0.00%	0.00%	18.40%	18.40%
261	21644.22924	0.00%	0.00%	13.21%	3.35%	0.00%	0.00%	16.56%
295	23486.00987	18.20%	0.00%	3.41%	11.99%	0.25%	0.00%	15.65%
125	20742.3249	0.00%	1.02%	5.65%	0.00%	6.67%	0.00%	13.34%
59	8172.007769	0.00%	13.09%	0.00%	0.00%	0.00%	0.00%	13.09%
302	120342.0641	1.46%	2.55%	2.55%	0.77%	2.33%	3.98%	12.19%
178	376781.2214	28.59%	2.79%	2.40%	0.68%	0.59%	2.64%	9.11%
93	43754.11642	0.19%	0.00%	0.00%	0.00%	0.00%	7.82%	7.82%
77	6044.427562	0.00%	1.51%	6.14%	0.00%	0.00%	0.00%	7.64%
179	15145.19453	85.06%	1.14%	0.00%	5.12%	0.00%	0.49%	6.75%
44	15081.76951	61.17%	0.27%	0.00%	0.00%	0.00%	4.68%	4.95%
252	39595.93143	63.47%	0.00%	3.80%	0.00%	0.00%	0.00%	3.80%
100	423621.7376	9.01%	1.32%	1.10%	0.72%	0.14%	0.00%	3.27%
276	123688.7819	0.61%	0.36%	1.87%	0.01%	0.00%	0.00%	2.24%
216	66424.06073	0.00%	0.91%	0.00%	0.00%	0.00%	0.00%	0.91%
154	33924.92259	0.00%	0.00%	0.37%	0.00%	0.00%	0.00%	0.37%
29	249998.8742	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.05%
1	30711.68144	0.41%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2	36339.91976	11.32%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3	24498.03483	24.77%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
31	42929.76479	100.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
96	95947.32128	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
130	1168.240433	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
176	39787.48373	0.89%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
195	7805.599588	99.94%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
317	584.7346337	99.70%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
318	5396.859208	99.74%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
320	125.5182447	98.79%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Status Quo Scenario

In the Status Quo scenario, there are predicted to be 75 populations of dwarf-flowered heartleaf on the landscape (Table 6.7). The predicted resilience of the extant populations are as follows:

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the seven additional populations predicted to persist under this scenario, four are in South Carolina, and three in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), and moderate (4).

Table 6.7. Predicted resilience categories for *Hexastylis naniflora* populations under the Status Quo scenario, and comparison to current condition.

Site Name	Current Resilience	Status Quo
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	high
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributray Rare Plant Site	very high	very high

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	Status Quo
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	high
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	Status Quo
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	low
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low
First Broad River (North Carolina)	n/a	present
Cherokee Creek/Bonner and Robin School Roads	n/a	present

High Development Scenario

In the High Development scenario, there are predicted to be 72 populations of dwarf-flowered heartleaf on the landscape (Table 6.8). The predicted resilience of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No new future populations are predicted to be discovered. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to moderate resilience; one high resilience population is predicted to drop to moderate; two moderate populations are predicted to drop to low resilience; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Table 6.8. Predicted resilience categories for *Hexastylis naniflora* populations under the High Development scenario, and comparison to current condition.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	High Development
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	moderate
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributary Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	moderate
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	High Development
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	extirpated
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	High Development
Gateway Elementary School	low	low

Targeted Conservation Scenario

In the Targeted Conservation scenario, there are predicted to be 79 populations of dwarf-flowered heartleaf on the landscape (Table 6.9). The predicted resilience of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations discovered to persist, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the sixteen additional populations predicted to persist under this scenario, ten are in South Carolina, and six in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), moderate (11), and low (2).

Table 6.9. Predicted resilience categories for *Hexastylis naniflora* populations under the Targeted Conservation scenario, and comparison to current condition.

Site Name	Current Resilience	Targeted Conservation
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	Targeted Conservation
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	high
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributray Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	high
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	Targeted Conservation
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	low
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low
First Broad River (North Carolina)	n/a	present
First Broad Hop-Hornbeam NA	n/a	present
Big Island Carolina Hemlock Bluff	n/a	present
Cherokee Creek/Bonner and Robin School Roads	n/a	present
Arrowood Branch	n/a	present
Cherokee Creek/SC 11	n/a	present

Viability Summary

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resilience and extirpation of a few populations is offset by the fact that several additional populations were found to persist in the Status Quo and Targeted Conservation scenarios. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resilience in several additional populations. Regardless of the scenario, the majority of the populations expected to persist on the landscape in 2040 are of at least moderate resilience.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances, however the species range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

Given that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where we have relatively few current populations. As discussed below, we believe there are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, we believe our scenarios do not predict declines in species representation.

Table 6.10. Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	CURRENT	STATUS QUO	HIGH DEVELOPMENT	TARGETED CONSERVATION
VERY HIGH	28	27	27	27
HIGH	5	6	4	6
MODERATE	26	23	25	23
LOW	19	17	16	17

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EXTIRPATED	n/a	5	6	5
PERSISTING	n/a	2	0	6
TOTAL	**78**	**75**	**72**	**79**

Opportunities for Additional Conservation

Although our scenarios focus on areas where dwarf-flowered heartleaf have been found in the past, the Maxent model identifies a number of areas as high quality potential habitat for the species that falls outside the immediately known occurrence areas. A few of these areas are detailed below (Figure 6.2).

1. West of the city of Lenoir, south of Highway 90/Adako Rd., north of Highway 64 within Caldwell County. This area identifies a large block of potential habitat. This area falls just outside the administrative boundary of the Pisgah National Forest. The bluffs and tributaries along the Johns River are identified as the best habitat, but there is also ample habitat identified along the forested areas of Celia, Husband, Abingdon and Greasy Creeks. The only known occurrence within this area is associated with Abingdon Creek and is under a conservation easement.

2. Henry Fork River bluffs and tributaries east of Highway 18 within Burke County. A historic element occurrence is present by the Burke County line, but the entire area is identified as good quality potential habitat for the species where forested habitats remain.

3. South West corner of Catawba County west of Highway 321. Several disjointed patches of high quality potential habitat are identified in this region associated with the river and creek slopes. Rock Creek, Jacob Fork River, Pott Creek, and their associated tributaries all contain blocks of potential habitat. A number of element occurrences are identified within this area, but additional habitat is identified both upstream and downstream of the known occurrences.

4. Clark, Pinch Gut, Maiden, and Allen Creeks, north of the town of Maiden. The slopes along these creeks all contain quality potential habitat. Known element occurrences are in the general area, but none are situated within the creeks listed.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

5. First Broad River North of Highway 74, Rutherford County. Two older element occurrences are located within this area, however, the forested bluffs along the First Broad River and associated tributaries are identified as good quality potential habitat in many additional upstream and downstream areas in this system.

6. Hickory Creek, Sulphur Springs Branch (Little Hickory), Shoal Creek, and tributaries draining into First Broad River South of the Town of Shelby, north of the South Carolina border. The town of Shelby has likely disconnected this site from area 5 listed above. Here, slopes along the creeks and tributaries draining into the First Broad River are identified as potential habitat more so than the slopes along the First Broad River themselves. There in only a single element occurrence known upstream along Hickory Creek.

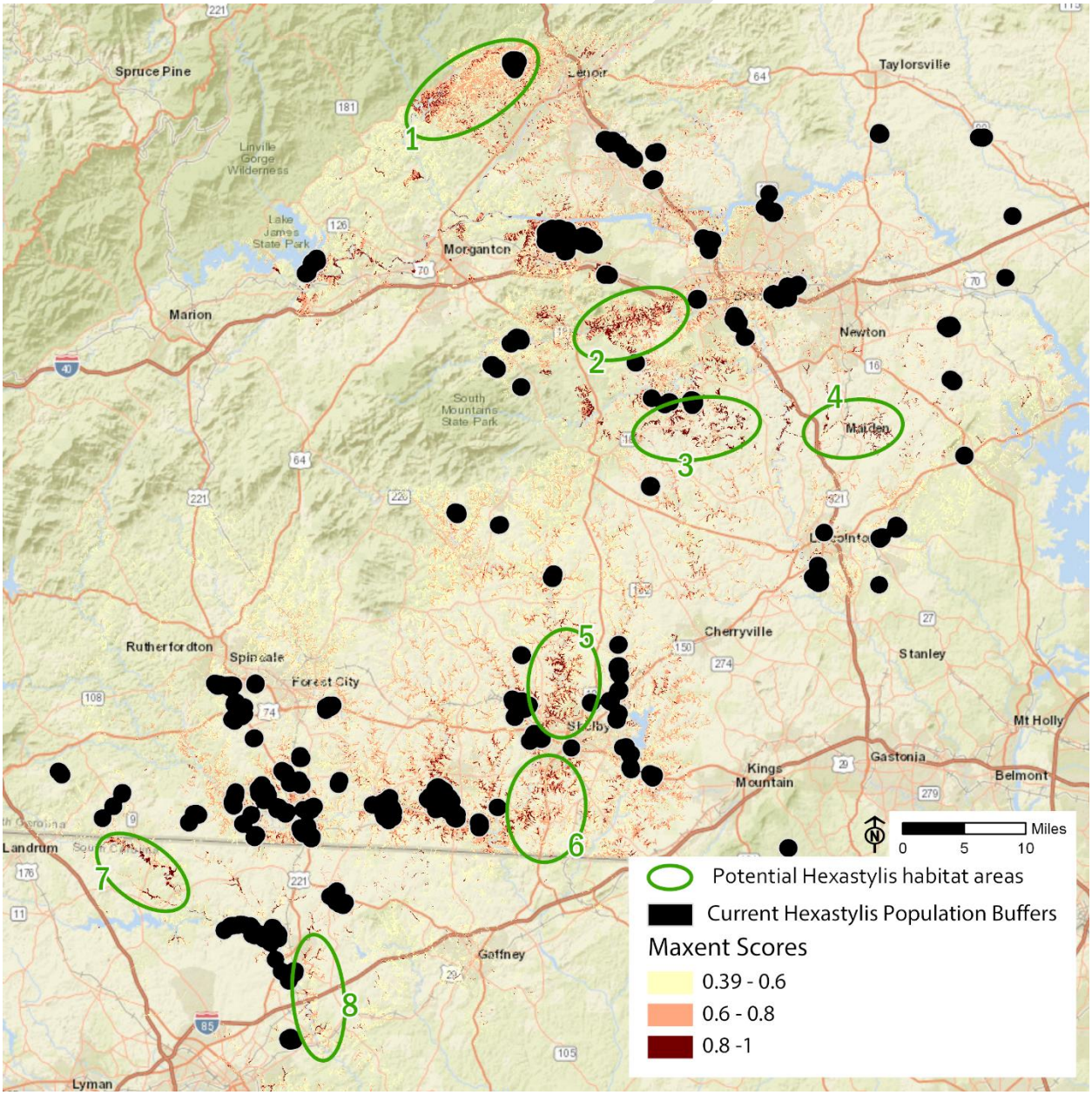
7. North Pacolet River and Obed Creek, north of where they join. The majority of potential habitat falls along the slopes of the North Pacolet River. Two older element occurrences (1991 last observation) are found in the tributaries draining into the North Pacolet River, and many occurrences are found further upstream. The habitat model suggests that additional undiscovered habitat areas are present.

8. Pacolet River and Island Creek, north of Peters Creek, downstream of the Pacolet River dam. This area displays limited amounts of good quality potential habitat. Recent element occurrences are present in the upper headwaters of Peters and Zekial Creeks (Zekial Creek drains into Peters Creek) and in areas north of the Pacolet River dam, but none are known along the areas identified in this immediate area.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Figure 6.2. Areas identified as high quality potential habitat by Maxent model for *Hexastylis naniflora* that fall outside the immediately known occurrence areas.



Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Literature Cited

Amoroso, J.L. 2016. *Hexastylis naniflora* status meeting with USFWS, NCNHP, ASU, and NCDOT [meeting minutes]. North Carolina Department of Natural and Cultural Resources office, Asheville, NC, 11 May 2016.

Baldwin, R.A. 2009. Use of maximum entropy modeling in wildlife research. Entropy. 11:854-866.

Barringer, K. 1993. New combinations in North American *Asarum* (Aristolochiaceae). Novon 3:225-227.

Blomquist, H.L. 1957. A Revision of *Hexastylis* in North America. Brittonia 8:255-281.

Clarke, K.C., Riggan, P., and Brass, J.A., 1995. A cellular automaton model of wildfire propagation and extinction, Photogram. Eng. Rem S. 60, 1355-1367.

Dobzhansky, T. 1937. Genetics and the origin of species. Columbia University Press, New York, NY.

DeWan, A., N. Dubois, K. Theoharides, and J. Boshoven. 2010. Understanding the impacts of climate change on fish and wildlife in North Carolina.

Flora of North America 1997. Flora of North America north of Mexico. Volume 3, Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York, NY. 590 pp. Contains Whittemore and Gaddy's treatment of *Asarum* and *Hexastylis*.

Gaddy, L.L. 1980. Status Report on *Hexastylis naniflora* Blomquist. Prepared for and submitted to USFWS, Endangered Species Office, Region 4, Atlanta, Georgia. July 1980.

Gaddy, L.L. 1981. The status of *Hexastlylis naniflora* Blomquist in North Carolina. Unpublished report prepared under contract to the Plant Conservation Program, North Carolina Department of
Agriculture, Raleigh.

Gaddy, L. 1986. Twelve new ant-dispersed species from the southern Appalachians. *Bulletin of the Torrey Botanical Club* 113: 247-251.

Gaddy, L.L. 1987. A review of the taxonomy and biogeography of *Hexastylis* (Aristolochiaceae). Castanea 52(3):186-196.

Golder Associates, Inc. 2009. Year 5 Monitoring Report, *Hexastylis naniflora*, Foothills Conservation Area, Caldwell County, North Carolina. Submitted to: Republic Services of North Carolina, LLC; copies (per cover letter) distributed to US Army Corps of Engineers, Asheville Regulatory Office and USFWS Asheville ES Office. June 26, 2009.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Golladay SW, Gagnon P, Kearns M, Battle JM. Hicks DW. Response of freshwater mussel assemblages (Bivalvia: Unionidae) to a record drought in the Gulf Coastal Plain of southwest Georgia. J. N. Am. Benthol. Soc. 2004;23:494–506.

Gonzalez, V. C. 1972. The ecology of *Hexastylis arifolia*, an evergreen herb in the North Carolina deciduous forest. Ph.D. disseration, Duke University. Durham, North Carolina, USA. HDR. 2005. Identification of *Hexastylis naniflora*. Notes on characteristics and field observations provided to the North Carolina Natural Heritage Program, Raleigh.

IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

Jones M.S., T. H. Jones, and J. J. English. 2014. The Pollination of *Hexastylis naniflora* in Cleveland County, North Carolina. Castanea: June 2014, Vol. 79, No. 2, pp. 74-77.

Jordan, Jones and Goulding (JJ&G), Inc. 1998. Section 404 Application and Conceptual Mitigation Plan, Lake Blalock Expansion Project. USFWS Log number 4-6-97-358. ACOE Project # 80-97-1732 (S). Section 9: *Hexastylis naniflora* Biological Assessment. Received by the Asheville Field Office July 16, 1998.

Jordan, Jones and Goulding (JJ&G), Inc. 2006. Lake Blalock Buffer Disturbance – Vicinity of Casey Creek Road. Memorandum to: Eddie Dearbury, Spartanburg Water Systems. Date: October 25, 2006.

Karl, T. R., Melillo, J. M., & Peterson, T. C. (Eds.). (2009). Global Climate Change Impacts in the United States. Washington, DC: U.S. Global Change Research Program.

Kelly, L. M. 1997. A Cladistic Analysis of *Asarum* (Aristolochiaceae) and Implications for the Evolution of Herkogamy. American Journal of Botany 84:1752-1765.

Kelly, L. M. 1998. Phylogenetic Relationships in *Asarum* (Aristolochiaceae) Based on Morphology and ITS Sequences. American Journal of Botany 85:1454-1467.

Kelly, L. M. 2001. Taxonomy of *Asarum* Section *Asarum* (Aristolochiaceae). Systematic Botany 26:17-53.

Lengyel, S., A. D. Gove, A. M. Latimer, J. D. Majer, and R. R. Dunn. 2010. Convergent evolution of seed dispersal by ants, and phylogeny and biogeography in flowering plants: A global survey. *Perspectives in Plant Ecology, Evolution and Systematic*s 12: 43-55.

McLaughlin, J.F. et al. (2002). Climate change hastens population extinctions. Proceedings of the National Academy of Sciences 99(9): 6070–6074.

Murrell, Z. et al. 2007. Ecological, Morphological, Micromorphological and Molecular Analyses of the Species in the *Hexastylis heterophylla* Complex. A report to the North Carolina

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Department of Transportation. NCDOT and CTE Joint Project 2002-2004, FHWA/NC/2004-01. May 2007.

Murrell, Z. 2015. Development of molecular and morphological tools to circumscribe and identify the Dwarf Flowered Heartleaf (*Hexastylis naniflora*). Report to the North Carolina Department of Transportation, NCDOT Project 2012-2111, July 2015.

National Climate Change Viewer. 2016. USGS. Accessed at https://www2.usgs.gov/climate_landuse/clu_rd/nccv.asp, January 2018.

NatureServe. 2002. Element Occurrence Data Standard, 6 February 2002. NatureServe, Arlington, Virginia. Accessed at http://www.natureserve.org/library/deliminting_plant_eos_Oct_2004.pdf, August 2016.

NCOSBM. North Carolina Budget and Management County and State Population Projections. Accessed at https://www.osbm.nc.gov/demog/county-projections, March 2018.

Newberry, G. 2006. South Carolina Populations of *Hexastylis naniflora*: 2006 updates. Received by the USFWS Asheville Field Office, September 7, 2006.

Newberry, G. 2009. University of South Carolina at Spartanburg. Evaluation of damage to *Hexastylis naniflora* plants on acreage bordering the hunt club. Letter to Jon Morgan, Lake Warden, Spartanburg Water Systems. Dated February 24, 2009.

North Carolina Natural Heritage Program (NCNHP). 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: August 5, 2016.

North Carolina Natural Heritage Program (NCNHP). 2018. Natural Heritage Element Occurrences. Accessed at https://www.ncnhp.org/activities/conservation/natural-heritage-element-occurrences, January 2018.

Newberry, G. 1993. Progress Report on Monitoring Studies of *Hexastylis naniflora*. Unpublished report. Copy submitted to the USFWS Asheville Field Office, on September 7, 2006.

Niedenberger, B.A. 2010. Molecular phylogeny and comparative pollen morphology of the genus *Hexastylis* (Aristolochiaceae). M.S. thesis. Appalachian State University, Boone, NC.

Otte, D. 1977. The pollination biology of *Hexastylis arifolia* (Michx.) Small var. *arifolia* and *H. minor* (Ashe) Blomquist (Aristolochiaceae) in the area of Chapel Hill, North Carolina. M.S. Thesis, University of North Carolina Chapel Hill, Chapel Hill, North Carolina, USA.

Padgett, J. E. 2004. Biogeographical, ecological, morphological, and micromorphological analyses of the species in the *Hexastylis heterophylla* complex. M.S. thesis. Appalachian State University, Boone, NC.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Phillips, S. J. 2018. A Brief Tutorial on Maxent. Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-02/21.

Renninger, H. 2010. North Carolina Department of Transportation (NCDOT). E-mail communication to Carolyn Wells, USFWS Asheville Field Office. Date: May 28, 2010. Subject: Dwarf-flowered heartleaf research proposal.

Robinson L.G. 2016. Dwarf-flowered Heartleaf range-wide status report. Final report to U.S. Department of Interior—U.S. Fish and Wildlife Service by North Carolina Natural Heritage Program. August 2016.

Robinson, L.G. and J.E. Padgett. 2016. Dwarf-flowered Heartleaf (*Hexastylis naniflora*) comprehensive review and monitoring report. Final report to the U.S. Department of Interior—U.S. Fish and Wildlife Service by the North Carolina Natural Heritage Program. August 2016.

Schneider, S. 2006. Spartanburg Water System (SWS) & Sanitary Sewer District, Assistant General Manager. E-mail communication to Lora Zimmerman, USFWS (formerly with the Charleston Field Office), dated December 18, 2006. Subject: Meeting at SWS on December 21, 2006 [to discuss Lake Blalock Buffer Disturbance].

South Carolina Department of Natural Resources (SCDNR) Heritage Trust. 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: February 4, 2016.

USFWS. 2001. Biological Opinion for Spartanburg Water System, Lake Blalock, P/N 2000-IP-194-W, USFWS log number 4-6-01-F-115. May 10, 2001.

USFWS. 2010. Draft Five Year Review for *Hexastylis naniflora* (dwarf flowered heartleaf). September 30, 2010. Submitted to the USFWS Southeast Regional Office September 30, 2010.

USFWS. 2015, August. Fact sheet for *Hexastylis naniflora*. Retrieved from https://www.fws.gov/raleigh/species/es_dwarf-flowered_heartleaf.html.

USFWS. 2016. USFWS species status assessment framework: an integrated analytical framework for conservation. Version 3.4.8, August 2016.

Wagner, J. 2013. Developing new morphological, geographic, and molecular tools to circumscribe *Hexastylis naniflora*. M.S. thesis. Appalachian State University, Boone, NC.

Walker, J. et al. 2009. What are the effects of prescribed fire on *Hexastylis naniflora*, a federally protected plant species? Unpublished final report prepared by U.S. Forest Service, Southern Research Station, Clemson University, Clemson, SC. Submitted to Timothy Stone, Superintendent, Cowpens National Battlefield. In partial fulfillment for Agreement

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

04-IA-11330138-234, between the NPS and USFS Southern Research Station. Revised March 19, 2009.

Warren II, R. J., 2008. Mechanisms driving understory evergreen herb distributions across slope aspects: as derived from landscape position. *Plant Ecology* 198: 297-308.

Weakley, A. 2010. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Working Draft as of March 8, 2010.

Weakley, A. 2015. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Working Draft as of 21 May 2015.

Whittemore, A. T., and L. L. Gaddy. 1997. Hexastylis. In Flora of North America Editorial Committee [Eds.], Flora of North America north of Mexico, vol. 3, 54–58. Oxford University Press, New York, New York, USA.

Wolf. S., B. Hartl, C. Carroll, M.C. Neel, and D.N. Greenwald. 2015. Beyond PVA: why recovery under the Endangered Species Act is more than population viability. BioScience 65:200-207.

DRAFT

<Draft media release written in the event the Service proposes delisting>

<insert date>

Contacts:
Gary Peeples, gary_peeples@fws.gov; 828/258-3939, ext. 234

Threatened Plant Proposed for Removal from Endangered Species List

(Asheville, N.C.) – Tens of thousands of threatened dwarf-flowered heartleaf plants (*Hexastylis naniflora*) are conserved by Duke Energy along the Broad River. Another population is conserved at Cowpens National Battlefield, in upstate South Carolina. A third is part of the Broad River Greenway, a local park in North Carolina's Cleveland County. These are three of myriad conservation efforts for this plant, leading the U.S. Fish and Wildlife Service to propose removing it from the federal threatened and endangered species list.

When the plant was put on the list in 1989, there were only 24 known populations, distributed across eight counties. Today, there are at least 119 populations of dwarf-flowered heartleaf, scattered across 10 North Carolina and three South Carolina counties. Of those 119 populations, 27 have more than 1,000 plants.

"What's fascinating about the dwarf-flowered heartleaf's story is that the plant grows in an area experiencing a fair amount of development, but we've seen so many organizations come together to conserve this plant it has become a conservation success story," said Service botanist Rebekah Reid.

Key to that conservation effort has been organizations acquiring and permanently protecting sites where the plant grows. Foothills Conservancy, Catawba Lands Conservancy, and The Nature Conservancy all protect sites. The North Carolina Department of Transportation is one of the greatest contributors to conservation, acquiring land and conserving multiple populations over the years, including land that became part of Cleveland County's Broad River Greenway.

Dwarf-flowered heartleaf is currently known from Greenville, Spartanburg, and Cherokee counties, South Carolina; and Polk, Rutherford, Cleveland, Gaston, Lincoln, Burke, Caldwell, Catawba, Alexander, and Iredell counties, North Carolina. As its name implies, the plant has heart-shaped leaves, which are dark green, evergreen, and grow from a buried stem. It rarely grows more than 6 inches tall.

To inform this decision, the Service brought together a team of biologists that compiled and examined all known data and research regarding the plant, the outcome being a peer-reviewed summary of its historic and current status and projections of population stability and future trends. These assessments were the foundation of the Service's proposal.

The proposal to delist the dwarf-flowered heartleaf will publish in the *Federal Register* on **<insert date>**. The public comment period for the proposed listing will be open for **X** days. Instructions on how to submit comments are available at regulations.gov under docket # **<insert docket number>**. Following the comment period, the Service will make a final listing determination regarding this matter.

This decision brings the total of "wildlife wins" in the Service's Southeast and Northeast Regions to **<check number>**, a result of joint at-risk conservation and recovery efforts in the Southeast. This effort drew praise from congressional appropriations leaders (p.13) in 2017 for its use of incentives and flexibilities within the ESA to protect imperiled wildlife, reduce regulations and keep working lands working.

The effort is led by the Service, 26 states that make up the Northeast and Southeastern associations of state fish and wildlife agencies, and a host of conservation groups, businesses and utilities.

Since 2011, the Service's biologists, working with state partners, have determined that **<check number>** species did not need federal protection as a result of proactive conservation with our partners and improved science and understanding of threats to imperiled species.

Another <**check number>** species protected by the ESA were downlisted or delisted as a result of recovery actions and intensive collaboration with partners, including state wildlife agencies, industry, local communities and conservation groups.

Commented [1]: Phil - are we still using this language? Did you see the article that slammed us for the 30 species WIG and the language we use in association?

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. For more information on our work and the people who make it happen, visit www.fws.gov/southeast. Connect with us on Facebook atwww.facebook.com/usfwssoutheast, follow our tweets at www.twitter.com/usfwssoutheast, watch our YouTube Channel at http://www.youtube.com/usfws, and download photos from our Flickr page at http://www.flickr.com/photos/usfwssoutheast.

-30-

Dwarf-flowered heartleaf (*Hexastylis naniflora*) Contact Grid

Governors

State	Member	Contact	Position	Email
NC	Roy Cooper	Christy Drew		drew.christy@nc.gov
SC	Henry McMaster			

Congressionals

State	Member	Contact	Position	Email
NC	Richard Burr	Mike Fenley		mike_fenley@burr senate.gov
NC	Thom Tillis	Jordan Barnes		Jordan_Barnes@tillis senate.gov
NC	Pat McCrory	David McCrary		David.McCrary@mail.house.gov
NC	Mark Meadows	Martha Peterson		martha.peterson@mail.house.gov
NC	Virginia Foxx	Robert Meek		robert.meek@mail.house.gov
NC	Ted Budd	Todd Poole		todd.poole@mail.house.gov
SC	Lindsay Graham			
SC	Tim Scott			
SC	William Timmons			
SC	Ralph Norman			

Tribes

State	Organization	Name	Position	Email
	Catawba Indian Nation	Darin Steen	Environmental Services Director	darin.steen@catawbaindian.net

State agencies

State	Organization	Name	Position	Email
NC	N.C. Plant Conservation Program	Cheryl Gregory	Administrator	cheryl.gregory@ncagr.gov
NC	N.C. Department of Transportation	Phil Harris	Section head, Natural Environment Section	pharris@ncdot.gov
NC	North Carolina Natural Heritage Program	Misty Buchanan	Director	misty.buchanan@ncdenr.gov
NC	North Carolina Botanical Garden	Damon Waitt	Director	aspain@unc edu
SC	SC Dept. of Natural Resources – Heritage Trust Program	Herrick Brown	Botanist	brownh@dnr.sc.gov
SC	SC Botanical Gardens	Patrick McMillan	Director	pmcmill@clemson edu

Commented [RNR1]: I m not sure who is head of the program but Herrick has been my contact.

Federal agencies

State	Organization	Name	Position	Email
NC	Federal Highways Administration	John Sullivan	Division Administrator	john.sullivan@dot gov
NC	USACE	(b)(6) PII	Supervisor, Asheville Regulatory Office	(b)(6) PII(b)(6) PII
NC	USACE	(b)(6) PII	Field Office Chief, Asheville Regulatory Field Office	(b)(6) PII(b)(6) PII
NC	NRCS	Tim Beard	State conservationist	timothy.beard@nc.usda.gov
SC	NRCS	Ann English	State conservationist	ann.english@sc.usda.gov
SC	Federal Highways	Emily Lawton	Division	emily.lawton@dot.gov

Commented [RNR2]: I think (b)(6) PII is still the Field Office Chief and may be the better contact for the Corps

	Administration		Administrator	
SC	NPS – Cowpens NBF	John Slaughter	Superintendent	john_slaughter@nps.gov
SC	USACE		Columbia Regulatory Field Office	

Commented [RNR3]: I know it s Columbia but I don t know who.

Conservation and environmental NGOs

State	Organization	Name	Position	Email
NC	Foothills Conservancy	Andrew Kota	Executive Director	akota@foothillsconservancy.org
NC	Catawba Lands Conservancy	Tom Okel	Executive Director	tom@catawbalands.org
NC	Conserving Carolina	Kieran Roe	Executive Director	Kieran@conservingcarolina.org
SC	The Nature Conservancy	Kristen Austin	Upstate Conservation Director	kaustin@tnc.org
SC	Naturaland Trust	Mac Stone	Executive Director	macstone@naturalandtrust.org
SC	Spartanburg Area Conservancy (SPACE)	Andrew Waters		Andrew@spartanburgconservation.org
SC	Upstate Forever	Andrea Cooper	Executive Director	acooper@upstateforever.org

Trade and industry groups

State	Organization	Name	Position	Email
NC	N.C. Farm Bureau	Larry Wooten	President	Larry.wooten@ncfb.org
NC	N.C. Forestry Assoc.	John Hatcher	Executive VP	jhatcher@ncforestry.org
NC	N.C. Homebuilders	Tim Minton	Dir., government affairs	tminton@nchba.org

Counties

State	County	Name	Position	Email
NC	Iredell	Ron Smith		rsmith@co.iredell.nc.us
NC	Alexander	Rick French		rfrench@alexandercountync.gov
NC	Caldwell	Stan Kiser		skiser@caldwellcountync.org
NC	Burke	Bryan Steen		Bryan.Steen@burkenc.org
NC	Lincoln	Kelly Atkins		katkins@lincolncounty.org
NC	Gaston	Earl Mathers		earl.mathers@gastongov.com
NC	Cleveland	Jeff Richardson		April.Crotts@clevelandcounty.com
NC	Rutherford	Steve Garrison		steve.garrison@rutherfordcountync.gov
SC	Cherokee			
SC	Spartanburg			
SC	Greenville			

Corporations

State	Organization	Name	Position	Email
NC	Facebook			

Colleges/Universities

State	Organization	Name	Position	Email
NC	Appalachian State U.	Matt Estep	Asst. Professor	estepmc@appstate.edu
SC	Wofford College	Doug Rayner	Professor	raynerdda@wofford.edu

The Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2018-XXXX; FXES11130900000-189-FF0932000]

RIN

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; availability of draft post-delisting monitoring plan.

SUMMARY: We, the U.S. Fish & Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicates that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened or endangered species under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan. If this proposal is finalized, *Hexastylis naniflora* will be removed from the List.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for public hearings, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES**:** You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2018–XXXX, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rules link to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2018–XXXX; U.S. Fish and Wildlife Service, MS: BPHC, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see *Public Comments*, below, for more information).

Document availability: The proposed rule, draft PDM plan and supporting documents (including the Species Status Assessment (SSA), references cited, five year review) are available at *http://www.regulations.gov* under Docket No. FWS-R4-ES-2018-XXXX.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC

28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. This action proposes to remove the dwarf-flowered heartleaf from the List of Endangered and Threatened Plants in title 50 of the Code of Federal Regulations (50 CFR 17.11(h)). Removing a species from the List ("delisting") can only be completed by issuing a rule.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The determination to delist a species must be based on an analysis of the same factors. In addition, the Act's implementing regulations at 50 CFR 424.11 provide that we may delist a species only if the best scientific and commercial data indicate the species is neither a threatened nor an endangered species for one or more of the following reasons: (1) The species is extinct; (2) the species has recovered and is no longer threatened or endangered; or (3) the original data used at the time the species was classified were in error. We have determined that the dwarf-flowered heartleaf should be proposed for delisting under the Act because, based on an analysis of the five listing factors, it no longer meets the definition of an endangered or threatened species, and that it has recovered.

Deleted: d

(b)(5) DPP & ACP

Peer review:

In accordance with our joint policy on peer review published in the **Federal Register** July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we have sought the expert opinions of seven appropriate specialists regarding the Species Status Assessment Report (SSA), which informed this proposed rule. The purpose of peer review is to ensure our determination is based on scientifically sound data, assumptions, and analyses.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from the public, other concerned governmental agencies (including but not limited to State and Federal agencies and city or county governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information received during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

(1) Information concerning the biology and ecology of the *Hexastylis naniflora* ;

(2) Relevant data concerning any threats (or lack thereof) to the *Hexastylis naniflora* particularly any data on the possible effects of climate change as it relates to habitat, the extent of State protection and management that would be provided to this plant as a delisted species;

(3) Current or planned activities within the geographic range of the *Hexastylis naniflora* that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment – including your personal identifying information – on *http://www.regulations.gov*. You may request, at the top of your document, that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee we will be able to do so.

Comments and materials we receive, as well as supporting documentation used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Service Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is a threatened or endangered species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the **Federal Register**. Such requests must be sent to the address shown in the **FOR FURTHER INFORMATION CONTACT** section. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings,

as well as how to obtain reasonable accommodations, in the **Federal Register** at least 15 days before the hearing.

Previous Federal Actions

On April 14, 1989, we published a final rule in the *Federal* Register (FR 54 14964) listing the *Hexastylis naniflora* as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing. A recovery plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf SSA to aid in determining the appropriateness of reclassifying the species.

Background

Hexastylis naniflora is a species of plant endemic to the Upper Piedmont region of western North Carolina and upstate South Carolina. It is a rare, low-growing herbaceous plant in the birthwort family (Aristolochiaceae). Although *Hexastylis naniflora* is restricted in range, it is not as rare as once thought (Service 2010, p. 15; NCNHP 2016, p. 4). When *Hexastylis naniflora* was federally listed in 1989, the listing rule described 24 extant populations (and one extirpated population) distributed across eight counties in the Upper Piedmont of North and South Carolina.. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two states. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Hexastylis naniflora appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This

unique combination of factors limits not only the range of *Hexastylis naniflora* , but also the size of any population.

Hexastylis naniflora occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186-196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, p. 114; Weakley 2015, p. 129; Service 2015, entire), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). Wagner (2013, pp. 30-32) conducted a habitat suitability study to quantify the habitat requirements for *Hexastylis naniflora* , which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants. The unit of measurement for population size in this species is a "clump" (rosette).

(b)(5) DPP & ACP

A thorough review of the taxonomy, life history, ecology, and overall viability of the *Hexastylis naniflora* is presented in the SSA (Service 2018, entire; available at https://www fws.gov/southeast/ and at http://www regulations.gov under Docket No. FWS-R4-ES-xxxx-xxxx).

Summary of Biological Status and Threats

The Act directs us to determine whether any species is endangered or threatened by factors affecting its continued existence. The SSA documents the results of our comprehensive biological status review for the *Hexastylis naniflora* , including an assessment of the potential stressors to the species. The SSA does not represent a decision by the Service on whether the species should be proposed for delisting as an endangered or threatened species under the Act. It

does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA; the full SSA can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.*gov under Docket No. FWS-R4-ES-201X-XXXX.

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the the conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate individual life-history needs. In the next stage, we assessed the historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We utilized this information to inform our decision in this proposed rule.

Current Condition

Resiliency

For *Hexastylis naniflora* to maintain viability, its populations, or some portion thereof, must be resilient. Resiliency is assessed at the level of populations and reflects a species' ability to withstand stochastic events (events arising from random factors). Resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates and fecundity (demographic stochasticity), variations in rainfall (environmental stochasticity), and

the effects of anthropogenic activities. Stochastic factors that have the potential to affect the *Hexastylis naniflora* include habitat impacts, particularly human development pressures, but also climate change, and exotic, invasive species. Factors influencing the resiliency of *Hexastylis naniflora* populations include population size, available habitat, and elements of *Hexastylis naniflora* ecology that determine whether populations can maximize habitat occupancy.

The Natural Heritage Program (NHP) collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member NHPs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2004, n.p.). Since the Service does not maintain its own database of known locations of *Hexastylis naniflora* , it regards the NHP databases as the best repository for this information (Service 2010, p.41). Based on recent reports using the methods described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple sub-EOs and stand-alone EO records. For the purpose of assessing resiliency, only the 78 populations observed since 2005 were assessed due to the high confidence in their persistence.

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The

primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Of the 78 populations assessed, 28 had very high resiliency, five had high, 26 had moderate, while 19 had low resiliency.

Deleted: resilience

Redundancy

Redundancy is also assessed at the species level and reflects a species' ability to withstand catastrophic events (such as a rare destructive natural event or episode involving many populations) by spreading the risk of such an event across multiple, resilient populations. We

measured redundancy for the *Hexastylis naniflora* by the number and distribution of resilient populations across the range of the species. It is important to note that *Hexastylis naniflora* has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area.. Redundancy for *Hexastylis naniflora* is the total number and resiliency of population segments and their distribution across the species range.

We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with devastating effects; however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of *Hexastylis naniflora* ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010, pp. 7-10). There are 119 populations of *Hexastylis naniflora* , spread across 13 counties. This is an increase from 24 populations across eight states at the time of listing. There appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press disturbances.

Representation

We lack genetic and ecological diversity data to characterize representation for *Hexastylis naniflora* . In the absence of species-specific genetic and ecological diversity

information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. Instead, we used the EO Data Standard, which provides a Default Separation Distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several *Hexastylis naniflora* populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Summary of Threats and Conservation Measures that Affect the Species

Section 4(a)(1) of the Act directs us to determine whether any species is an endangered species or a threatened species because of any factors affecting its continued existence due to one or more of the five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable

future. In the SSA (Service 2018, entire) we discuss the threats affecting the *Hexastylis naniflora* .

The NC Natural Heritage Program assessed threats in populations they monitored from 2012-2016 (Robinson and Padgett 2016, pp. 7-8, 17-20). Threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank (A-G) for each threat factor determined an overall value for each threat observed at each population. Threats observed during these years included development, incompatible forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and road construction. Despite threats observed in many of the populations surveyed, several of the populations appear to be stable during the five-year survey and no significant changes in threats within populations were noted between 2012 and 2016.

Development

Hexastylis naniflora populations occur in rapidly-growing urban areas within expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

The most recent 5 year review for the species identified the most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving *Hexastylis naniflora* , *a*s road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations. Collectively, these projects have adversely impacted or were expected to impact approximately 22,135 rosettes. In most cases, the Section 7 process resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection. Significant portions of other populations have been purchased by the NC Department of Transportation (NCDOT) as off-site conservation measures in association with these consultations. Other forms of economic development have also resulted in the destruction or modification of habitats occupied by the *Hexastylis naniflora* ; in many cases, these activities have also required Section 7 consultations with the Service. Examples include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities at a regional airport. Collectively, these activities involved the loss or relocation of several thousand rosettes.

The North Carolina Plant Protection and Conservation Act, N.C. Gen. Stat. § 106-202.12 et seq., lists native plants as threatened, endangered, or species of concern, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. In South Carolina, plants are protected only from disturbance where they occur on those properties owned by the State and specifically managed as South Carolina Heritage Preserves (SC State Code of Regulations Part 123 § 200-204).

The overwhelming majority of *Hexastylis naniflora* populations have been discovered as a direct result of surveys conducted to ensure compliance with the Endangered Species Act. Even more significantly, the majority of sites that have the potential to afford long-term protection to the species have been protected as a direct result of the provisions of Section 7 of the ESA, which directs consulting agencies to minimize adverse effects to federally listed species through conservation measures pledged as a part of the project description.

Invasive, Exotic Species

Deleted: *Invasice*

Formatted: Font: Not Bold

Invasive exotic plant species occur across the range of this species. Plants such as English ivy, Chinese privet, Japanese honeysuckle and Japanese stiltgrass are known at several sites which contain *Hexastylis naniflora*, (Service 2011, p. 15). Invasive, exotic species were identified as a threat at eight of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17-19). The eight populations include four stand-alone EOs and four parent EOs with 19 sub-EOs. Of the four stand-alone EOs, one has an invasive threat rank of B (moderate to severe, imminent threat for a significant portion (20-60%) of the population, occurrences, or area), two have a rank of F (low severity threat for most or significant proportion of population, occurrences, or area), and one has a rank of G (low severity threat for a small proportion of population, occurrences, or area). Of the 19 sub-EOs, nine have invasive, exotic species identified as a threat. Of the nine sub-EOs, one has an invasive threat rank of A (moderate to severe, imminent threat for most (>60%) of population, occurrences, or area), four have a rank of B (moderate to severe, imminent threat for a significant portion (20-60%) of the population, occurrences, or area), two have a rank of E (moderate to severe threat for small proportion of population, occurrences, or area), and two have a rank of G (low severity threat for a small proportion of population, occurrences, or area). The one stand-alone and five sub-EOs

Deleted: I

Deleted: dwarf-flowered heartleaf

with the highest threat ranks (A and B) are located in three populations. Based on the most recent monitoring data, one is increasing, one is stable, and one is decreasing (Robinson and Padgett 2016, p.11).

Invasive exotic species were identified as a threat at all (three) South Carolina populations monitored by NCNHP and all sites had an invasive threat rank of F (low severity threat for most or significant proportion of population, occurrences, or area) (Robinson and Padgett 2016, pp. 20). Based on the most recent monitoring data, all populations are stable (Robinson and Padgett 2016, p.11).

In short, the data indicate that *Hexastylis naniflora* populations can persist and increase in the presence of exotic invasive species. Despite the long-term presence of invasive, exotic plants, from 2012 to 2016 there were no changes in the severity of threats observed in the field from these species significant enough to elevate the threat ranks of populations evaluated (NCNHP 2016, p. 8).

(b)(5) DPP & ACP

Climate Change

Formatted: Font: Not Bold

There is concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Because typical habitats for this species include moist soils adjacent to creeks, streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams, specific effects of climate change to the *Hexastylis naniflora* are likely related to changes in soil moisture associated with potential increases in drought. Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.) which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly,

leading to increased flooding events (IPCC 2013, p.7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p.7). Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats.. In recent years, the southeast has experienced moderate to severe droughts, which many observers have implicated in population declines and poor transplant survivorship (NC NHP, 2010; and references throughout this review). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). Although climate change is likely to affect terrestrial habitats in the Southeast, there is uncertainty about the specific effects of climate change on *Hexastylis naniflora* . Currently, we have no evidence that climate change effects observed to date have had any adverse impact on the species or its habitats; however, *Hexastylis naniflora* is found in 13 counties, up from eight at listing, and is up to 119 known populations, up from 24 at listing.

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Future Condition

Our analysis of the past, current, and future influences on what the *Hexastylis naniflora* needs for long term viability revealed that there are several influences that may pose risks to future viability of the species. These risks are primarily related to invasive species, climate change, and habitat changes from development.

Invasive, Exotic Species

As discussed above, invasive, exotic plants were identified as a threat at the time of listing; however, the threat may not be as significant as once thought. The NCNHP monitored 13 populations of *Hexastylis naniflora* and assessed threats at each population. Their results show that, of monitored sites, only 9% of populations (one of 11) where invasive, exotic species are present are also in decline, indicating the species has at least some capacity to withstand the presence of invasive, exotic species. The number of populations has increased dramatically since listing; the invasive, exotic plant threat posed at many of the largest populations is low (NCNHP, pp. 8, 17-20); and the number of populations under conservation ownership with management has increased.

Therefore, we do not believe that competition from invasive, exotic species will be a significant threat r in the foreseeable future (2040).

Climate Change

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time,

Formatted: Font: Not Bold

Deleted: I

Deleted: impactful

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: This data

Deleted: s

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: is

Deleted: to the species now o

(b)(5) DPP & ACP

Deleted: ¶

depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

According to IPCC, ‘‘most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change on most landscapes’’ (IPCC 2014, p. 13). Plant species with restricted ranges may experience population declines as a result of the effects of climate change. The concept of changing climate can be meaningfully assessed both by looking into the future and reviewing past changes.

As part of the current, worldwide collaboration in climate modelling under the IPCC, climate assessments of the full dataset of 30 climate models for historical and 21st century comparisons provide predictions at scales ranging from global to county level in the U.S. (USGS National Climate Change Viewer (NCCV) 2019; https://www2.usgs.gov/landresources/lcs/nccv.asp). This global climate information has been recently downscaled by NASA to scales relevant to our region of interest, and projected into the future under two different scenarios of possible emissions of greenhouse gases (Alder and Hostetler 2017, p. 3). Using the NCCV and assuming the more extreme Representative Concentration Pathways (RCP) greenhouse gas emission scenario (RCP 8.5), in which greenhouse gas emissions continue to rise unchecked through the end of the century leading to an equivalent radiative forcing of 8.5 Watts m^2, we calculated projected annual mean changes comparing 1981-2010 to 2025-2049 for maximum temperature (+2.9-3.1°F in NC and +2.9 °F in SC), precipitation (+0.02 inches per month for NC and SC), soil storage (-0.1 inch for NC and SC), and evaporative deficit (no change for NC or SC) in all counties where *Hexastylis naniflora*

occurs (Adler and Hostetler 2017, entire). Based on these results, all 13 counties within the range of *Hexastylis naniflora* will be subjected to higher temperatures (annual mean increase of 2.9 °F) and slightly higher precipitation (annual mean increase of 0.2 inches per month) relative to the period of 1981-2010. Because the average annual increase in precipitation is predicted to be only slight, the loss in soil storage is likely primarily the result of higher predicted temperatures. While the predictions of a changing climate could negatively impact *Hexastylis naniflora*, the species possesses other biological traits to provide resiliency to this threat. *Hexastylis naniflora* is a long-lived perennial species. Several populations have been revisited after decades and the species was still present. For example, one population (WHERE?) was first observed in 1957 and was next observed in 2001 (NCNHP 2018, n.p.). In their analyses of life-history traits in relation to potential vulnerability to variability in demographic vital rates caused by increased variability in climatic patterns, Morris et al. (2008, p. 22) and Dalgleish et al. (2010, p. 216) concluded that longer-lived species should be less influenced by climate-driven increases in demographic variability.

Deleted: ly higher

Deleted: resilience

Deleted: such

Within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal by ants) (Lengyel et al. 2010, p. 49). This supports Gaddy's work (1986, entire), which found three species of *Hexastylis,* including *Hexastylis naniflora,* employ myrmecochory as a method for seed dispersal. While species with ant dispersed seeds have been shown to have slower migration rates than species with seeds that are adhesive or ingested (Brunet and Von Oheimb 1998, p. 429), the multiple benefits myrmecochory provides for plants is evidence for the adaptive advantages of this strategy. Ants can disperse seeds to sites that might be nutrient-enhanced or where plant fitness will be higher. Additionally, ants are

known to bury seeds and some studies show burying seeds may protect them from fire and drought (Boyd 2001, p. 235) - two conditions exacerbated by climate change.

Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl et al. 2009, p. 111). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations of *Hexastylis naniflora* in 2009 (Golder and Associates 2009). However, anecdotal observation suggests that the species was not appreciably harmed by this fire (Service 2011, p.14). Additionally, the National Park Service (NPS) uses prescribed fire as a vegetation management tool at Cowpens National Battlefield. The scope of NPS's prescribed burning activity includes the majority of the *Hexastylis naniflora* population on site. Monitoring data suggest that burning has had no adverse effects upon growth or flowering (Walker et al. 2009, p. 14).

Deleted: A

Deleted: s

Formatted: Indent: First line: 0.5

Populations are located within various ecological settings within the species' range. *Hexastylis naniflora* occurs on piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186-196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, p. 114; Weakley 2015, p. 129), or moist soils adjacent to creeks, streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats demonstrating the species' ability to adapt to different environmental conditions that could be brought on by climate change.

Although climate change is almost certain to affect *Hexastylis naniflora* habitats in North and South Carolina (USGS NCCV 2019; https://www2.usgs.gov/landresources/lcs/nccv.asp), there is uncertainty about the specific effects of climate change on the plant. As discussed

Deleted: Currently,

above, we have no direct evidence that climate change has had any adverse impact on *Hexastylis naniflora* or its habitat, and we are uncertain of how projected changes in temperature, precipitation, and soil moisture will influence the species in the future. However, based on the biological traits discussed above, we do not believe that climate change is a threat to the plant now or within the foreseeable future (2040; see below).

Development

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. We have identified 2040 as our foreseeable future based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape (see SSA for further explanation). Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040, a time period for which

Deleted: effects

Deleted: observed to date have

Deleted: future

Formatted: Font: Not Bold

the models would provide reliable data. SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995, entire). The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations
- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There are no data available on the exact relationships between urbanization and the impacts to *Hexastylis naniflora* . We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative

impacts; development increase of at least 50% was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. This is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider under Current Conditions include detections that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years and the species was present. For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where *Hexastylis naniflora* is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where *Hexastylis naniflora* is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-

current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resiliency of that population.

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000 meterbuffer. The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 meterbuffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 meterbuffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where *Hexastylis naniflora* is likely to persist.

Deleted:

Status Quo Scenario

Under the status quo scenario, we assume a few populations (75) will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that

are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no negative impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold

High Development Scenario

Under the high development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

- No additional populations are identified as persisting
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:

- Protected areas
    - Protected in perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Voluntary protection/non-perpetuity— population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold
- Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold; extirpation of populations if % increase in urbanization exceeds >90% threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we assume it is likely several additional populations (i.e. more than status quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resiliency under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no impacts from urbanization

        - Voluntary protection/non-perpetuity—population drops 1 resiliency rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold

Future Resiliency

Status Quo Scenario

In the Status Quo scenario, there are predicted to be 75 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and two additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

High Development Scenario

In the High Development scenario, there are predicted to be 72 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition a few

populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate; two moderate populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the Targeted Conservation scenario, there are predicted to be 79 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and six additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few populations is offset in the Status Quo and Targeted Conservation scenarios by the persistence of several additional populations. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resiliency in several additional populations. However, in all three

scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press catastrophic disturbances; however the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events over the next 20-30 years, such as climate change.

Based on the assumption that *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. Here are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Table 1 Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	Current	Status Quo	High Development	Targeted Conservation
Very High	28	27	27	27
High	5	6	4	6
Moderate	26	23	25	23
Low	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total	**78**	**75**	**72**	**79**

Determination

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the *Hexastylis naniflora*. Currently, there are a total of 119 known populations in 13 counties, 78 of which have been documented since 2005. This is a significant increase from 24 known populations in eight counties at the time of listing. Of the 78 populations, 75 percent are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend.

When the *Hexastylis naniflora* was placed on the threatened and endangered species list, the two prominent threats identified were invasive, exotic plants and habitat loss or destruction. As discussed above, invasive, exotic species are not as significant a threat to *Hexastylis naniflora* as originally thought. Only one of the 11 monitored populations where invasive, exotic species occur was identified is declining. Additionally, analysis in the SSA indicates *Hexastylis naniflora* has the capacity to withstand habitat loss and destruction due to development. The species currently has significant redundancy (119 populations), resilient populations (33 of 78 evaluated populations with high or very high viability), and representation in two different ecological settings. Even under our High Development scenario, only two high or very high viability populations are lost to a lower viability rank. Therefore, we do not believe that competition from invasive, exotic species or habitat loss and destruction are significant threats to the species. Additionally, since listing, there has been a nearly four-fold increase in the number of known populations and several populations have entered into conservation ownership by organizations with management staff (e.g. Broad River Greenway) or commitments of management (e.g. N.C. Department of Transportation). We conclude that the species is currently not in danger of extinction throughout its range.

Deleted: dwarf-flowered heartleaf

(b)(5) DPP & ACP

In order to more closely examine the future threat posed by habitat loss or destruction, the Service analyzed three different development scenarios into the future until 2040. Under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (5-6) of currently low resilient populations are projected to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Approximately 31 percent of the 78 currently known populations are permanently protected, and another 23 or so percent are somewhat protected (voluntary agreements or provided some level of protection), reducing the likelihood of development impacting those populations. Recent examination of the species also identified climate change and invasive species as potential future threats. The broadened range (eight counties to thirteen) and significantly increased population numbers (24 to 119) since initial listing indicate the species benefits from sufficient redundancy and resiliency to withstand perturbations from climate change as well as from invasive species. Based on this analysis, we conclude that the species is not likely to become in danger of extinction in the foreseeable future.

(b)(5) DPP & ACP

Deleted: a potential

Deleted: ¶

Determination of Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range (SPR). Where the best available information allows the Services to determine a status for the species rangewide, that determination should be given conclusive weight because a rangewide determination of status more accurately reflects the species' degree of imperilment and better promotes the purposes of the Act. Under this reading, we should first

consider whether the species warrants listing "throughout all" of its range and proceed to conduct a "significant portion of its range" analysis if, and only if, a species does not qualify for listing as either an endangered or a threatened species according to the "throughout all" language.

Having determined that the *Hexastylis naniflora* is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in an SPR. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do the "screening" analysis, we ask whether there are portions of the species' range for which there is substantial information indicating that: (1) the portion may be significant; and, (2) the species may be, in that portion, either in danger of extinction or likely to become so in the foreseeable future. For a particular portion, if we cannot answer both questions in the affirmative, then that portion does not warrant further consideration and the species does not warrant listing because of its status in that portion of its range. We emphasize that answering these questions in the affirmative is not a determination that the species is in danger of extinction or likely to become so in the foreseeable future throughout a significant portion of its range—rather, it is a step in determining whether a more detailed analysis of the issue is required.

If we answer these questions in the affirmative, we then conduct a more thorough analysis to determine whether the portion does indeed meet both of the SPR prongs: (1) the portion is significant and (2) the species is, in that portion, either in danger of extinction or likely to become so in the foreseeable future. Confirmation that a portion does indeed meet one of these prongs does not create a presumption, prejudgment, or other determination as to whether

the species is an endangered species or threatened species. Rather, we must then undertake a more detailed analysis of the other prong to make that determination. Only if the portion does indeed meet both SPR prongs would the species warrant listing because of its status in a significant portion of its range.

At both stages in this process—the stage of screening potential portions to identify any portions that warrant further consideration and the stage of undertaking the more detailed analysis of any portions that do warrant further consideration—it might be more efficient for us to address the "significance" question or the "status" question first. Our selection of which question to address first for a particular portion depends on the biology of the species, its range, and the threats it faces. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range.

For *Hexastylis naniflora*, we first chose to evaluate the status question (i.e., identifying portions where the *Hexastylis naniflora* may be in danger of extinction or likely to become so in the foreseeable future). To conduct this screening, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. If a species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range and the threats to the species are essentially uniform throughout its range, then the species would not have a greater level of imperilment in any portion of its range than it does throughout all of its range and therefore no portions would qualify as an SPR.

Deleted:

Deleted: first

Analysis

Formatted: Indent: First line: 0

Applying the process described above, we first determine if any portion of the range of *Hexastylis naniflora* warrants further consideration. As discussed above, a portion of a species'

Formatted: Font: Italic

range is significant if it is part of the current range of the species and is important to the conservation of the species because it contributes meaningfully to the representation, resiliency or redundancy of the species. The contribution must be at a level such that its loss would result in a decrease in the ability to conserve the species. While there is some variability in the habitats occupied by *Hexastylis naniflora* across its range, the basic ecological components required for the species to complete its life cycle are present throughout the habitats occupied by the 119 populations of the species. No specific location within the current range of the species provides a unique or biologically significant function that is not found in other portions of the range, and no specific locations are likely to be of greater biological or conservation importance than any other locations.

We next examined whether any threats are geographically concentrated in some way that could indicate the species could be in danger of extinction, or likely to become so, in a specific area. The NCNHP monitored 13 populations of *Hexastylis naniflora* throughout the species range. Eleven of the 13 populations had invasive, exotic species identified as a threat, indicating that invasive, exotic species are found throughout the range and not concentrated in any specific location. Climate change effects, as discussed previously, are very uniform throughout the range. The opportunity for habitat loss and destruction due to development is higher on privately owned lands that could be sold for future development. Of the 78 populations evaluated, we determined that 31 percent are permanently protected and another approximately 23 percent are partially protected (i.e. voluntary landowner agreements). The unprotected populations are spread throughout the species' range and not geographically "clumped" together.

Since we found no portions of the species' range where threats are significantly concentrated or substantially greater than in other portions of its range, we did not identify any

Formatted: Font: Italic

(b)(5) DPP & ACP

Formatted: Font: Italic

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

portions where the species may be in danger of extinction or likely to become so in the foreseeable future. Therefore, no portions warrant further consideration through a more detailed analysis.

Our review of the best available scientific and commercial information indicates that the *Hexastylis naniflora* is not in danger of extinction or likely to become so in the foreseeable future in any significant portion of its range. Our approach to analyzing SPR in this determination is consistent with the court's holding in *Desert Survivors v. Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018).

On the basis of this evaluation, we believe *Hexastylis naniflora* no longer requires the protection of the Act, and we propose to remove *Hexastylis naniflora* throughout its range from the Federal List of Endangered and Threatened Plants (50 CFR 17.12(h)).

Effects of this Proposed Rule

Deleted: ¶

This proposal, if made final, would revise 50 CFR 17.12(h) to remove *Hexastylis naniflora* from the Federal List of Endangered and Threatened Wildlife. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under Section 7 of the Act in the event that activities they authorize, fund, or carry out may affect *Hexastylis naniflora*.

Deleted:

Deleted:

(b)(5) DPP & ACP

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than five years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to

verify that a species delisted remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as a threatened or endangered species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2018-XXXX. Copies can also be obtained from the Service's Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT** section). We seek information, data, and comments from the public regarding *Hexastylis naniflora* and the PDM plan. We are also seeking peer review of this draft plan concurrently with this comment period. We anticipate finalizing this plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Deleted: U S Fish and Wildlife

Deleted: ,

Deleted: the dwarf-flowered heartleaf

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(a) Be logically organized;

(b) Use the active voice to address readers directly;

(c) Use clear language rather than jargon;

(d) Be divided into short sections and sentences; and

(e) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc. Send a copy of any comments on how we can make this rule easier to understand to: Office of Regulatory Affairs, Department of the Interior, room 7229, 1849 C Street NW., Washington, DC 20240. You may also email the comments to this address: Exsec@ios.doi.gov.

National Environmental Policy Act

We have determined that we do not need to prepare an Environmental Assessment or Environmental Impact Statement, as defined in the National Environmental Policy Act (42 USC 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act. We published a notice outlining our reasons for this determination in the Federal Register October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands associated with this proposed regulation.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket Number FWS-R4-ES-2018-XXXX and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

2. Amend § 17.11(h), by removing the entries for "Heartleaf, Dwarf-flowered" under "FLOWERING PLANTS" from the List of Endangered and Threatened Plants.

Deleted: Wildlife

§ 17.11 Endangered and threatened wildlife.

Dated: _____

_____

Margret E. Everson
Principal Deputy Director
U.S. Fish and Wildlife Service,
Exercising the Authority of the Director,
U.S. Fish and Wildlife Service.

Deleted: f

~~**Endangered and Threatened Wildlife and Plants; Removal of the Nashville Crayfish from the Federal List of Endangered and Threatened Wildlife**~~

FHWA - NC	John Sullivan, Divison Administrator	john.sullivan@dot.gov
FHWA - SC	Emily Lawton, Divison Administrator	emily.lawton@dot.gov
HUD - NC	Christopher Taylor, Acting Field Office director	NC_Webmanager@hud.gov
HUD - SC	Michael German, Acting Field Office director	SC_Webmanager@hud.gov
NRCS - NC	Tim Beard, State conservationist	timothy.beard@nc.usda.gov
NRCS - SC	Ann English, State conservationist	ann.english@sc.usda.gov
USACOE - Wilmington	(b)(6) PII , Division chief	(b)(6) PII(b)(6) PII(b)(6) PII
USFS-Pisgah National Forest	Allen Nicholas, Forest Supervisor	anicholas@fs.fed.us
USFS-Pisgah National Forest	Gary Kauffman	gkauffman@fs.fed.us
US Army Corps of Engineers - Asheville Regulatory Field Office	(b)(6) PII Asheville Office supervisor	(b)(6) PII(b)(6) PII
US Fish and Wildlife Service - Charleston	April Punsalan, SC FWS botanist	april_punsalan@fws.gov
US Fish and Wildlife Service - Raleigh	Dale Suiter	dale_suiter@fws.gov
National Park Service - Cowpens National Battlefield	John Slaughter	John_Slaughter@nps.gov
NC State Parks - West	Sean McElhone,	Sean.mcelhone@ncparks.gov
NC State Parks	Ed Corey, Inventory biologist	ed.corey@ncparks.gov
NCDOT	Phil Harris, Head, environmental analysis unit	pharris@ncdot.gov
NCDOT	Heath Slaughter, Division environmental officer - Divison 11	hslaughter@ncdot.gov
NCDOT	Trish Beam, Environmental supervisor - Division 12	pdbeam@ncdot.gov
NCDOT	Roger Bryan, Environmental supervisor - Divisin 13	rbrahn@ncdot.gov
NCDOT	Dave McHenry, Environmental supervisor - Division14	dgmchenry@ncdot.gov
NCPCP	Cheryl Gregory, Administrator	cheryl.gregory@ncagr.gov
NCNHP	Misty Buchanan, Director	misty.buchanan@ncdenr.gov
NCNHP	Laura Robinson, Botanist	Laura.Robinson@ncdenr.gov
NCWRC	Gordon Myers, Executive director	gordon.myers@ncwildlife.org
NC Botanical Garden	Johnny Randall, Director of conservation programs	jrandall@email.unc.edu
NC Forest Service	Greg Yates, Regional forester	greg.yates@ncagr.gov
NC Department of Transportation	Tim Bassette, Environmental Program Consultant	tpbassette@ncdot.gov

NC Department of Transportation	Jared Gray, Environmental Program Supervisor II	jgray@ncdot.gov
NC Division of Parks and Recreation - State Parks	Mike Murphy,	michael.murphy@ncparks.gov
NC Natural Heritage Program	Laura Robinson, Botanist	laura.robinson@ncdcr.gov
NC Natural Heritage Program	Jame Amoroso, Conservation Information Specialist	jame.amoroso@ncdcr.gov
NC Natural Heritage Program	Misty Buchanan, Director	misty.buchanan@ncdcr.gov
NC Natural Heritage Program	Wesley Knapp, Western Regional Ecologist/Botanist	wesley.knapp@ncdcr.gov
NC Natural Heritage Program	Suzanne Mason, Conservation Data Manager & NCDOT Project Specialist	suzanne.mason@ncdcr.gov
NC Natural Heritage Program	Mike Shafale, Terrestial Biologist	michael.schafale@ncdcr.gov
NC Natural Heritage Program	Harry LeGrand, retired	hlegrandjr@gmail.com
NC Natural Heritage Program	Bruce Sorrie, retired	basorrie@gmail.com
NC Plant Conservation Program	Cheryl Gregory, Administrator	cheryl.gregory@ncagr.gov
NC Plant Conservation Program	Lesley Starke,	lesley.starke@ncagr.gov
NC Plant Conservation Program	Jenny Stanley,	jennifer.stanley@ncagr.gov
SC Department of Natural Resources - Heritage Trust Program	Herrick Brown, Assistant Botanist	brownh@dnr.sc.gov
SC Department of Natural Resources - Heritage Trust Program	Bert Pittman, Botanist	pittmanb@dnr.sc.gov
SC Department of Natural Resources - Heritage Trust Program	Kathy Boyle,	boylek@dnr.sc.gov
SC Department of Natural Resources - Heritage Trust Program	Pat Cloninger, Preserve manager	cloningerp@dnr.sc.gov
SC Department of Transportation	Chad Long,	longcc@scdot.org
Clean Water Management Trust Fund	Nancy Gutherie, Acquisition Program Manager	nancy.gutherie@ncdcr.gov
Wi kes County	John Yates	jyates@wilkescounty.net
Caldwell County	Stan Kiser	skiser@caldwellcountync.org
Alexander County	Don Adams	manageralc@skybest.com
Iredell County	Ron Smith	rsmith@co.iredell.nc.us
Catawba County	Mark Berry	MBerry@CatawbaCountyNC.gov
Burke County	Bryan Steen	Bryan.Steen@burkenc.org
Lincoln County	Kelly Atkins	katkins@lincolncounty.org
Gaston County	Earl Mathers	earl.mathers@gastongov.com

Cleveland County	Jeff Richardson	April.Crotts@clevelandcounty.com
Rutherford County	Steve Garrison	steve.garrison@rutherfordcountync.gov
Po k County	D. Marche Pittman	mpittman@polknc.org
Cherokee County	Bill Blanton	bill.blanton@cherokeecountysc.com
Spartanburg County	Katherin O'Neil	koneill@spartanburgCounty.org
Greenville County	Jospeh Kernell	countyadministrator@greenvillecounty.org
Burke County School System	Larry Putnam	lputnam@burke.k12.nc.us
City of Landrum	Rich Caplan	rich.caplan@cityoflandrumsc.com
City of Shelby	Rick Howell	rick.howell@cityofshelby.com
Cleveland County	Jeff Richardson	Jeff.Richardson@clevelandcounty.com
Foothills Environmental Landfill	Barry Calloway	bcalloway@caldwellcountync.org
Hickory Parks and Recreation	Mack McLeod	mmcleod@hickorync.gov
Rutherford County	Steve Garrison	steve.garrison@rutherfordcountync.gov
Self McNeilly Landfill - Cleveland County	Nathan McNeilly	Nathan.McNeilly@clevelandcounty.com
Town of Boiling Springs	Tom Hart	tom.hart@boilingspringsnc.net
NC Foresty Assocaiton	Chris Brown, Sr director of communications	cbrown@ncforestry.org
NC Farm Bureau	Larry Wooten, President and CEO	larry.wooten@ncfb.org
Forestry Association of South Carolina	Cam Crawford, President and CEO	ccrawford@scforestry.org
SC Farm Bureau	Harry Ott, President and CEO	harryott@scfb.org
NC Wildlife Federation	Tim Gestwicki, Chief executive officer	tim@ncwf.org
Defenders of Wildlife	Ben Prater, SE coordinator	BPrater@defenders.org
TNC - NC	Katherine Skinner, State director	kskinner@tnc.org
TNC - SC	Mark Robertson, Executive direcor	kskinner@tnc.org
NC Native Plant Society	Jean Woods, President	jean@ncwildflower.org
Foothills Conservancy	Andrew Kota, Executive director	akota@foothillsconservancy.org
Catawba Lands Conservancy	Tom Okel, Executive director	tom@catawbalands.org
Catawba Lands Conservancy	Sean Bloom, Rhyne Preserve	sean@catawbalands.org
Conestee Foundation - Lake Conestee Nature Park	Mary Walter, Director of Development and Communication	mary@lakeconesteenaturepark.com
Conserving Carolina	Pam Torlina, Southeast Stewardship Manager, Conserving Carolina	pam@conservingcarolina.org

Foothills Conservancy NC	Andrew Kota, Executive Director	akota@foothillsconservancy.org
Foothills Conservancy of NC	Ryan Sparks, Conservation Associate	rsparks@foothillsconservancy.com
Friends of Plant Conservation	Alvin Braswell, Friends group to PCP	alvin.braswell@naturalsciences.org
Naturaland Trust	Frank Hollemon, President	frankholleman@naturalandtrust.org
Spartanburg Area Conservancy (SPACE)	Frederick Parrish	fmpiii@bellsouth.net
Spartanburg Area Conservancy (SPACE)	Andrew Waters	andrew@spartanburgconservation.org
The Nature Conservancy - NC	Brenda Wichmann, Conservation Coordinator	brenda.wichmann@tnc.org
The Nature Conservancy - SC	Kristen Austin, Upstate Conservation Direstor	kaustin@tnc.org
Upstate Forever	Andrea Cooper, Executive Director	acooper@upstateforever.org
Appalachian State University	Assistant Professor, Evolutionary Genetics and Genomics	estepmc@appstate.edu
Appalachian State University	Zack Murrell, Professor and Chair	murrellze@appstate.edu
Gardner-Webb University	Thomas Jones, Professor of Biology	tjones@gardner-webb.edu
NC Botanical Gardens	Johnny Randall, Director of Conservation Programs	jrandall@email.unc.edu
NC Botanical Gardens	Michael Kunz, Conservation Ecologist	mkunz@email.unc.edu
NCSU Herbarium	Alexander Krings, Director	Alexander_Krings@ncsu.edu
SC Botanical Gardens	Patrick McMillan, Director	pmcmill@clemson.edu
UNC Herbarium	Alan Weakly, Director	weakley@unc.edu
USC Upstate	Gill Newberry, Retired	gnewberry@charter.net, gnewberry@uscupstate.edu
USC Upstate Herbarium	Benjamin Montgomery, Director	BMONTGOMERY@uscupstate.edu
Wofford College	Doug Rayner, Professor of Biology	raynerda@wofford.edu
Atlas Environmental	Jennifer Robertson	jrobertson@atlasenvi.com
Axiom Environmental	Grant Lewis	glewis@axiomenvironmental.org
Carolina Ecosystems, Inc.	Brian Smith	info@carolinaeco.com
Carolina Wetland Services	Greg Antemann	gregg@cws-inc.net
ClearWater Environmental Consultants	Clement Riddle	clement@cwenv.com
ECS Carolinas, LLP	Cory Darnell	cdarnell@ecslimited.com
Environmental Services Inc.	Kevin Markham	kmarkham@esinc.cc
Habitat Assessment and Restoration Professionals	Karri Cecil Blackmon	info@habitatassessment.com
Hazen and Sawyer	Jarrod Karl	jkarl@hazenandsawyer.com
HDR	Kevin Mosteller	kevin.mosteller@hdrinc.com

HW Lochner	Kenneth Smith	ksmith@hwlochner.com
Kimley-Horn and Associates, Inc.	Chris Tinklenberg	chris.tinklenberg@kimley-horn.com
Kleinfelder	Kevin Thomas	kthomas@kleinfelder.com
Maser Consulting	Seth Ryan	sryan@maserconsulting.com
Michael Baker International	Frank Curti	fcurti@mbakerintl.com
Michael Baker International	Jake Byers	jbyers@mbakerintl.com
S&EC	Bob Zarzecki	bzarzecki@sandec.com
Three Oaks Engineering	Mary Frazer	mary.frazer@threeoaksengineering.com
Wetlands & Waters, Inc.	Tamp Bandy	jtampbandy@gmail.com
Wetlands and Environmental Planning Group	Len Rindner	len.rindner@wetlands-epg.com

NC-10th-Patrick McHenry	David McCrary	David.McCrary@mail.house.gov
NC-11th-Mark Meadows	Beverly Elliott	Beverly.Elliott@mail.house.gov
NC-5th-Virginia Foxx	Dawn Boyer	dawn.boyer@mail.house.gov
NC-13th-Ted Budd	Todd Poole	todd.poole@mail.house.gov
NC-N/A-Richard Burr	Mike Fenley	mike_fenley@burr.senate.gov
NC-N/A-Thom Tillis	Jordan Barnes	Jordan_Barnes@tillis.senate.gov
SC-4th-William Timmons	Hope Blackley	hope.blackley@mail.house.gov
SC-5th-Ralph Norman	Jeffrey Sligh	jeffrey.sligh@mail.house.gov
SC-N/A-Lindsay Graham	Laura Bauld	laura_bauld@lgraham.senate.gov
SC-N/A-Tim Scott	Danielle Gibbs	danielle_gibbs@scott.senate.gov

FHWA - NC	John Sullivan, Divison Administrator	john.sullivan@dot.gov
FHWA - SC	Emily Lawton, Divison Administrator	emily.lawton@dot.gov
HUD - NC	Christopher Taylor, Acting Field Office director	NC_Webmanager@hud.gov
HUD - SC	Michael German, Acting Field Office director	SC_Webmanager@hud.gov
NRCS - NC	Tim Beard, State conservationist	timothy.beard@nc.usda.gov
NRCS - SC	Ann English, State conservationist	ann.english@sc.usda.gov
USACOE - Wilmington	(b)(6) PII(b)(6) PII	(b)(6) PII(b)(6) PII(b)(6) PII
USFS-Pisgah National Forest	Allen Nicholas, Forest Supervisor	anicholas@fs.fed.us
USFS-Pisgah National Forest	Gary Kauffman	gkauffman@fs.fed.us
US Army Corps of Engineers - Asheville Regulatory Field Office	(b)(6) PII(b)(6) PII (b)(6) PII	(b)(6) PII(b)(6) PII
US Army Corps of Engineers - Columbia Regulatory Field Office		
US Fish and Wildlife Service - Charleston	April Punsalan, SC FWS botanist	april_punsalan@fws.gov
US Fish and Wildlife Service - Raleigh	Dale Suiter	dale_suiter@fws.gov
National Park Service - Cowpens National Battlefield	John Slaughter	John_Slaughter@nps.gov

NC State Parks - West	**Sean McElhone,**	**Sean.mcelhone@ncparks.gov**
NC State Parks	Ed Corey, Inventory biologist	ed.corey@ncparks.gov
NCDOT	Phil Harris, Head, environmental analysis unit	pharris@ncdot.gov
NCDOT	Heath Slaughter, Division environmental officer - Divison 11	hslaughter@ncdot.gov
NCDOT	Trish Beam, Environmental supervisor - Division 12	pdbeam@ncdot.gov
NCDOT	Roger Bryan, Environmental supervisor - Divisin 13	rbrahn@ncdot.gov
NCDOT	Dave McHenry, Environmental supervisor - Division14	dgmchenry@ncdot.gov
NCPCP	Cheryl Gregory, Administrator	cheryl.gregory@ncagr.gov
NCNHP	Misty Buchanan, Director	misty.buchanan@ncdenr.gov
NCNHP	Laura Robinson, Botanist	Laura.Robinson@ncdenr.gov
NCWRC	Gordon Myers, Executive director	gordon.myers@ncwildlife.org
NC Botanical Garden	Johnny Randall, Director of conservation programs	jrandall@email.unc.edu
NC Forest Service	Greg Yates, Regional forester	greg.yates@ncagr.gov
NC Department of Transportation	Tim Bassette, Environmental Program Consultant	tpbassette@ncdot.gov
NC Department of Transportation	Jared Gray, Environmental Program Supervisor II	jgray@ncdot.gov
NC Division of Parks and Recreation - State Parks	Mike Murphy,	michael.murphy@ncparks.gov
NC Natural Heritage Program	Laura Robinson, Botanist	laura.robinson@ncdcr.gov
NC Natural Heritage Program	Jame Amoroso, Conservation Information Specialist	jame.amoroso@ncdcr.gov
NC Natural Heritage Program	Misty Buchanan, Director	misty.buchanan@ncdcr.gov
NC Natural Heritage Program	Wesley Knapp, Western Regional Ecologist/Botanist	wesley.knapp@ncdcr.gov
NC Natural Heritage Program	Suzanne Mason, Conservation Data Manager & NCDOT Project Specialist	suzanne.mason@ncdcr.gov

NC Natural Heritage Program	Mike Shafale, Terrestial Biologist	michael.schafale@ncdcr.gov
NC Natural Heritage Program	Harry LeGrand, retired	hlegrandjr@gmail.com
NC Natural Heritage Program	Bruce Sorrie, retired	basorrie@gmail.com
NC Plant Conservation Program	Cheryl Gregory, Administrator	cheryl.gregory@ncagr.gov
NC Plant Conservation Program	Lesley Starke,	lesley.starke@ncagr.gov
NC Plant Conservation Program	Jenny Stanley,	jennifer.stanley@ncagr.gov
SC Department of Natural Resources - Heritage Trust Program	Herrick Brown, Assistant Botanist	brownh@dnr.sc.gov
SC Department of Natural Resources - Heritage Trust Program	Bert Pittman, Botanist	pittmanb@dnr.sc.gov
SC Department of Natural Resources - Heritage Trust Program	Kathy Boyle,	boylek@dnr.sc.gov
SC Department of Natural Resources - Heritage Trust Program	Pat Cloninger, Preserve manager	cloningerp@dnr.sc.gov
SC Department of Natural Resources - Heritage Trust Program	Austen Pickhardt, Preserve manager	
SC Department of Transportation	Chad Long,	longcc@scdot.org
NC Clean Water Management Trust Fund	Nancy Gutherie, Acquisition Program Manager	nancy.gutherie@ncdcr.gov

Wilkes County	John Yates	jyates@wilkescounty.net
Caldwell County	Stan Kiser	skiser@caldwellcountync.org
Alexander County	Don Adams	manageralc@skybest.com
Iredell County	Ron Smith	rsmith@co.iredell.nc.us
Catawba County	Mark Berry	MBerry@CatawbaCountyNC.gov
Burke County	Bryan Steen	Bryan.Steen@burkenc.org
Lincoln County	Kelly Atkins	katkins@lincolncounty.org
Gaston County	Earl Mathers	earl.mathers@gastongov.com
Cleveland County	Jeff Richardson	April.Crotts@clevelandcounty.com
Rutherford County	Steve Garrison	steve.garrison@rutherfordcountync.gov
Polk County	D. Marche Pittman	mpittman@polknc.org
Cherokee County	Bill Blanton	bill.blanton@cherokeecountysc.com
Spartanburg County	Katherin O'Neil	koneill@spartanburgCounty.org
Greenville County	Jospeh Kernell	countyadministrator@greenvillecounty.org
Burke County School System	Larry Putnam	lputnam@burke.k12.nc.us
City of Landrum	Rich Caplan	rich.caplan@cityoflandrumsc.com
City of Shelby	Rick Howell	rick.howell@cityofshelby.com
Cleveland County	Jeff Richardson	Jeff.Richardson@clevelandcounty.com
Foothills Environmental Landfill	Barry Calloway	bcalloway@caldwellcountync.org
Hickory Parks and Recreation	Mack McLeod	mmcleod@hickorync.gov

Rutherford County	Steve Garrison	steve.garrison@rutherfordcountync.gov
Self McNeilly Landfill - Cleveland County	Nathan McNeilly	Nathan.McNeilly@clevelandcounty.com
Town of Boiling Springs	Tom Hart	tom.hart@boilingspringsnc.net

NC Foresty Assocaiton	Chris Brown, Sr director of communications	cbrown@ncforestry.org
NC Farm Bureau	Larry Wooten, President and CEO	larry.wooten@ncfb.org
Forestry Association of South Carolina	Cam Crawford, President and CEO	ccrawford@scforestry.org
SC Farm Bureau	Harry Ott, President and CEO	harryott@scfb.org

NC Wildlife Federation	Tim Gestwicki, Chief executive officer	tim@ncwf.org
Defenders of Wildlife	Ben Prater, SE coordinator	BPrater@defenders.org
TNC - NC	Katherine Skinner, State director	kskinner@tnc.org
TNC - SC	Mark Robertson, Executive direcor	kskinner@tnc.org
NC Native Plant Society	Jean Woods, President	jean@ncwildflower.org
Foothills Conservancy	Andrew Kota, Executive director	akota@foothillsconservancy.org
Catawba Lands Conservancy	Tom Okel, Executive director	tom@catawbalands.org
Catawba Lands Conservancy	Sean Bloom, Rhyne Preserve	sean@catawbalands.org
Conestee Foundation - Lake Conestee Nature Park	Mary Walter, Director of Development and Communication	mary@lakeconesteenaturepark com
Conserving Carolina	Pam Torlina, Southeast Stewardship Manager, Conserving Carolina	pam@conservingcarolina org
Foothills Conservancy NC	Andrew Kota, Executive Director	akota@foothillsconservancy.org
Foothills Conservancy of NC	Ryan Sparks, Conservation Associate	rsparks@foothillsconservancy com
Friends of Plant Conservation	Alvin Braswell, Friends group to PCP	alvin.braswell@naturalsciences.org
Naturaland Trust	Frank Hollemon, President	frankholleman@naturalandtrust org
Spartanburg Area Conservancy (SPACE)	Frederick Parrish	fmpiii@bellsouth.net
Spartanburg Area Conservancy (SPACE)	Andrew Waters	andrew@spartanburgconservation org
The Nature Conservancy - NC	Brenda Wichmann, Conservation Coordinator	brenda.wichmann@tnc.org
The Nature Conservancy - SC	Kristen Austin, Upstate Conservation Direstor	kaustin@tnc.org
Upstate Forever	Andrea Cooper, Executive Director	acooper@upstateforever.org

Affiliation	Name	Email
Appalachian State University	Assistant Professor, Evolutionary Genetics and Genomics	estepmc@appstate.edu
Appalachian State University	Zack Murrell, Professor and Chair	murrellze@appstate.edu
Gardner-Webb University	Thomas Jones, Professor of Biology	tjones@gardner-webb.edu
NC Botanical Gardens	Johnny Randall, Director of Conservation Programs	jrandall@email.unc.edu
NC Botanical Gardens	Michael Kunz, Conservation Ecologist	mkunz@email.unc.edu
NCSU Herbarium	Alexander Krings, Director	Alexander_Krings@ncsu.edu
SC Botanical Gardens	Patrick McMillan, Director	pmcmill@clemson.edu
UNC Herbarium	Alan Weakly, Director	weakley@unc.edu
USC Upstate	Gill Newberry, Retired	gnewberry@charter.net, gnewberry@uscupstate.edu
USC Upstate Herbarium	Benjamin Montgomery, Director	BMONTGOMERY@uscupstate.edu
Wofford College	Doug Rayner, Professor of Biology	raynerda@wofford.edu

Affiliation	Name	Email
Atlas Environmental	Jennifer Robertson	jrobertson@atlasenvi.com
Axiom Environmental	Grant Lewis	glewis@axiomenvironmental.org
Carolina Ecosystems, Inc.	Brian Smith	info@carolinaeco.com
Carolina Wetland Services	Greg Antemann	gregg@cws-inc.net
ClearWater Environmental Consultants	Clement Riddle	clement@cwenv.com
ECS Carolinas, LLP	Cory Darnell	cdarnell@ecslimited.com
Environmental Services Inc.	Kevin Markham	kmarkham@esinc.cc
Habitat Assessment and Restoration Professionals	Karri Cecil Blackmon	info@habitatassessment.com
Hazen and Sawyer	Jarrod Karl	jkarl@hazenandsawyer.com
HDR	Kevin Mosteller	kevin.mosteller@hdrinc.com
HW Lochner	Kenneth Smith	ksmith@hwlochner.com
Kimley-Horn and Associates, Inc.	Chris Tinklenberg	chris.tinklenberg@kimley-horn.com
Kleinfelder	Kevin Thomas	kthomas@kleinfelder.com
Maser Consulting	Seth Ryan	sryan@maserconsulting.com
Michael Baker International	Frank Curti	fcurti@mbakerintl.com
Michael Baker International	Jake Byers	jbyers@mbakerintl.com
RK&K Consulting Engineers	Dave Willoughby	
S&EC	Bob Zarzecki	bzarzecki@sandec.com
S&ME		
Three Oaks Engineering	Mary Frazer	mary.frazer@threeoaksengineering.com
Wetlands & Waters, Inc.	Tamp Bandy	jtampbandy@gmail.com
Wetlands and Environmental Planning Group	Len Rindner	len.rindner@wetlands-epg.com

HENA SSA peer review ready

Marshall, Michael E <michael_marshall@fws.gov>
Fri 5/11/2018 12:47 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Becker, Drew N <Drew_Becker@fws.gov>; Reid, Rebekah N <rebekah_reid@fws.gov>; Endries, Mark <mark_endries@fws.gov>; Stephanie DeMay <Stephanie.DeMay@ag.tamu.edu>

4 attachments (10 MB)

Possible Peer Reviewers v2.docx; HENA Cover Page and Table of Contents_Peer Review.pdf; Combined Appendices_Peer Review.pdf; Draft HENA SSA_05112018_Peer Review.pdf;

Good afternoon Byron!

The draft SSA for dwarf-flowered heartleaf is ready for peer review. Attached you will find the document Rebekah put together suggesting folks for the peer review. We need the reviews turned around by June 4th, so that we can incorporate before the Recommendation meeting. Also, will you please cc me and Rebekah when it gets sent out for the peer review please? Any way this can be sent out today?

Attachments are: the SSA itself, a cover page and table of contents, and appendices....and the list of reviewers to reach out to.

Let me know if you have any questions....thanks a bunch!

Mike

--
Mike Marshall
SSA Program Specialist
U.S. Fish and Wildlife Service Region 4
Cell: 512-461-6217
Alternate email: mmarshall@ag.tamu.edu

Work Schedule 1st Week
Monday-Thursday --> In Office 7:30-4:30 CST

Work Schedule 2nd Week
Monday-Thursday --> In Office 7:30-4:30 CST

This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act and may be disclosed to third parties.

Wesley Knapp
NC Natural Heritage Program
wesley.knapp@ncdcr.gov

Tim Bassette
NC Department of Transportation
tpbassette@ncdot.gov

Dr. Gillian Newberry
University of South Carolina – Upstate (retired)
gnewberry@charter.net
gnewberry@uscupstate.edu

Dr. Doug Rayner
Wofford College
raynerda@wofford.edu

Dr. LL "Chick" Gaddy
Terra Incognita
llgaddy2@gmail.com

Dr. Zack Murrell
Appalachian State University
murrellze@appstate.edu

Bert Pittman or Herrick Brown
SC Heritage Trust Program
pittmanb@dnr.sc.gov
brownh@dnr.sc.gov

DRAFT Species Status Assessment Report

for

Dwarf-flowered Heartleaf (*Hexastylis naniflora*)

Version 1.0

xx-xx-201x (date)

U.S. Fish and Wildlife Service

Region 4

Atlanta, GA

ACKNOWLEDGEMENTS

This document was prepared by Michael Marshall (U.S. Fish and Wildlife Service [Service]-Texas A &M Natural Resource Institute [NRI]), Rebekah Reid (Service), Mark Endries (Service), and Stephanie DeMay (Texas A&M NRI). External species expertise, guidance, and document reviews were provided by technical team members Suzanne Mason (North Carolina Natural Heritage Program [NCNHP]), Jame Amoroso (NCNHP), Matt Estep (Appalachian State University), and Laura Robinson (NCNHP). Peer review was provided by _____.

EXECUTIVE SUMMARY

The Species Status Assessment (SSA) reports the results of the comprehensive status review for the dwarf-flowered heartleaf (*Hexastylis naniflora*). For the purpose of this assessment, we generally define viability as the ability of the dwarf-flowered heartleaf to sustain resilient populations in the natural ecosystems within its range over time. Using the SSA framework, we consider what the species needs to maintain viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation (USFWS 2016, entire; Wolf et al. 2015, entire). This SSA provides a thorough assessment of biology and natural history and assesses demographic risks, stressors, and limiting factors in the context of determining the viability for the species. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time.

The dwarf-flowered heartleaf is a low growing herbaceous plant in the birthwort family (Aristolochiaceae) with a range currently restricted to 13 counties within the Upper Piedmont of South Carolina and North Carolina. The species appears to have a restricted range due to its habitat requirements, including soil type, moisture availability, and various other landform characteristics (Wagner 2013).

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect the species include habitat loss due to the conversion of land to residential, commercial, and industrial use. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of

ponds, impacts from grazing cattle, ORV damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or siltation (NCNHP 2016, Robinson and Padgett 2016). Climate change may exacerbate these risk factors through changes in temperature and precipitation.

For the purposes of this SSA, we use population size as the main driver of population resilience. The unit of measurement for population size in this species is a "clump" (rosette). We used Element Occurrence data from both North Carolina Natural Heritage Program and South Carolina Heritage Trust Program as a basis for delineating populations. Delineations were based off of NatureServe criteria such as EO separation distance and intervening landscape matrix. EO data included a wide range of years since the species was last observed at a given location (1964-2017), however, we only used EOs that were observed since 2005.

To determine overall resilience for populations, we used last known abundance estimates to bin population size classes into corresponding resilience categories. EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, given there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, depending on habitat conditions; poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016; Robinson and Padgett 2016) focus monitoring studies on populations with greater than 1,000 individuals, populations that are assumed to be very viable. We synthesized all of the above population size information and created four resilience categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.

- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.

- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.

- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

There are currently 78 populations of dwarf-flowered heartleaf that have been observed since 2005. The resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low).

Our analysis of future conditions focused on the potential negative impacts of urbanization, and potential positive effects of location or rediscovery of additional populations. Because the actual impacts of urbanization and probability of locating additional populations are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. A projection out to 2040 was based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape.

We used the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040. We used a habitat model and corresponding SMART methodology to assess the likelihood that the species would be found to persist on various sites.

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resilience and extirpation of a few populations is offset by the fact that several additional populations were found to persist in the Status Quo and Targeted Conservation scenarios. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resilience in several additional populations. Regardless of the scenario, the majority of the populations expected to persist on the landscape in 2040 are of at least moderate resilience.

Given the species' current condition and the impacts that the species is expected to experience under the future scenarios, some reductions in resilience are anticipated, but redundancy and representation are unaffected under all scenarios. The results of the SSA indicate the species has a low susceptibility to threats and a high degree of stability.

Table of Contents

INTRODUCTION **1**

SPECIES BIOLOGY **4**

Taxonomy and Species Description 4

Distribution 6

Life History 8

Demographics 8

Pollination and Dispersal 8

Habitat 9

Soils 10

Fire 11

Genetics 11

SPECIES NEEDS FOR VIABILITY **13**

Delineating Populations 13

Population Resiliency 14

Habitat Factors 15

Reproduction and Presence of Pollinators 22

Abundance 22

Population Trends 24

CURRENT CONDITION **25**

Current Population Resilience 26

Categorizing Resilience 26

Occupancy and Abundance 27

Population Trends 30

Current Species Representation 31

Current Species Redundancy 32

INFLUENCES ON VIABILITY **33**

Human Population Change 33

Development 36

Invasive Species and Woody Encroachment 38

Climate Change 39
FUTURE CONDITIONS **41**
Future Considerations 41
Status Quo Scenario 67
High Development Scenario 67
Targeted Conservation Scenario 68
Future Resilience 69
Status Quo Scenario 71
High Development Scenario 73
Targeted Conservation Scenario 76
Viability Summary 78
Opportunities for Additional Conservation 80

LITERATURE CITED **83**

Appendix 1

Populations of *Hexastylis naniflora* estimated to contain over 1,000 rosettes in 2010, with updated information in 2016[1], and protection measures for these populations.

Populations known to be afforded some protection are indicated in **bold**.[2]

USFWS population number	State	County	NHP EO numbers (2016)[3]	NHP EO rank (2016)[4,5]	Site	Latest estimate of population size (year)	Estimate of plants on-site protection (year)	Protection comments
1	NC	Burke	029	A	Island Creek Heath Bluff (Lovelady Sites)	50,000+ (2016)	0	Not protected.
2	NC	Burke	178.159-178.161 178.254-178.256 178.280-178.282	A	Catawba River: Love Lady (Hoyle and Micol Creek)	~6,738 (2008-2011)	Awaiting data from NCDOT.	Possible NCDOT protected R-O-W, protection unconfirmed. In early 2016, the Town of Valdese applied to CWMTF to acquire part of this population.
3	**NC**	**Caldwell**	**227**	**A**	**Peaked Top Rare Plant Site (Foothills Landfill)**	**16,463 (2014)**	**16,463 (2014)**	**Conservation Easement (Foothills Conservancy of NC).**
4	**NC**	**Caldwell**	**044**	**AB**	**Little Gunpowder Creek Rare Plant Site 1**	**2,707 (2015)**	**2,424 (2015)**	**DOT mitigation site.**
5	NC	Catawba	158	D	South Fork Catawba River: Jacob Fork, Camp Creek	123 (2016)	27 (2015)	Some plants occur within an undetermined acreage within NCDOT R-O-W (Bassette 2016). Protection unconfirmed.
6	**NC**	**Catawba**	**243.012,** 243.242 243.269, **243.270**	**A**	**Catawba Wildlife Club**	**1,000-1300 (1995-2007)**	**>1,000 (1995-2007)**	**Catawba County Wildlife Club Registered Heritage Area (EO 12) The Nature Conservancy Conservation Easement (EO 270).**
7	NC	Catawba	031	C?	US 321, southeast Hickory	1,202 (2010)	161 (2010)	161 plants within NCDOT R-O-W (Bassette 2016).
8	**NC**	**Catawba**	**96.184,** 96.038 96.039	**A**	**Murrays Mill/Upper Balls Creek**	**~9,150 (2005)**	**11,860 (2013)**	**Fee title by NCDOT (~34 acres).**
9	**NC**	**Cleveland**	100.014, **100.049, 100.050, 100.051, 100.073, 100.074 100.149, 100.233**	**A**	**Broad River/Sandy Run Natural Areas (aka "Broad River Tract")**	**~33,500 (2001-2015)**	**32,702 (2015)**	**Fee title by Broad River Greenway (1,000 acres).**

USFWS population number	State	County	NHP EO numbers (2016)[3]	NHP EO rank (2016)[4,5]	Site	Latest estimate of population size (year)	Estimate of plants on-site protection (year)	Protection comments
			100.236, 100.237 **100.238, 100.239 100.240, 100.241,** 100.246					
10	NC	Cleveland	208	A?	Buffalo Creek: Potts Creek	3,572 (2007)		Awaiting verification that plants are protected in NCDOT R-O-W. Protection unconfirmed.
11	NC	Cleveland	211.072, 211.194		First Broad River: Hop-Hornbeam Natural Area	1,965 (2000)		Awaiting verification that plants are protected in NCDOT R-O-W. Protection unconfirmed.
12	NC	Cleveland	214.201, **214.202, 214.203,** 214.204, **214.205, 214.209,** 214.212, **214.213,**	A	Buffalo Creek: tributaries north and south of SR2047	6,447 (200-2007)		Awaiting verification that plants are protected in NCDOT in R-O-W, bold in EO column. Protection unconfirmed (EO 202, 203, 205, 209, 213).
13	NC	Cleveland	216.028, 216.196, 216.197, 216.198, **216.199, 216.200**	A	Buffalo Creek: Kings Mountain Reservoir	3,310 (200-2016)	~500? (2000-2007) (awaiting updates)	Awaiting verification that plants are protected in NCDOT in R-O-W, bold in EO column. Protection unconfirmed (EO 199, 200).
14	NC	Cleveland	157	AB	First Broad River: Crooked Run Creek	330 (2010)		None of the population is protected within NCDOT R-O-W, determined too far away from roadside, DOT stopped monitoring in 2010 (Bassette 2016).
15	**NC**	**Cleveland/ Rutherford**	**276**	**A**	**Cliffside Steam Station**	**39,545 (2016)**	**~39,545 (2016)**	**Voluntary agreement with Duke Energy; protected acreage unknown.**
16	NC	Lincoln	261.252, 261.259, 261.263	B	Lincoln County Airport and Leepers Creek	7,032 (2005-2006)		Not protected.
17	NC	Polk	023	A	Mills Creek Forest and Seep	1,459 (2016)		Not protected.

USFWS population number	State	County	NHP EO numbers (2016)[3]	NHP EO rank (2016)[4,5]	Site	Latest estimate of population size (year)	Estimate of plants on-site protection (year)	Protection comments
18	**NC**	**Polk**	**125**	**A**	**Broad River: New Hope Springhead Swamp**	**12,235 (2016)**	**1,000-3,000 estimated (2016)**	**New Hope Springhead Swamp Registered Heritage Area (voluntary conservation agreement).**
19	**NC**	**Rutherford**	**154**	**C**	**Second Broad River (Forest City Industrial Complex)**	**2,576 (2016)**	**2478 (2008)**	**Deed restrictions (12 acres). Significant threats from industrial development, invasive exotics, erosion, sedimentation in a fragmented landscape.**
20	**NC**	**Rutherford**	99.009, 99.010, 99.037, 99.052, 99.053, 99.055, 99.061, 99.063, 99.075, **99.076,** 99.079, 99.090, 99.121, **99.172,** 99.181, 99.182, 99.249-.251, 99.267, 99.268	**A**	**Broad River: Hensons Creek Ravine, Brice Rare Plant Site, Sandy Mush Outcrop**	**106,940 (2016)**	**~200-250 (2007-2012)**	**Parris Heartleaf Registered Heritage Area (voluntary conservation agreement on subEO 076 and 172).**
21	NC	Rutherford	176.167-176.170	A	Broad River: Cleghorn Creek Tributary/US221	6,750 (2016)		Not protected.
22	NC	Rutherford	177.016, 177.107, 177.122, 177.063, 177.164, 177.165, 177.166	A	Broad River: Floyds Creek, Long Branch	12,687 (2008-2016)		Not protected.
23	**NC**	**Rutherford**	247.013, 247.056, 247.080, **247.106,** 247.114, 247.115, 247.173, 247.174, **247.286**	**A**	**Broad River: Floyds Creek (aka New Bethel Rare Plant Site)**	**~5,480 (2003-2015)**	**4,873 (2015)**	**Tate Conservation Easement (8 acres) (SubEOs 106 and 286).**
24	**SC**	**Cherokee**	**016, 017, 018**	**BC**	**Cowpens Battlefield**	**2,823 (2016)**	**2,823? (2016)**	**National Park Service, National Battlefield.**

USFWS population number	State	County	NHP EO numbers (2016)[3]	NHP EO rank (2016)[4,5]	Site	Latest estimate of population size (year)	Estimate of plants on-site protection (year)	Protection comments
25	SC	Greenville /Spartanburg	002, 004, 024, 032, 033, 036, 038, 039, 040, 041, 042, 049, 050, 054	Various AB-BD	South Pacolet River and tributaries	5,205 (1991-1998)		Not protected.
26	**SC**	**Spartanburg**	**011, 014, 026--028, 047, 048, 057**	**Various AB-BD**	**Peters Creek Heritage Preserve**	**3,306 (2016)**	**3,306 (2016)**	**State Heritage Preserve (194 acres).**
27	**SC**	**Spartanburg**	**007, 029**	**BD, H?**	**Blalock Reservoir**	**3,505 (2016)**	**3,505? (2016)**	**Restrictive covenants (protected acreage unknown); significant threats to remaining population.**
28[6]	**NC**	**Lincoln**	302.046, **302.262**	**A**	**Rhyne Preserve**	**19,880 (2016)**	**19,873 (2016)**	**Rhyne Preserve (fee title by Catawba Lands Conservancy).**

[1]This table was replicated in the same format and populations as Table B.2 from the most recent USFWS five-year Review of *Hexastylis naniflora* (USFWS 2010) for comparison of changes since the time of the five-year review. Populations that are not believed to contain over 1,000 rosettes but were included in the original Table B.2 are included here, but the "NHP EO rank" and in the "Latest estimate of population size" reflects the smaller size.

[2] In the case of partially protected populations, the column "NHP EO numbers" indicates the specific portions of the population afforded protection in bold font.

[3]NHP EO numbers use the following format: Principal EO.SubEO. Only one number is listed if it is a stand-alone principal EO.

[4]NHP EO rank specifications are defined in Appendix B2. In cases involving principal/sub EOs, only the rank for the principal EO is given.

[5] EO ranks with two letters indicate a degree of uncertainty within the range provided (e.g. a rank of "AB" indicates possibly excellent to good viability).

[6]Population that is currently estimated to have over 1,000 rosettes that was not known to be large populations in 2010 have been added to this table.

Appendix 2

NC Natural Heritage Program (NCNHP) Element Occurrence Rank Specifications for *Hexastylis naniflora*

"A" Rank Specifications (excellent viability)
An A-ranked population of *Hexastylis naniflora* should have more than 500 clumps (rosettes) occurring in greater than one acre of high quality forest such as Dry-Mesic Oak Hickory Forest or Mesic Mixed Hardwood Forest.

“B” Rank Specifications (good viability)
A B-ranked population of *Hexastylis naniflora* should have 200-500 clumps (rosettes) occurring in greater than one acre of high quality forest such as Dry-Mesic Oak Hickory Forest or Mesic Mixed Hardwood Forest - OR - more than 500 clumps occurring in less than one acre of high quality forest or on land impacted by human disturbance such as logging, grazing, mowing, etc.

"C" Rank Specifications (fair viability)
A C-ranked population of *Hexastylis naniflora* should have 100-200 clumps (rosettes) occurring in greater than one acre of high quality forest such as Dry-Mesic Oak Hickory Forest or Mesic Mixed Hardwood Forest - OR - 200- 500 clumps occurring in less than one acre of high quality forest or on land impacted by human disturbance such as logging, grazing, mowing, etc.

"D" Rank Specifications (poor viability)
A D-ranked population of *Hexastylis naniflora* should have fewer than 100 clumps (rosettes) occurring in greater than one acre of high quality forest such as Dry-Mesic Oak Hickory Forest or Mesic Mixed Hardwood Forest - OR - less than 200 clumps occurring in less than one acre of high quality forest or on land impacted by human disturbance such as logging, grazing, mowing, etc.

“E” Rank Specifications (extant)
An E-ranked population of *Hexastylis naniflora* is an occurrence that has recently been verified as still existing, but sufficient information for the factors used to estimate viability has not yet been obtained.

“H” Rank Specification (historical)
An H-ranked population of *Hexastylis naniflora* lacks recent field information verifying the continued existence of the occurrence. In the absence of known disturbance and with the habitat still extant, H is generally recommended for occurrences that have not been reconfirmed for approximately 30 or more years.

“F” Rank Specification (failed to find)
An F-ranked population of *Hexastylis naniflora* has not been found despite a search by an experienced observer at a time and under conditions appropriate for the Element at a location where it was previously reported, but the occurrence still might be confirmed to exist at that location with additional field survey efforts. For occurrences with vague locational information, the search must include areas of appropriate habitat within the range of locational uncertainty.

“X” Rank Specification (failed to find)
An X-ranked population of *Hexastylis naniflora* is considered destroyed based on adequate surveys by one or more experienced observers at times and under conditions appropriate for the species at the occurrence location, or other persuasive evidence indicates that the species no longer exists there or that the habitat has been destroyed to such an extent that it can no longer support the species.

“U” Rank Specification (failed to find)
A U-ranked population of *Hexastylis naniflora* cannot be assigned a rank due to lack of sufficient information on the occurrence or the species identification has not been confirmed.

Rank Specifications Justification
The unit of measurement for population size in this species is "clump" (rosette). EO size (as quantified by number of clumps or rosettes) is the primary rank factor. Condition of habitat (vegetation community and structure) and Landscape context (extent of suitable habitat and physical factors) are also incorporated secondarily. The species thrives most in undisturbed habitat. However, disturbed lands, that have been logged, grazed, mown, or converted to pasture, orchards, or tree plantations have been found to support remnant patches of *Hexastylis naniflora*. The extent to which this species can withstand disturbance is unknown. Populations in disturbed habitat are considered at risk, with relatively poor viability (C or D). Care should be taken when estimating population size, as population estimates have been found to vary widely from the number counted in population censuses. Specifications are based on largest known populations and expert opinion (including James Padgett, Carolyn Wells, Misty Buchanan (formerly Franklin), and Brenda Wichmann).

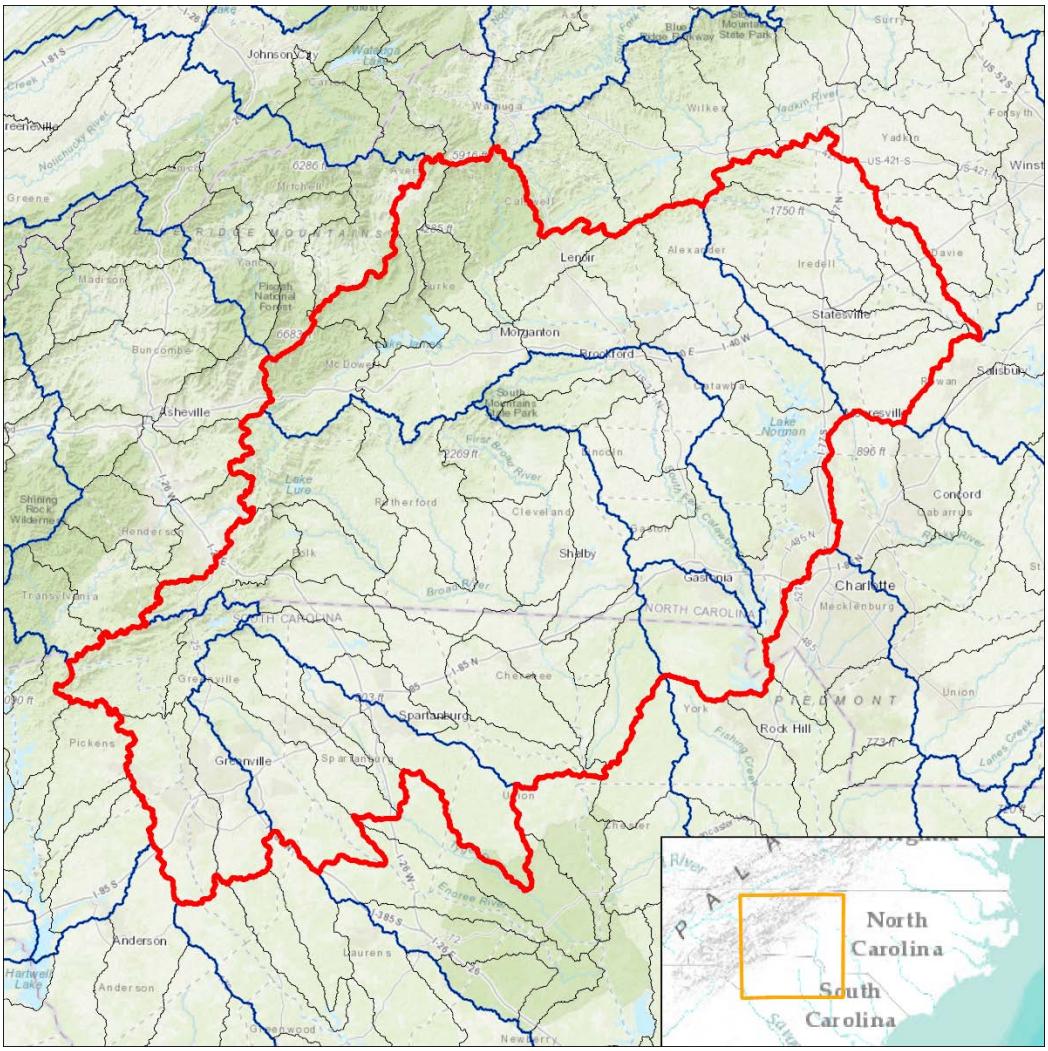
Appendix 3

Maxent Model Methodology

Study Extent, Coordinate System, and Cell Size

Fifty three 10-digit hydrologic units (HUC) comprise the analysis extent (Figure 1). In North Carolina it includes all 10-digit HUC that fall within the boundaries of 8-digit HUC with known occurrence of Hexastylis. In South Carolina we also included all 10-digit HUC that fell within the boundaries of 8-digit HUC with known occurrence of Hexastylis, but excluded the southern portions of the HUC-8 areas due to the boundaries being exceedingly large and far away from any known occurrences.

Figure 1. Analysis extent. Red line indicates Maxent analysis extent, blue lines are 8-digit HUC boundaries, black lines are 10-digit HUC boundaries. The orange line in the inset map indicates where the analysis extent is situated in North and South Carolina



Coordinate System: USA Contiguous Albers Equal Area Conic USGS version

Cell Size: 30 x 30 meters derived from the USGS National GAP Landcover

Source Element Occurrence Data

Hexastylis naniflora element occurrence data was obtained from the North and South Carolina Natural Heritage Programs. These data were in polygon format and digitized at scale that accurately identified the boundaries of the individual population areas. Current populations of Hexastylis naniflora were identified by reviewing the last observed data in the database and excluding all populations that have not been observed in the last 10 years (2007). To represent these current population areas in Maxent, a raster cell center was retained for every 30 x 30 meter pixel that was situated within the current element occurrence data polygons.

Source Datasets Used:

USGS National GAP Landcover - The GAP National Terrestrial Ecosystems – Ver 3.0 is a 2011 update of the National Gap Analysis Program Land Cover Data – Version 2.2 for the conterminous U.S. The GAP National Terrestrial Ecosystems – Version 3.0 represents a highly thematically detailed land cover map of the U.S at a 30 x 30 meter pixel resolution. The map legend includes types described by NatureServe's Ecological Systems Classification (Comer et al. 2002) as well as land use classes described in the National Land Cover Dataset 2011 (Homer et al. 2015). These data cover the entire continental U.S. and are a continuous data layer. The land cover map identifies 49 different land cover types within the range of Hexastylis Naniflora.

LandFire - Landscape Fire and Resource Management Planning Tools, is a shared program between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior, providing landscape scale geo-spatial products to support cross-boundary planning, management, and operations.

SSURGO Soils - The SSURGO database contains information about soil as collected by the National Cooperative Soil Survey over the course of a century. The information was gathered by walking over the land and observing the soil. Many soil samples were analyzed in laboratories. The maps outline areas called map units. The map units describe soils and other components that have unique properties, interpretations, and productivity. The information was collected at scales ranging from 1:12,000 to 1:63,360.

National Elevation Dataset - The NED is a seamless dataset with the best available raster elevation data of the conterminous United States, Alaska, Hawaii, and territorial islands. The NED is derived from diverse source data that are processed to a common coordinate system and unit of vertical measure. NED data are available nationally (except for Alaska) at resolutions of 1 arc-second (about 30 meters) and 1/3 arc-second (about 10 meters), and in limited areas at 1/9 arc-second (about 3 meters). The 1/3 arc-second database was used for HENA modelling purposes.

PRISM Climate Data - The PRISM Climate Group gathers climate observations from a wide range of monitoring networks, applies sophisticated quality control measures, and develops spatial climate datasets to reveal short- and long-term climate patterns. The resulting datasets incorporate a variety of modeling techniques and are available at multiple spatial/temporal resolutions, covering the period from 1895 to the present.

Model Variables Created:

Landcover – Landcover represented by the default landcover classification (Table 1).

Landcover Hexastylis Grouping – Landcover represented by a grouping of landcover types. For the purposes of discussing Hexastylis naniflora habitat, many of the default landcover classifications are similar and could be grouped together. The definition of each landcover classification was reviewed and categorized using a much broader habitat definition (Table 1).

Table 1. Landcover classification

Default Landcover Classification	Hexastylis Grouping
Southern Piedmont Glade and Barrens	Barren
Southern Ridge and Valley / Cumberland Dry Calcareous Forest	Barren
Undifferentiated Barren Land	Barren
Cultivated Cropland	Disturbed
Deciduous Plantations	Disturbed
Developed, High Intensity	Disturbed
Developed, Low Intensity	Disturbed
Developed, Medium Intensity	Disturbed
Developed, Open Space	Disturbed
Disturbed/Successional - Grass/Forb Regeneration	Disturbed
Disturbed/Successional - Shrub Regeneration	Disturbed
Evergreen Plantation or Managed Pine	Disturbed
Harvested Forest - Grass/Forb Regeneration	Disturbed
Harvested Forest-Shrub Regeneration	Disturbed
Introduced Upland Vegetation - Annual Grassland	Disturbed
Introduced Upland Vegetation - Shrub	Disturbed
Introduced Upland Vegetation - Treed	Disturbed
Pasture/Hay	Disturbed
Quarries, Mines, Gravel Pits and Oil Wells	Disturbed
Ruderal forest	Disturbed
Southern Appalachian Low Mountain Pine Forest	Evergreen
Southern Appalachian Montane Pine Forest and Woodland	Evergreen
Southern and Central Appalachian Cove Forest	Hardwood
Southern and Central Appalachian Oak Forest	Hardwood
Southern and Central Appalachian Oak Forest - Xeric	Hardwood
Southern Piedmont Mesic Forest	Hardwood

Central and Southern Appalachian Montane Oak Forest	High Elevation
Central and Southern Appalachian Northern Hardwood Forest	High Elevation
Central and Southern Appalachian Spruce-Fir Forest	High Elevation
Southern Appalachian Grass and Shrub Bald	High Elevation
Southern Appalachian Grass and Shrub Bald - Shrub Modifier	High Elevation
Appalachian Hemlock-Hardwood Forest	Mixed
Southern Piedmont Dry Oak-(Pine) Forest - Hardwood Modifier	Mixed
Southern Piedmont Dry Oak-(Pine) Forest - Loblolly Pine Modifier	Mixed
Southern Piedmont Dry Oak-(Pine) Forest - Mixed Modifier	Mixed
Southern Ridge and Valley Dry Calcareous Forest	Mixed
Southern Ridge and Valley Dry Calcareous Forest - Pine modifier	Mixed
Open Water (Fresh)	Open Water/Wetland
Southern and Central Appalachian Bog and Fen	Open Water/Wetland
Southern Piedmont/Ridge and Valley Upland Depression Swamp	Open Water/Wetland
Southern Appalachian Granitic Dome	Outcrop
Southern Appalachian Montane Cliff	Outcrop
Southern Appalachian Rocky Summit	Outcrop
Southern Piedmont Cliff	Outcrop
Southern Piedmont Granite Flatrock	Outcrop
South-Central Interior Large Floodplain - Forest Modifier	Riparian
South-Central Interior Small Stream and Riparian	Riparian
Southern Piedmont Large Floodplain Forest - Forest Modifier	Riparian
Southern Piedmont Small Floodplain and Riparian Forest	Riparian

Landcover Diversity – Identifies the number of landcover classes (default classification) within a 10-cell radius (300 meters) of an individual pixel.

Landcover Majority – Identifies the dominant landcover class (default classification) within a 10-cell radius (300 meters) of an individual pixel.

Landfire Canopy Height – Represents the vertically projected percent cover of the live vegetation canopy.

Landfire Canopy Cover – Represents the average height of the dominant vegetation across the landscape.

SSURGO mukey – SSURGO soils dataset represented by the Map Unit Key (mukey)

SSURGO Drainage Class – SSURGO soils dataset represented by wettest drainage class. Drainage class refers to the frequency and duration of wet periods in conditions similar to those under which the soil formed.

SSURGO Hydrologic Group – SSURGO soils dataset represented by hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

Elevation – National elevation dataset elevation values. This 10-meter dataset was reclassified to 30-meters.

Aspect 9-class – Using the national elevation dataset, the aspect was derived and categorized into the following classes: Flat, North, Northeast, East, Southeast, South, Southwest, West, and Northwest.

Aspect 5-class – Using the national elevation dataset, the aspect was derived and categorized into the following classes: Flat, North, East, South, and West.

Slope – The national elevation dataset represented by degree of slope.

Geomorphons – A pattern recognition analysis that converts a digital elevation dataset into 10 common landform elements: flat, peak, ridge, shoulder, spur, slope, pit, valley, footslope, and hollow. The national elevation dataset was used as the source elevation for the analysis.

Solar Radiation – An analysis of the amount of solar radiation (radiant energy) reaching the earth's surface using the national elevation dataset as the elevation model. The output solar model is reported in watt hours per square meter (WH/m^2)

Average Annual Precipitation – Climate dataset of average annual precipitation according to a model using point precipitation and elevation data for the 30-year period of 1971-2000.

Maximum Average Annual Temperature – Climate dataset of average annual maximum temperature according to a model using point temperature data for the 30-year period of 1981-2010.

Minimum Average Annual Temperature – Climate dataset of average annual minimum temperature according to a model using point temperature data for the 30-year period of 1981-2010.

Maxent Model Development

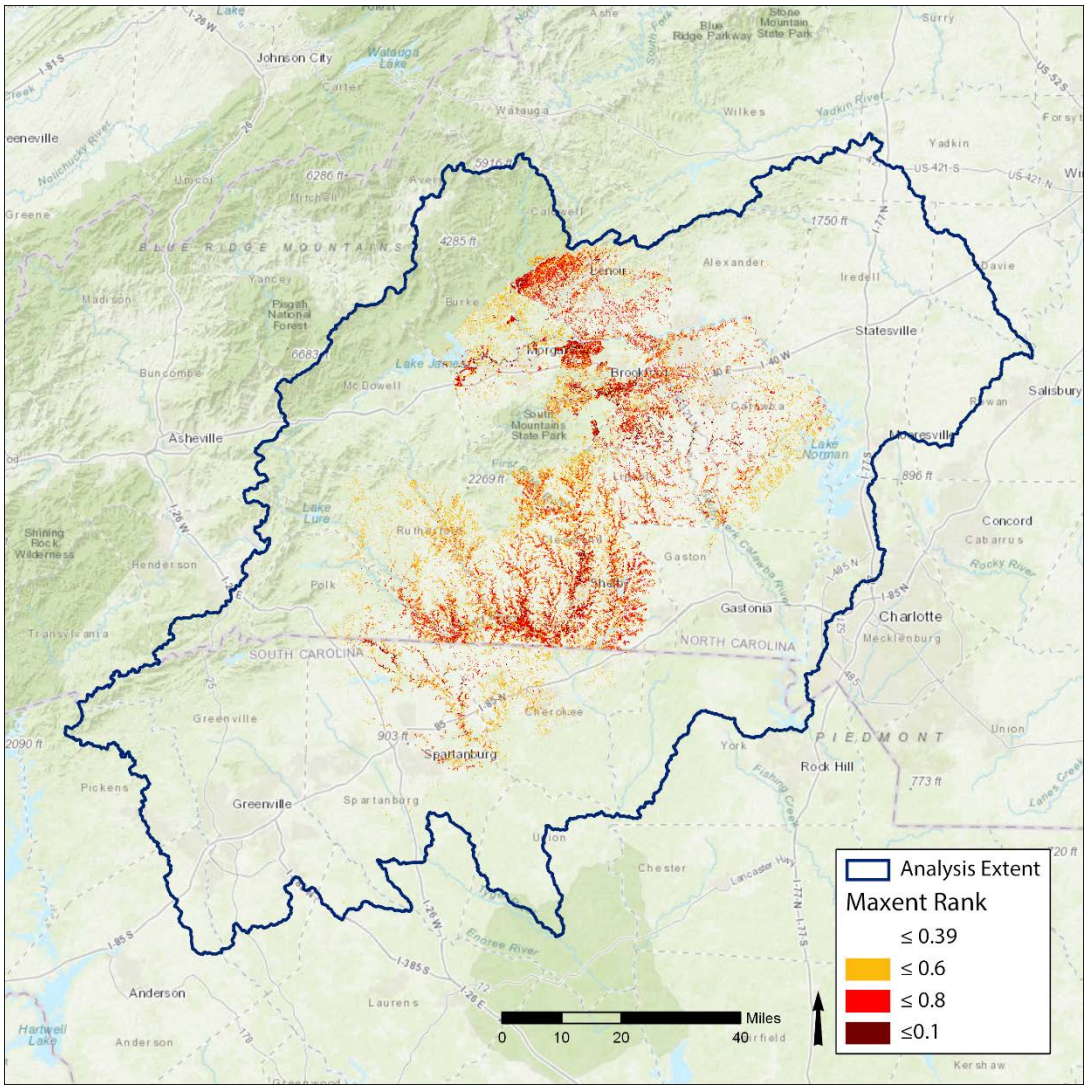
Maxent software for species habitat modeling (version 3.4.1) was used (Philips et al., 2018).

An initial single model Maxent run was done to determine which variables could be excluded due to limited percent contribution to the model. Any variable that contributed less than 1% to the single model run results was excluded in the final model. The following variables were excluded:

landcover diversity, canopy height, SSURGO drainage class, SSURGO hydrologic group, aspect 9-class, aspect 5-class, slope, solar radiation, and maximum annual temperature.

For the final model a 10-run replicate Maxent model was created using crossvalidation. For replicate models, the occurrence data is randomly split into a number of equal-sized groups called "folds", and separate models are created leaving out each fold in turn. The individual model runs are then averaged together to derive the final model. Cloglog output format was used. Cloglog output gives an estimate between 0 and 1 of probability of presence assuming an appropriate sampling design.

Figure 2. Maxent model output map.



Results

Figure 2 shows the model output. The minimum cutoff value (to determine if an area is considered potential habitat for a species) of 0.39 was determined by using the average 10th percentile training presence. The 10th percentile training presence uses the suitability threshold associated with the presence record that occurs at the 10th percentile of presence records (Phillips 2018). This value excludes some of the outlier population areas in the Maxent predictions to focus on the typical habitat conditions for this species. The total area ranked greater than 0.39 in the Maxent model was just 6.0% of the total analysis area (Table 1).

Table 1. Area estimates of the Maxent model

Maxent Score	Acres	Square Miles	Percent of Total
0.406 and greater	302,834.13	473.18	6.02%
0.6 and greater	128,273.52	200.43	2.55%
0.8 and greater	22,115.97	34.56	0.44%

The average area-under-curve (AUC) score for the replicate Maxent model is 0.86. The AUC is calculated from the receiver operating characteristic (ROC) plot. This value has a range of 0 – 1 and may be interpreted as a single test statistic that assesses model performance, indicating the ability of the model to correctly classify the occurrence data used. AUC values close to 0.50 indicate a model fit no better than random, values less than 0.5 indicate a model fit worse than random, a value of 1.0 indicate a perfect fit (Baldwin 2009). A value of 0.86 is a good fitting model.

The Maxent output supplies estimates of the relative contributions of the environmental variables to the Maxent model (Table 2.)

Table 2. Percent contribution of the environmental variables

Environmental Variable	Percent Contribution
SSURGO mukey	23.5%
Minimum Annual Temperature	17.8%
Average Annual Precipitation	15.7%
Landcover	12.9%
Landcover Majority	12.0%
Landcover Hexastylis Grouping	5.4%
Geomorphons	4.9%
Elevation	4.6%
Canopy Cover	3.2%

SSURGO mukey is the top contributing variable. 135 different individual soil types are present within the polygon boundaries of the Hexastylis element occurrences. Many of these individual soil types are part of soil complexes and are separated by things such as percent slope, erosion, how stony/rocky, and amount of clay. The most common individual soil type was Meadowfield-Rhodhiss complex, 25 to 60 percent slopes, very stony (14.1% of total). However, collectively the Meadowfield soils only comprised 14.3% of all soils). The individual Pacolet soil types were very common and collectively comprise 32.2% of all soil types present. Woolwine, Rion, and Fairview

soils were also collectively common, comprising 10.4%, 9.7%, and 8.8% of all soils present respectively.

The minimum annual average temperature range in the analysis extent is 39 – 51 degrees Fahrenheit. The majority of the Hexastylis element occurrences (89%) are found at the 47 and 48 degrees. The Average annual precipitation range in the analysis extent is 42 – 81 inches per year. The majority of the Hexastylis element occurrences (82%) are found in the 47 – 49 inches per year range.

Piedmont forested landcover habitats dominate the land area of the element occurrences. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier (53%), Southern Piedmont Mesic Forest (9%), Southern Piedmont Dry Oak-Pine Forest (5.2%), Southern Piedmont Small Floodplain and Riparian Forest (4.4%), and collectively comprise 71% of the element occurrences area. Unfortunately, non-native habitats are also present. Evergreen Plantation or Managed Pine (9%), Harvested Forest (7.2%), Developed, Open Space (5%), Pasture/Hay (2.1%) collectively comprise 22% of the total element occurrence area. The Remaining 6 percent of element occurrence area is comprised of a mix of 14 other natural and disturbed landcover classes, but each at small percentages.

The landcover majority classification scheme reduces the total number of landcover classes present in the analysis extent from 23 to 11. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier is still the dominant landcover class (58%). However disturbed categories are increased in area (sum total of 35%). Evergreen plantation or managed pine (12%) and Pasture/Hay (12%) are the only other categories that have at least 10% or greater area. The increase in disturbed landcover area representation in the landcover majority layer suggests that many Hexastylis population areas are situated in areas impacted by disturbed landcover. This is likely due to urban encroachment and increasing fragmentation of habitats.

The landcover Hexastylis grouping reveals the amount of disturbance present in Hexastylis population areas. Landcover classes grouped as disturbed comprises 27% of the total area. Mixed forest (deciduous and evergreen) comprises 58%, pasture/hay 12%, and hardwood forest 2%,

Geomorphons revealed that the majority of Hexastylis element occurrence areas are situated in concave landforms. Geomorphon categories hollow (13%), valley (46%), and depression (10%) collectively comprise 69% of all Hexastylis population areas. Flat landforms comprise 15.5% of the area and convex landforms the remaining 15.5%.

Within the analysis extent, the range of elevation present is 335 – 5,265 feet. For Hexastylis, the prime elevation range is from 666 – 908 feet (53% of total element occurrence area). A lesser elevation range is present from 935 – 1,184 (37% of total element occurrence area).

Canopy cover for the Hexastylis populations are dominated by Tree Cover 70-80% (20.2%) and Tree Cover 80-90% (63.9%). The rest of the canopy cover categories are 2% or less.

Citations

Baldwin, R.A. 2009. Use of maximum entropy modeling in wildlife research. Entropy. 11:854-866.

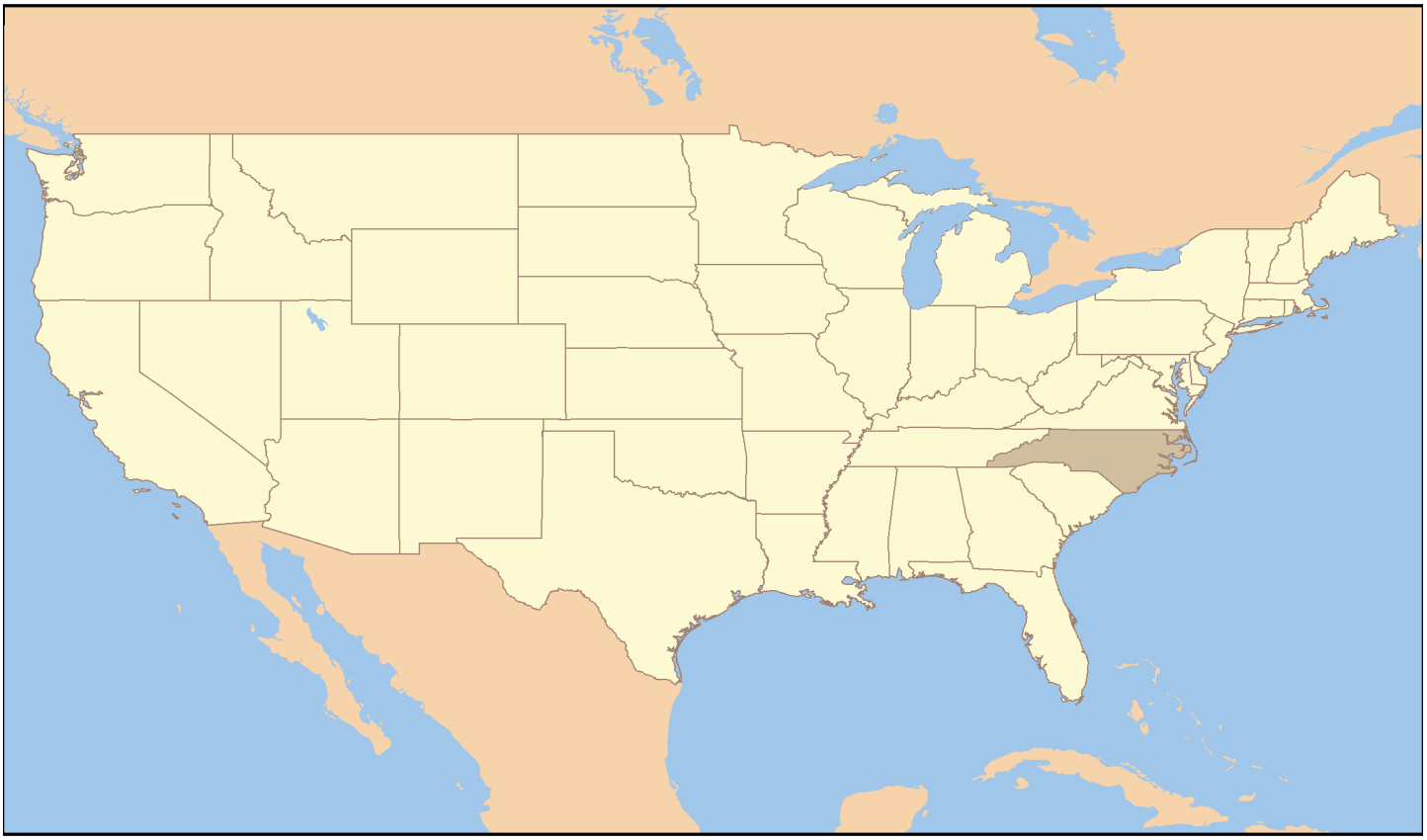
Phillips, S. J. 2018. A Brief Tutorial on Maxent. Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-02/21.

Steven J. Phillips, Miroslav Dudík, Robert E. Schapire. [Internet] Maxent software for modeling species niches and distributions (Version 3.4.1). Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-2-20.

Appendix 4a

U.S. Geological Survey - National Climate Change Viewer

Summary of North Carolina



December 1, 2016

1 Maximum 2-m Air Temperature

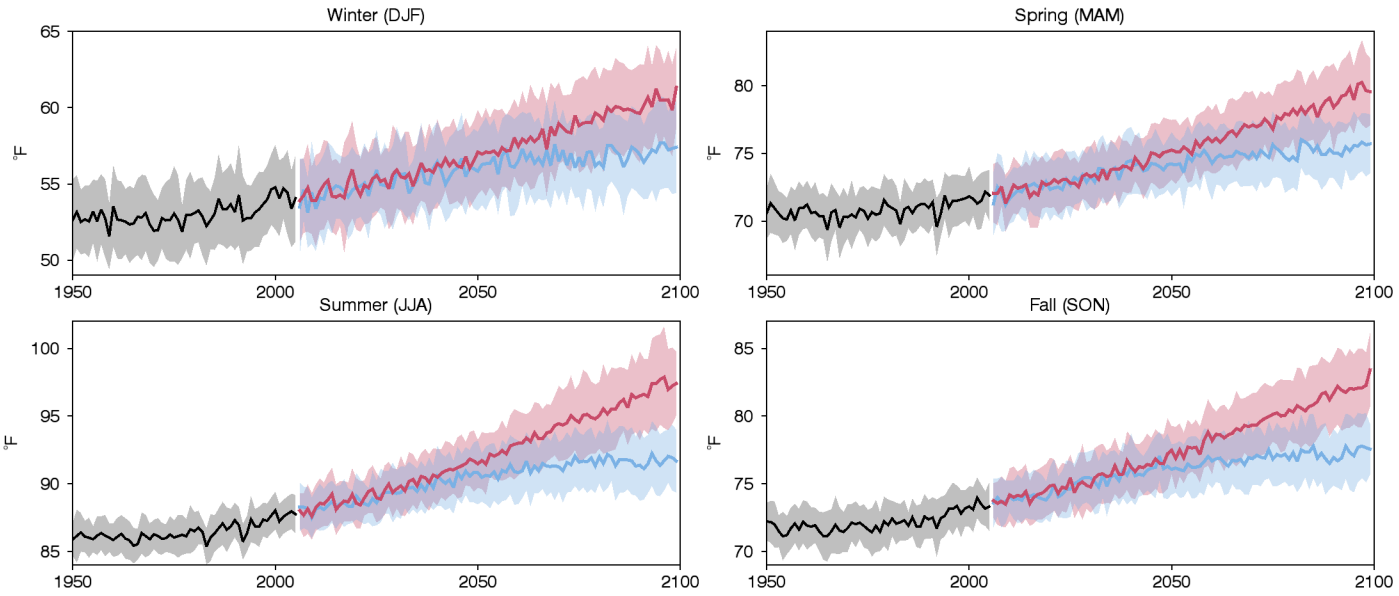


Figure 1: Seasonal average time series of maximum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

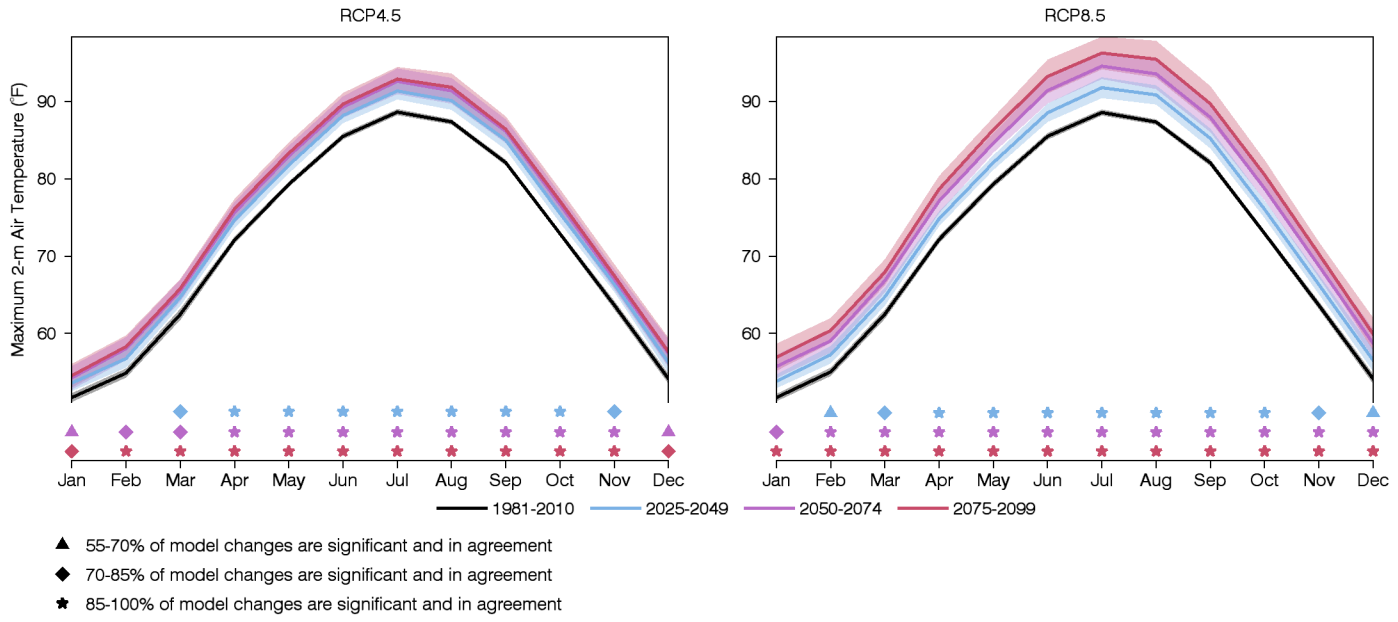


Figure 2: Monthly averages of maximum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

2 Minimum 2-m Air Temperature

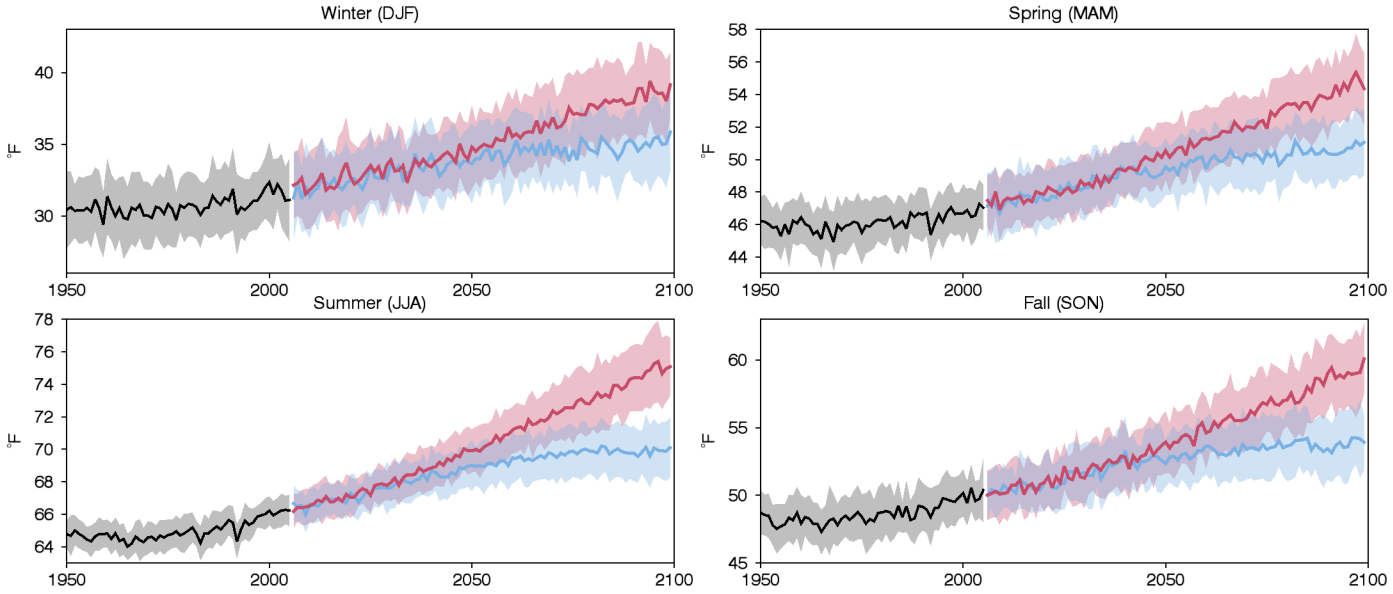


Figure 3: Seasonal average time series of minimum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

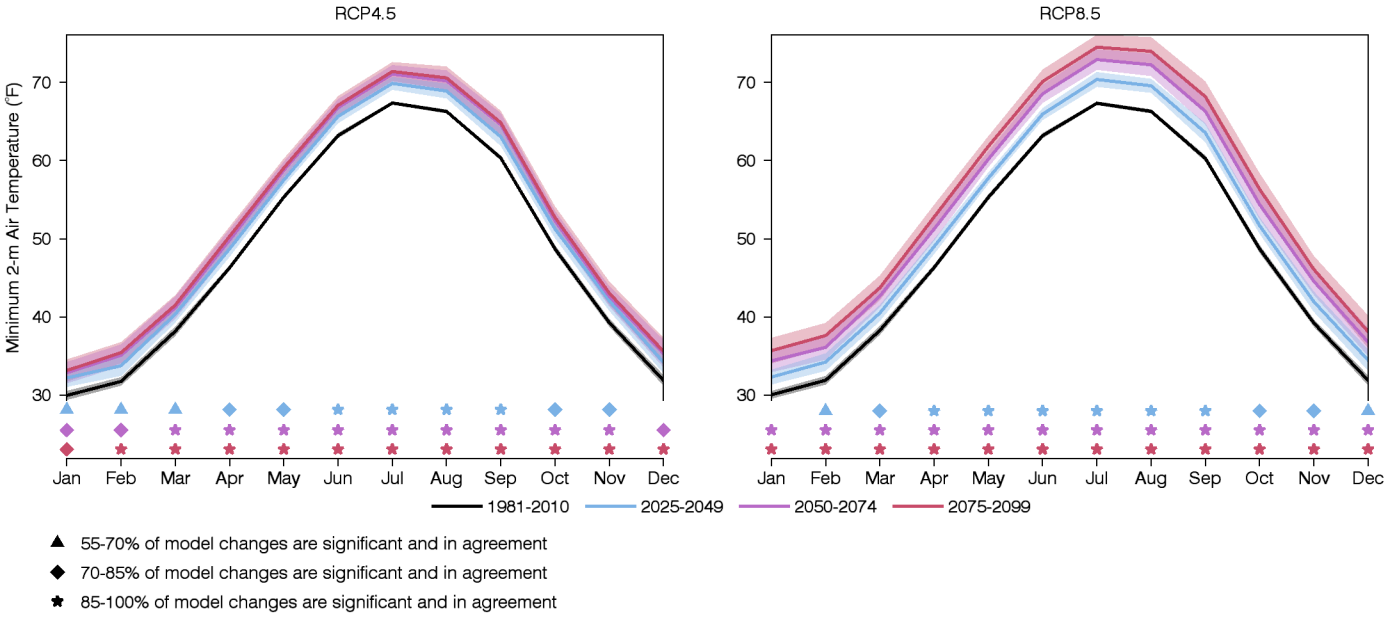


Figure 4: Monthly averages of minimum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

3 Precipitation

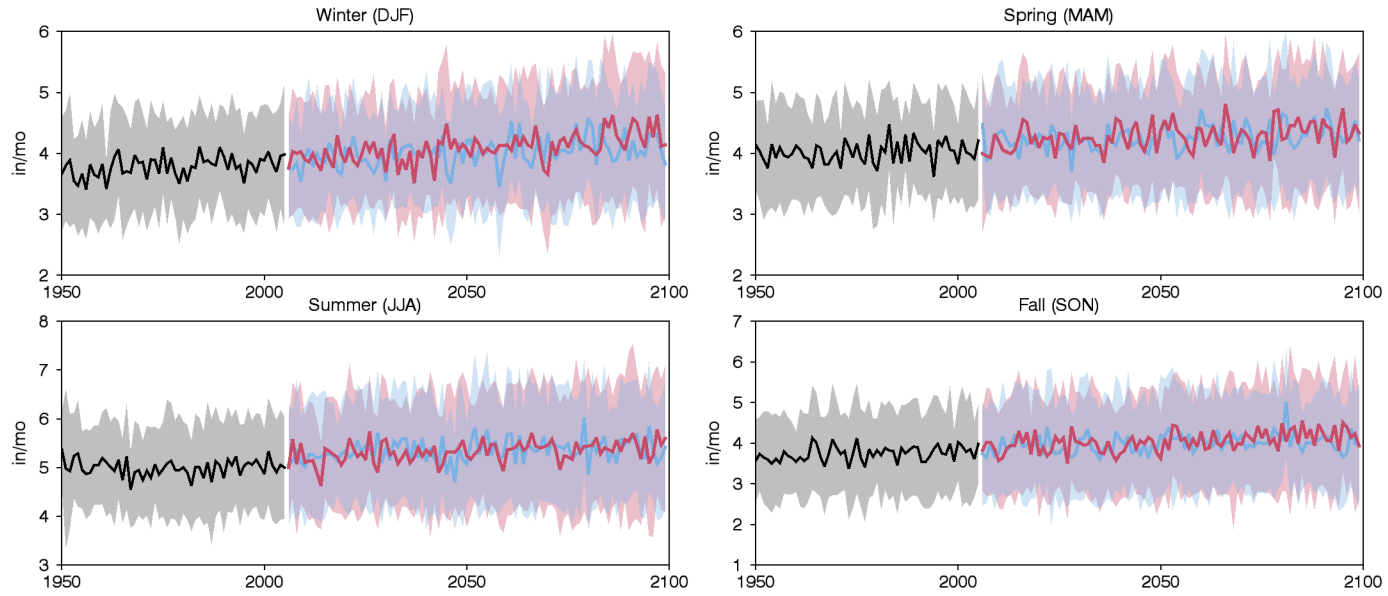


Figure 5: Seasonal average time series of precipitation for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

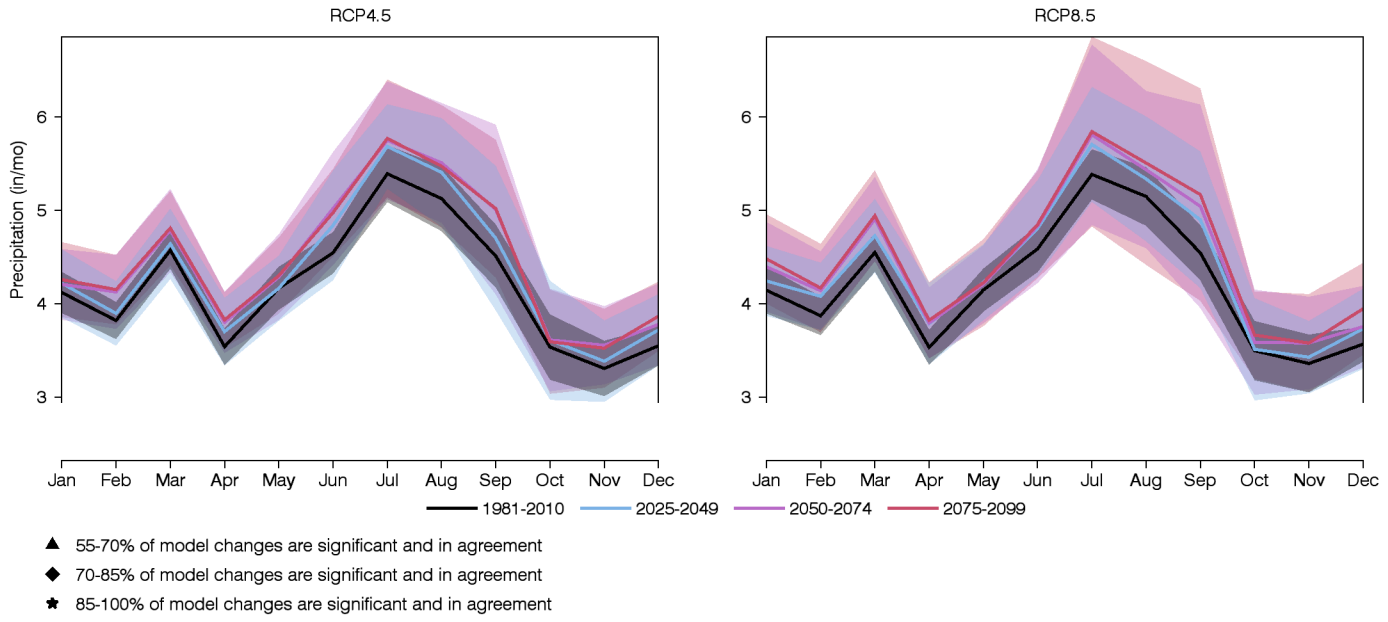


Figure 6: Monthly averages of precipitation for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

4 Snow Water Equivalent

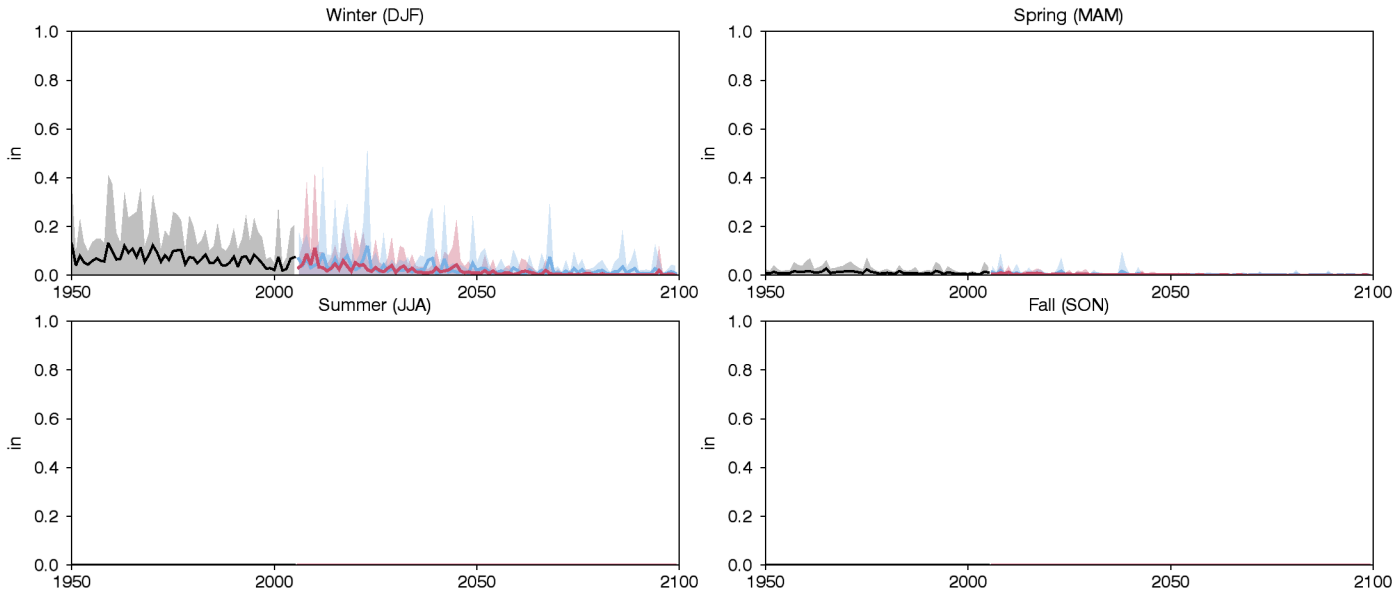


Figure 7: Seasonal average time series of snow water equivalent for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

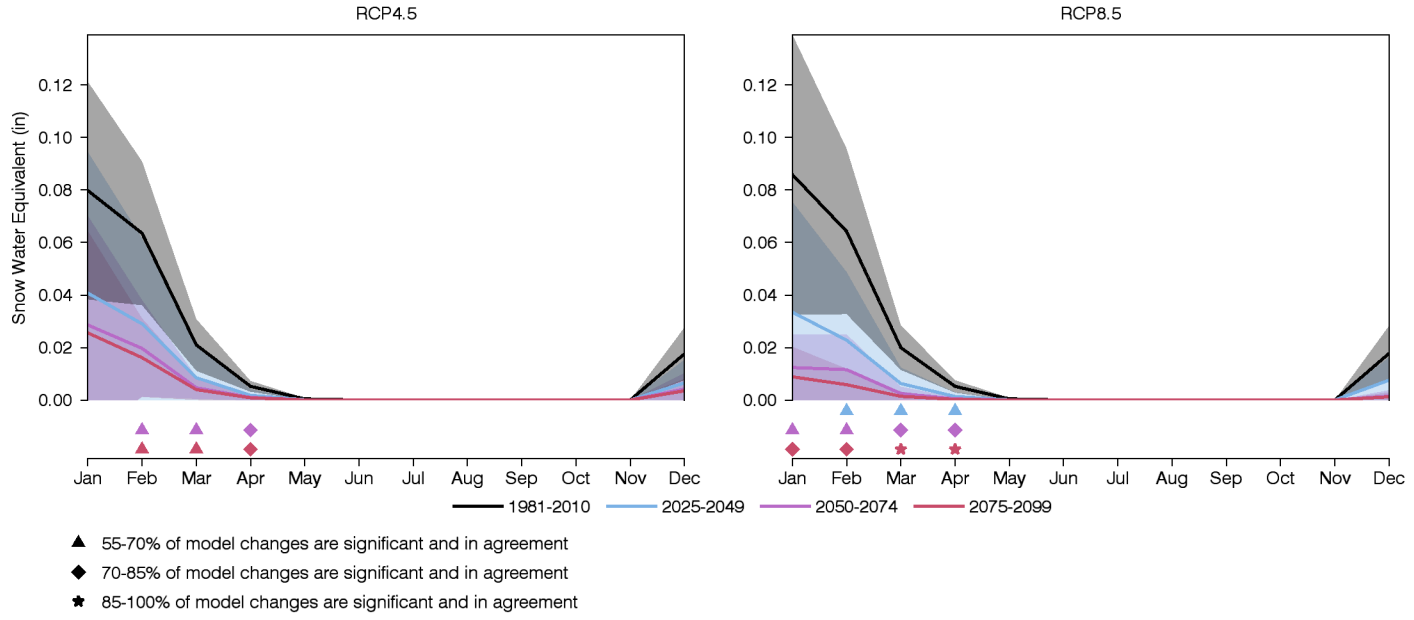


Figure 8: Monthly averages of snow water equivalent for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

5 Runoff

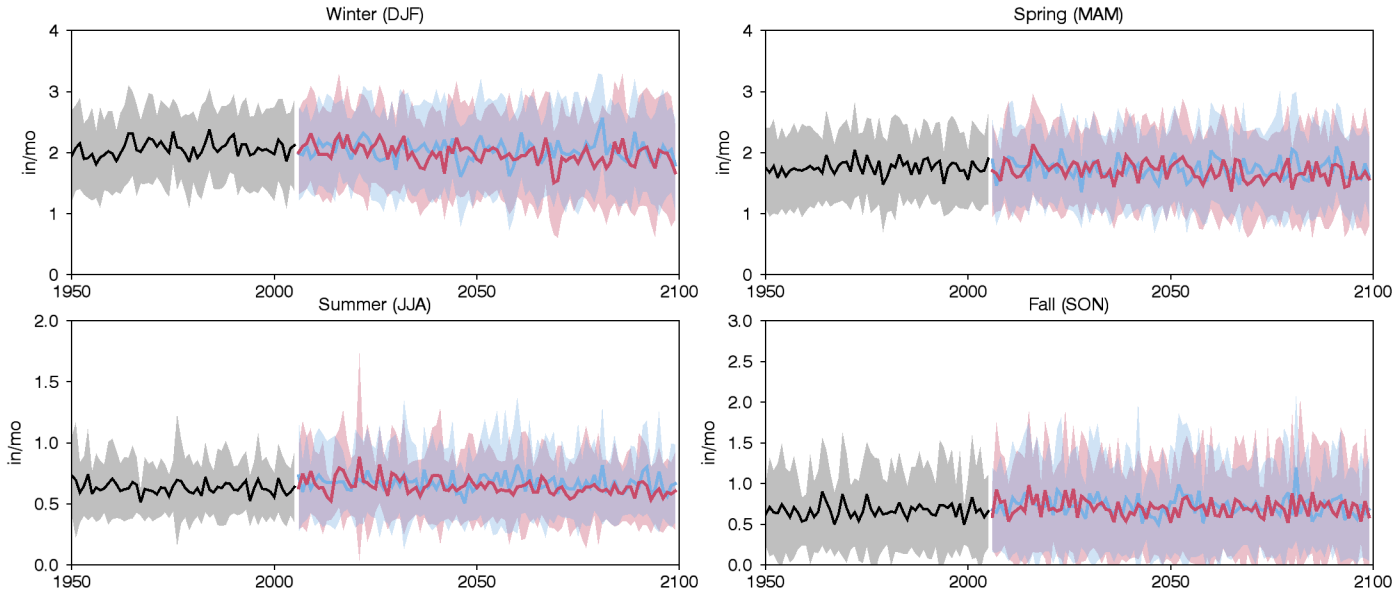


Figure 9: Seasonal average time series of runoff for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

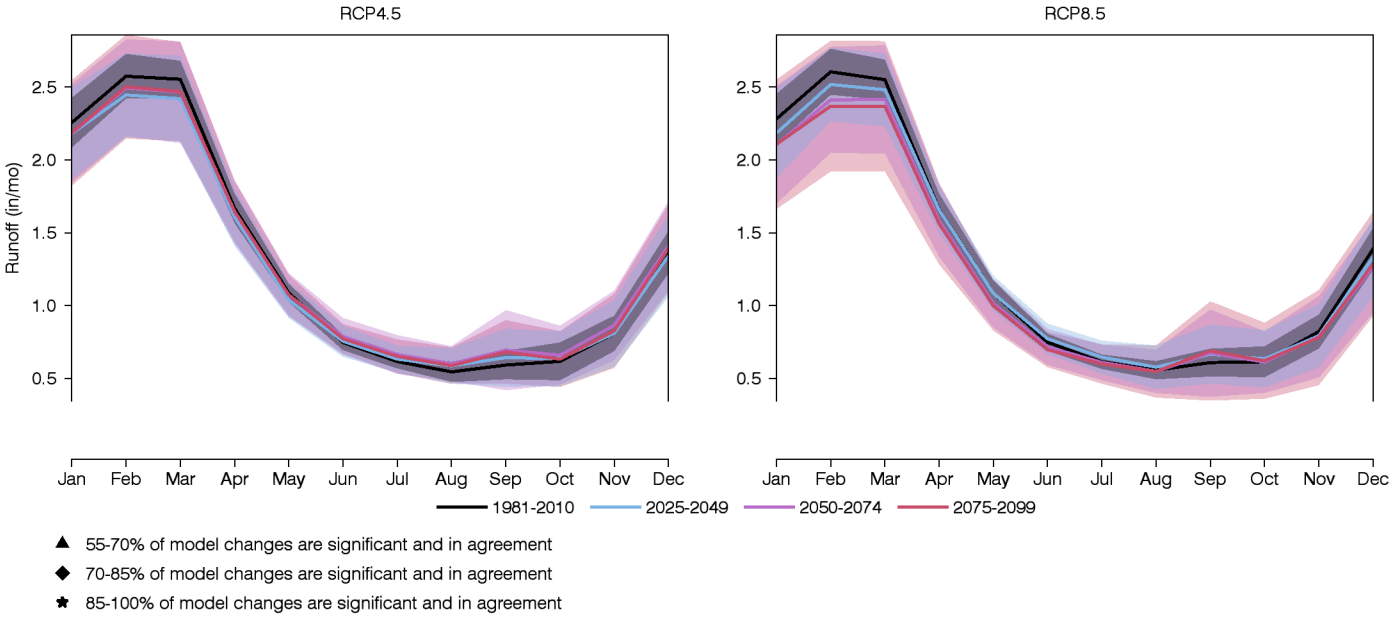


Figure 10: Monthly averages of runoff for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

6 Soil Water Storage

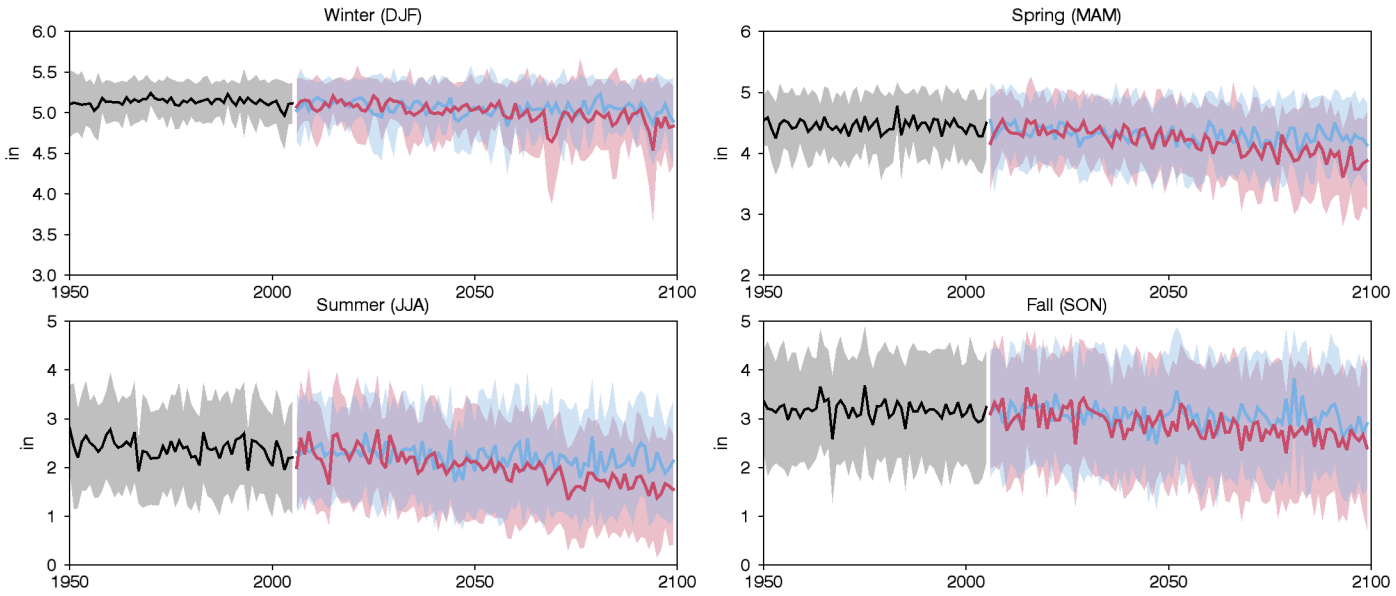


Figure 11: Seasonal average time series of soil water storage for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

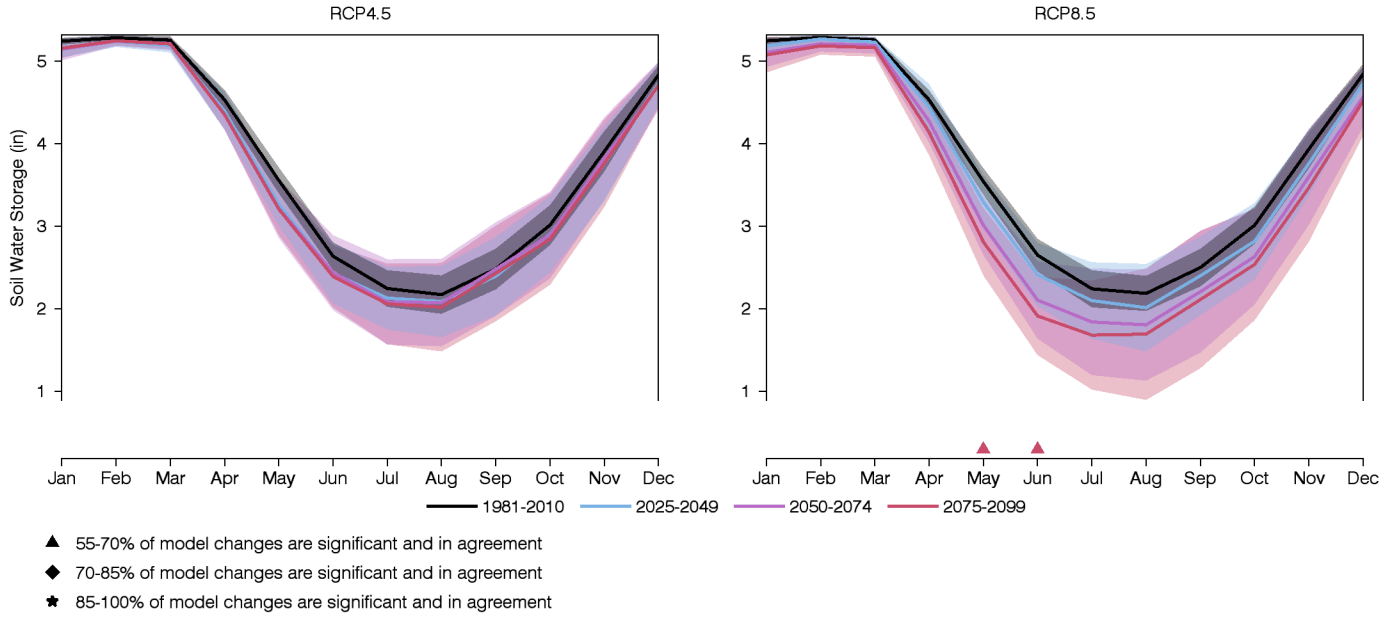


Figure 12: Monthly averages of soil water storage for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

7 Evaporative Deficit

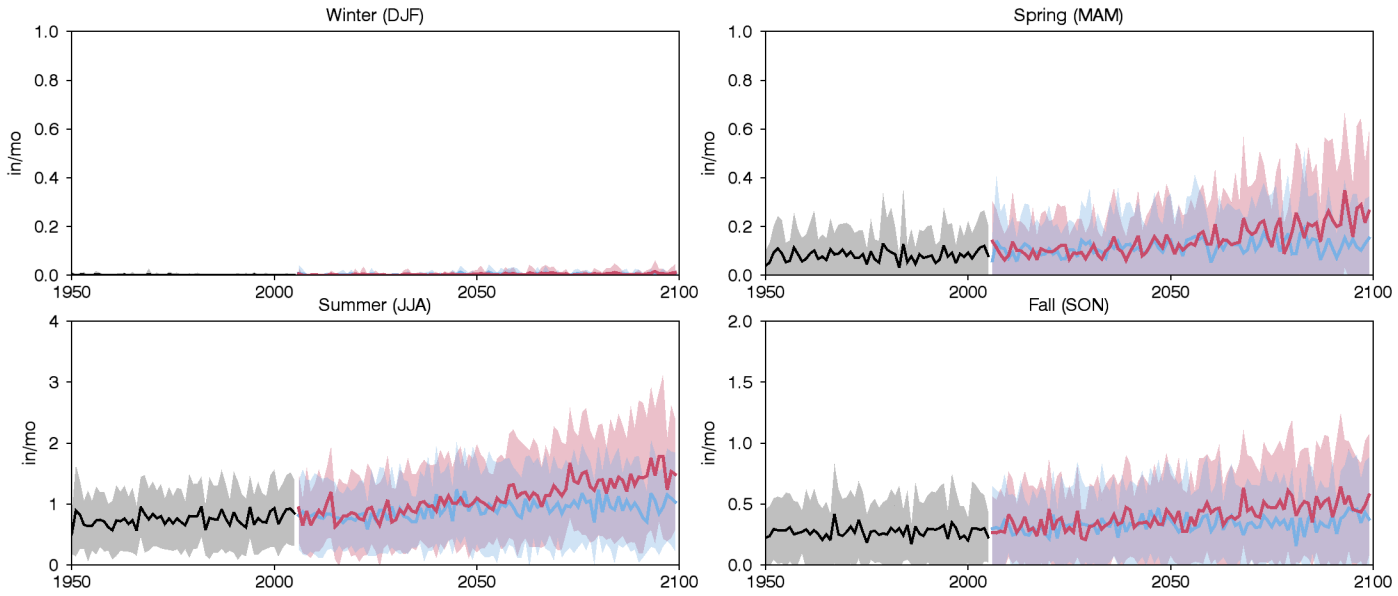


Figure 13: Seasonal average time series of evaporative deficit for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

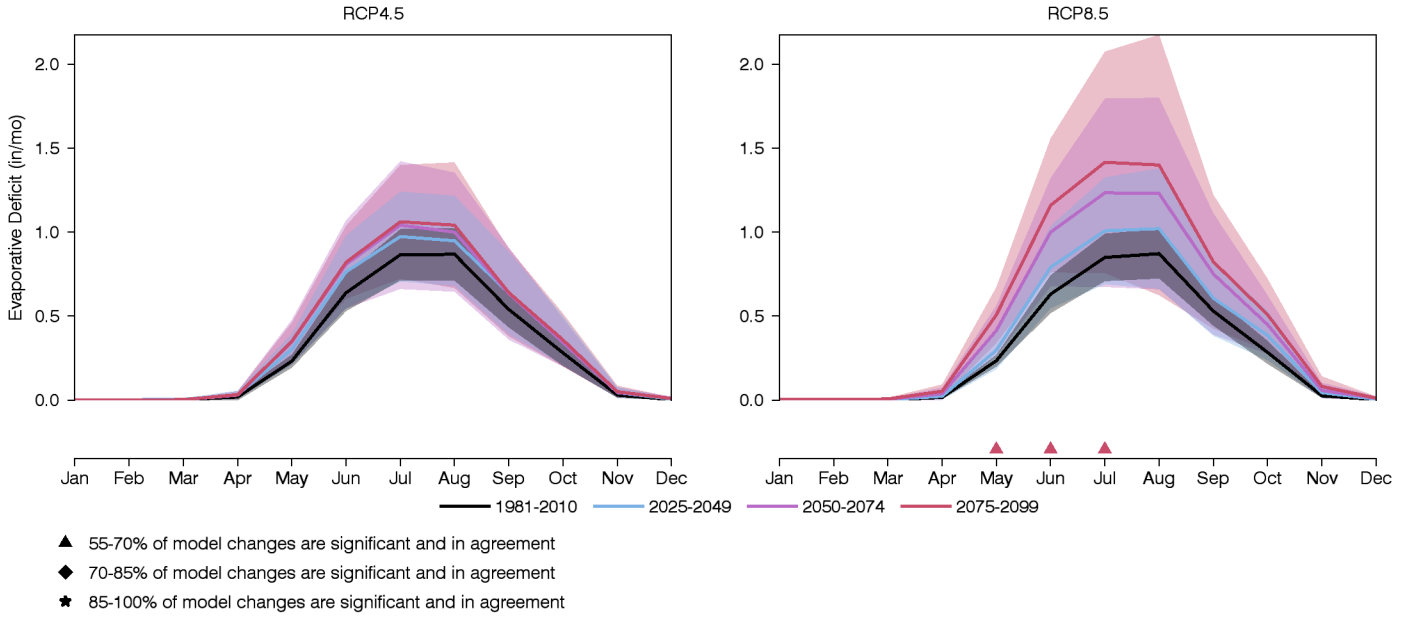


Figure 14: Monthly averages of evaporative deficit for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

8 Data

The temperature and precipitation summaries are created by spatially averaging the NASA NEX-DCP30 data set (Thrasher et al., 2013). The water-balance variables snow water equivalent, runoff, soil water storage and evaporative deficit are simulated by using the NEX-DCP30 temperature and precipitation as input to a simple model (McCabe and Wolock, 2007). The water-balance model accounts for the partitioning of water through the various components of the hydrologic system, but does not account for groundwater, diversions or regulation by impoundments.

9 Models

ACCESS1-0	bcc-csm1-1	bcc-csm1-1-m	BNU-ESM	CanESM2	CCSM4
CESM1-BGC	CMCC-CM	CNRM-CM5	CSIRO-Mk3-6-0	FGOALS-g2	FIO-ESM
GFDL-CM3	GFDL-ESM2G	GFDL-ESM2M	GISS-E2-R	HadGEM2-AO	HadGEM2-CC
HadGEM2-ES	inmcm4	IPSL-CM5A-LR	IPSL-CM5A-MR	IPSL-CM5B-LR	MIROC5
MIROC-ESM	MIROC-ESM-CHEM	MPI-ESM-LR	MPI-ESM-MR	MRI-CGCM3	NorESM1-M

10 Citation Information

Alder, J. R. and S. W. Hostetler, 2013. USGS National Climate Change Viewer. US Geological Survey `http://www.usgs.gov/climate_landuse/clu_rd/nccv.asp` doi:10.5066/F7W9575T.

Hostetler, S.W. and Alder, J.R., 2016. Implementation and evaluation of a monthly water balance model over the U.S. on an 800 m grid. Water Resources Research, 52, doi:10.1002/2016WR018665.

Thrasher, B., J. Xiong, W. Wang, F. Melton, A. Michaelis, and R. Nemani, 2013. New downscaled climate projections suitable for resource management in the U.S. Eos, Transactions American Geophysical Union 94, 321-323, doi:10.1002/2013EO370002.

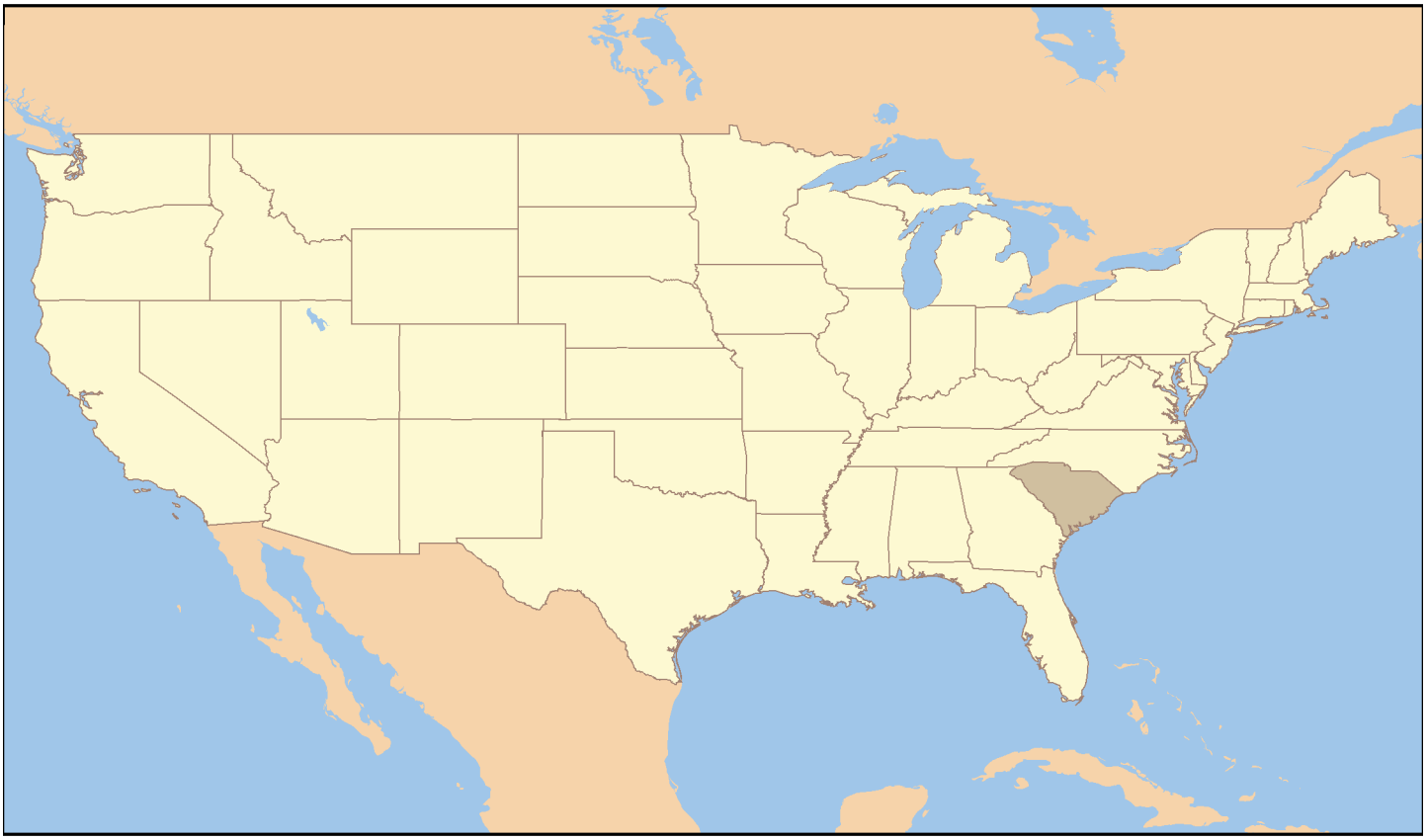
11 Disclaimer

These freely available, derived data sets were produced by J. Alder and S. Hostetler, US Geological Survey (USGS). The original climate data are from the NEX-DCP30 dataset, which was prepared by the Climate Analytics Group and NASA Ames Research Center using the NASA Earth Exchange, and is distributed by the NASA Center for Climate Simulation. No warranty expressed or implied is made by the USGS regarding the display or utility of the derived data on any other system, or for general or scientific purposes, nor shall the act of distribution constitute any such warranty. The USGS shall not be held liable for improper or incorrect use of the data described and/or contained herein.

Appendix 4b

U.S. Geological Survey - National Climate Change Viewer

Summary of South Carolina



December 1, 2016

1 Maximum 2-m Air Temperature

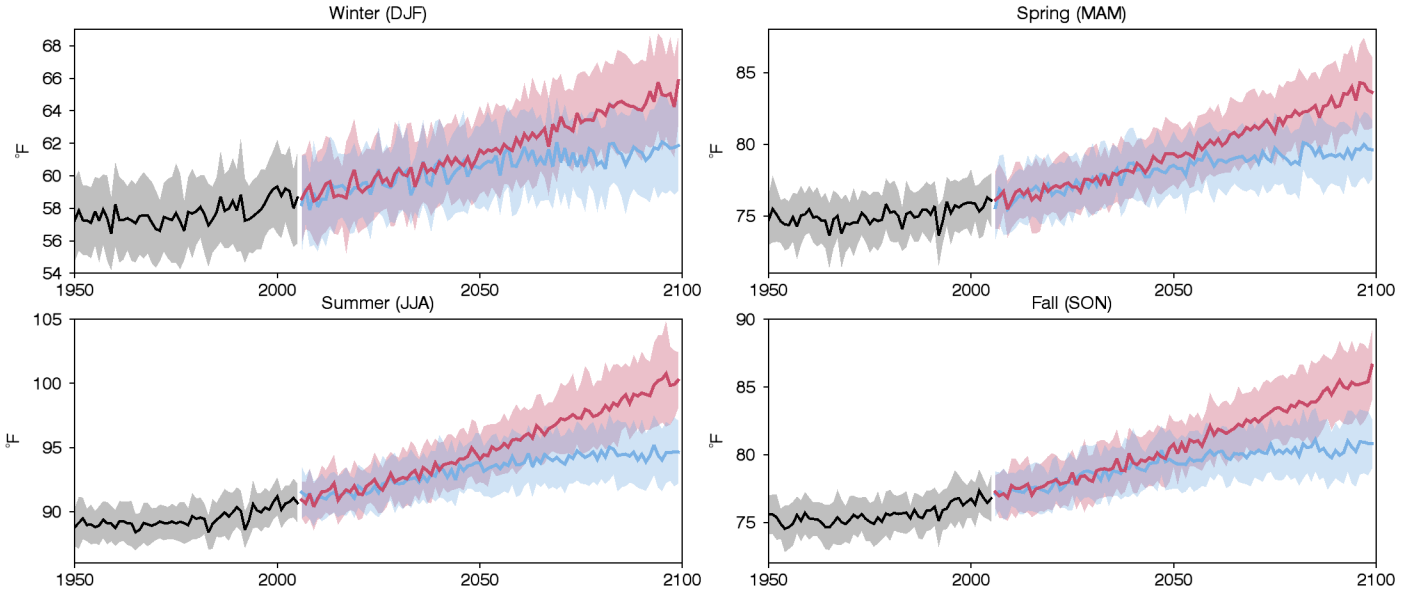


Figure 1: Seasonal average time series of maximum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

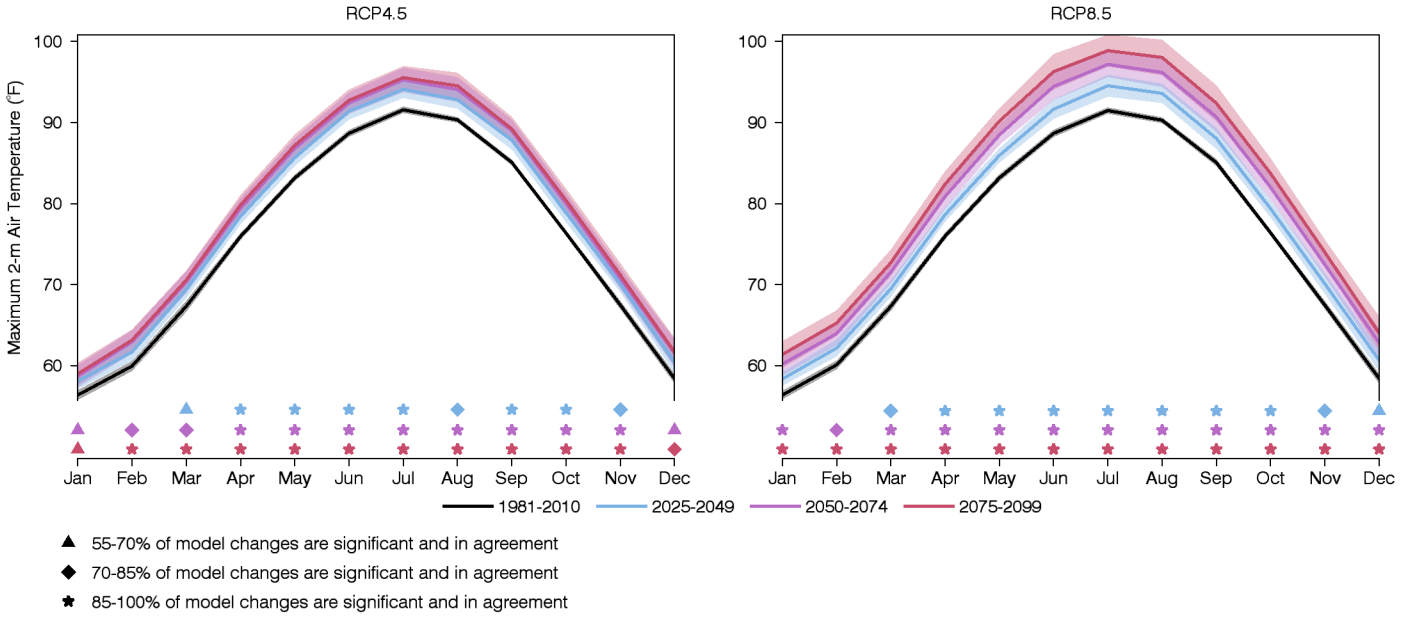


Figure 2: Monthly averages of maximum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

2 Minimum 2-m Air Temperature

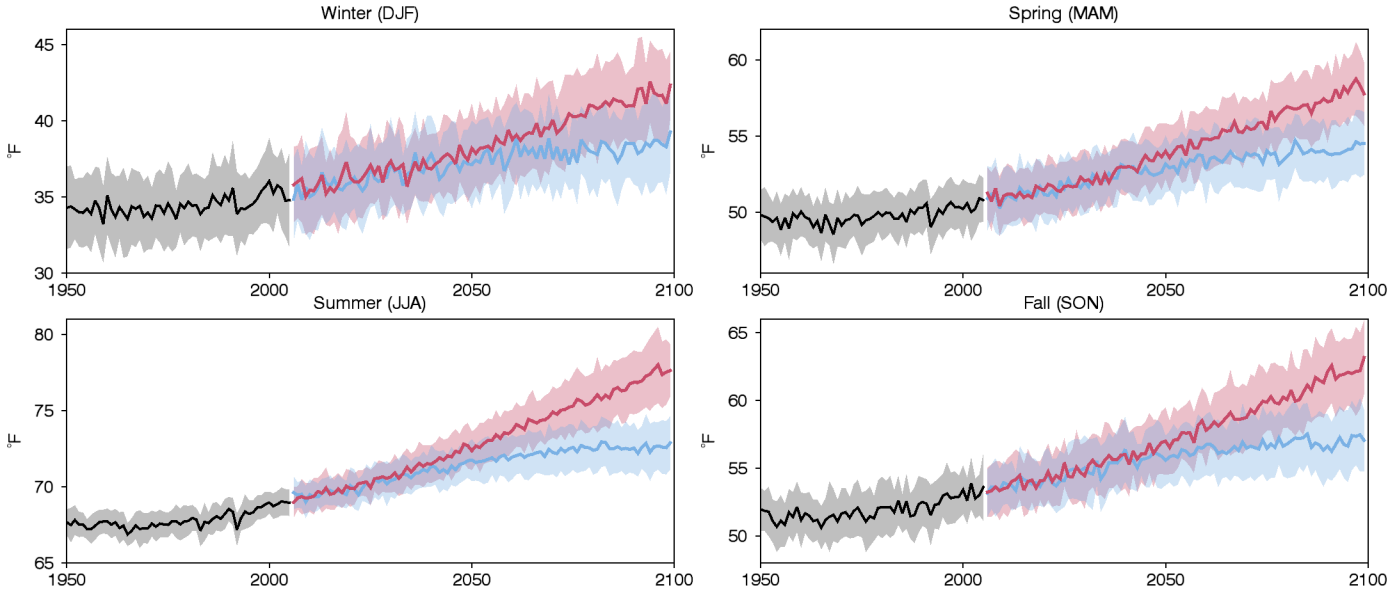


Figure 3: Seasonal average time series of minimum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

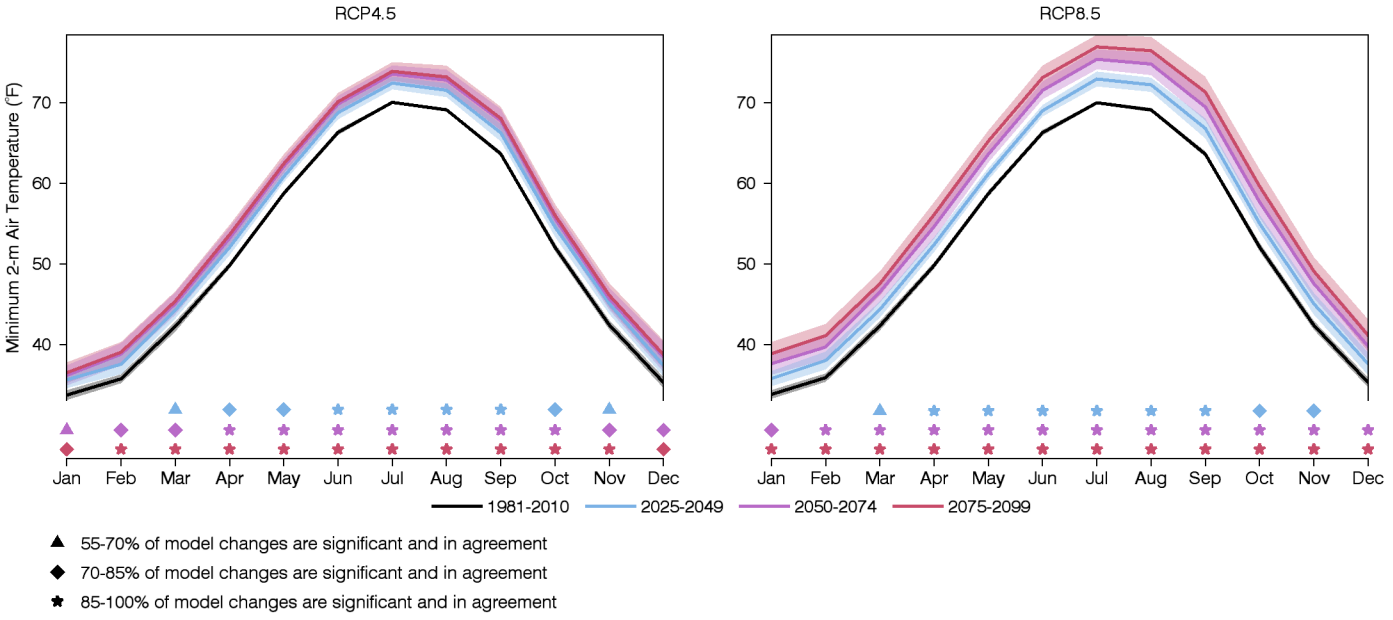


Figure 4: Monthly averages of minimum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

3 Precipitation

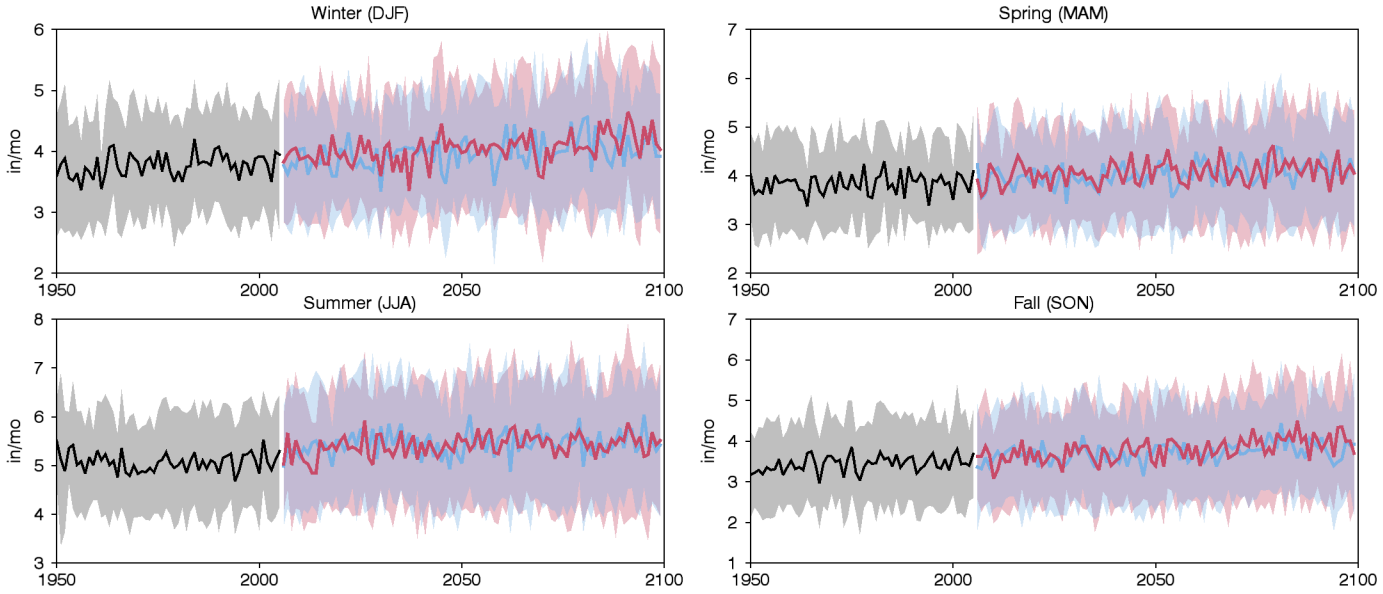


Figure 5: Seasonal average time series of precipitation for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

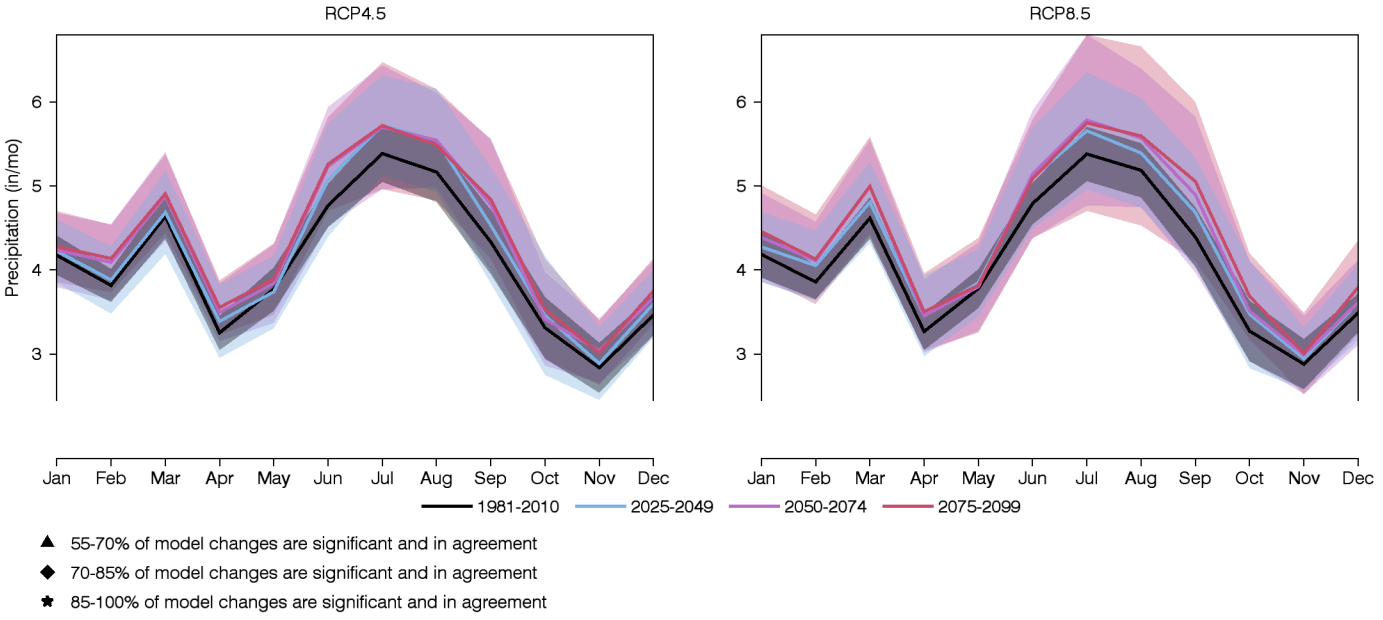


Figure 6: Monthly averages of precipitation for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

4 Snow Water Equivalent

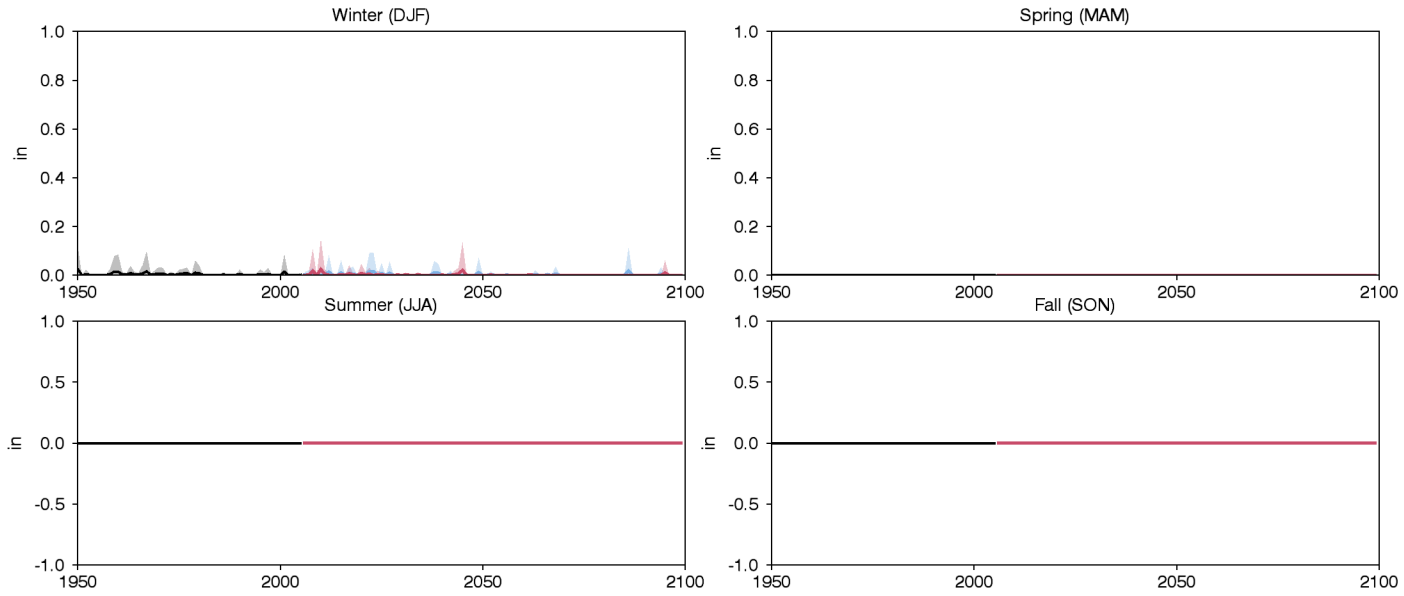


Figure 7: Seasonal average time series of snow water equivalent for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

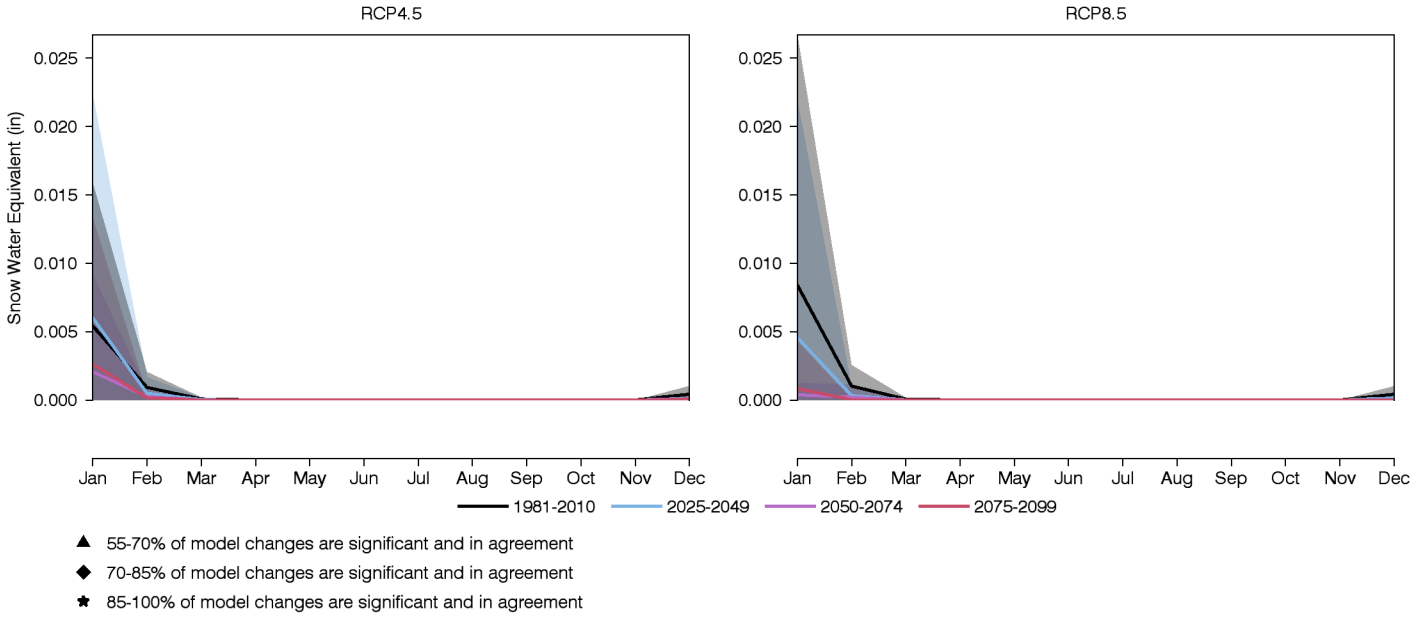


Figure 8: Monthly averages of snow water equivalent for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

5 Runoff

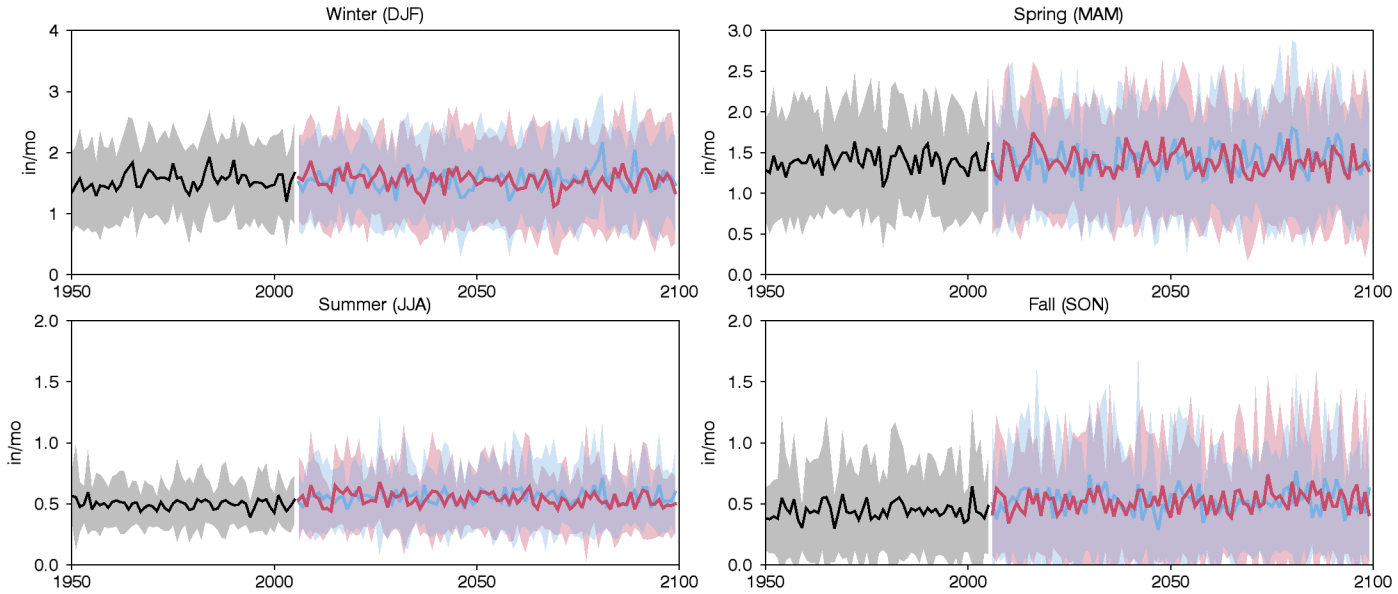


Figure 9: Seasonal average time series of runoff for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

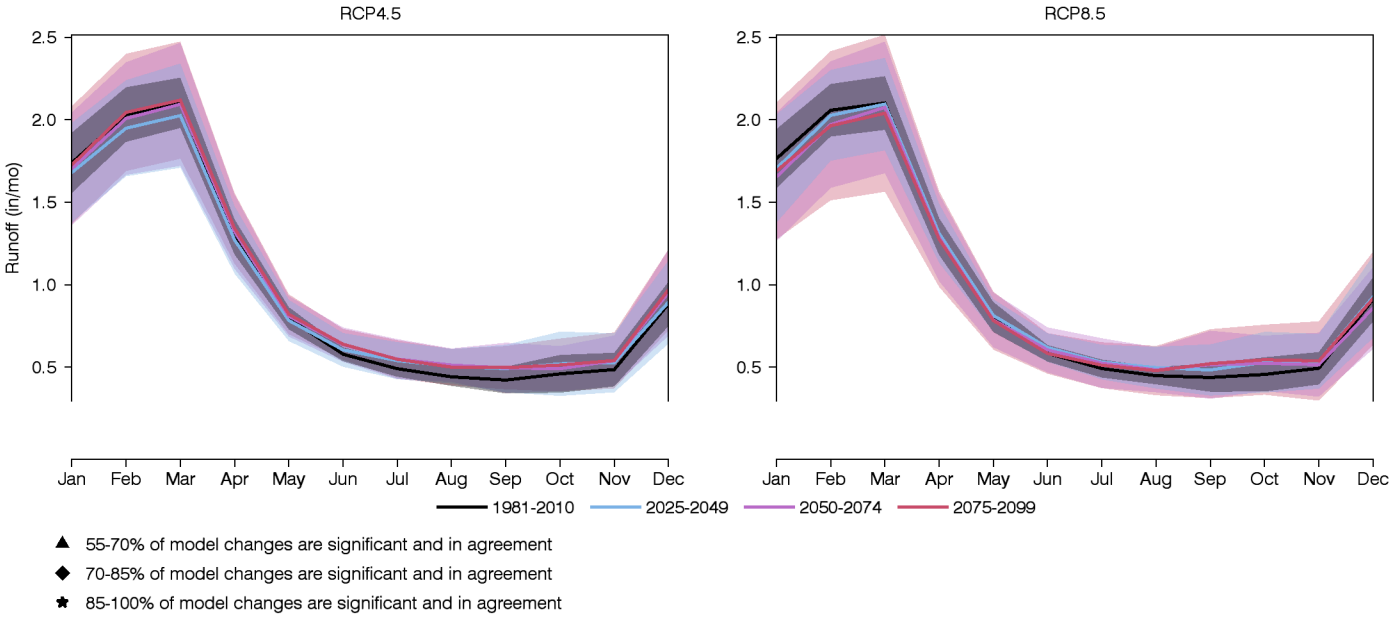


Figure 10: Monthly averages of runoff for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

6 Soil Water Storage

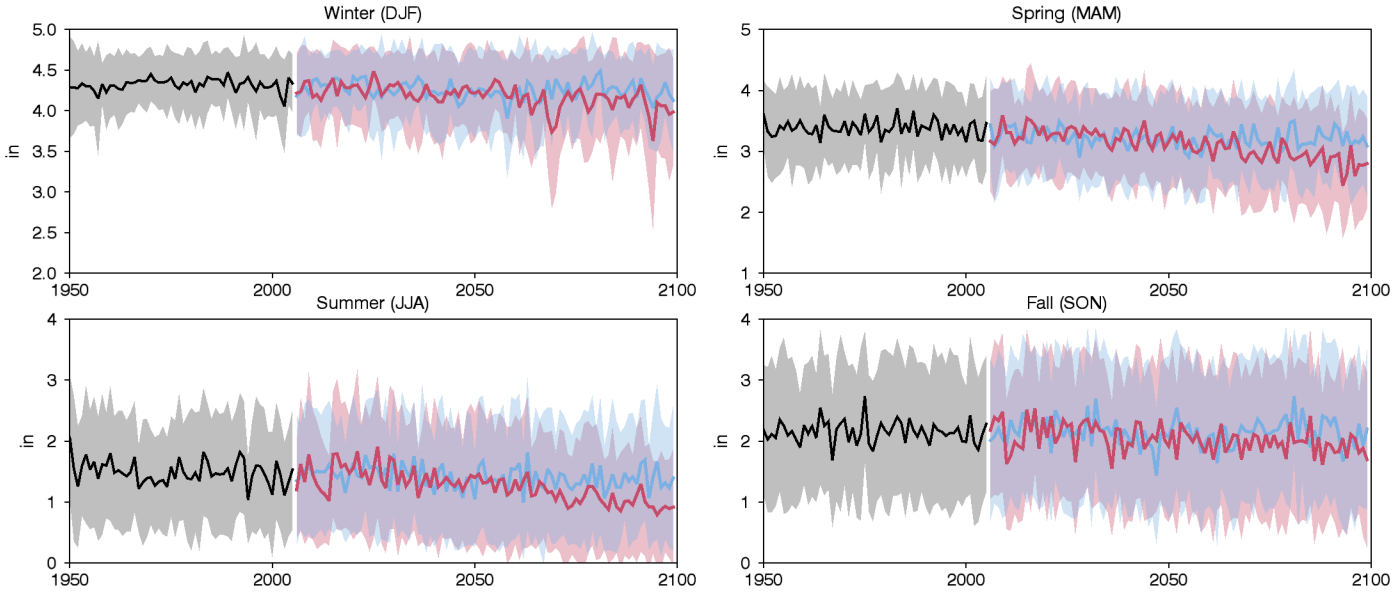


Figure 11: Seasonal average time series of soil water storage for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

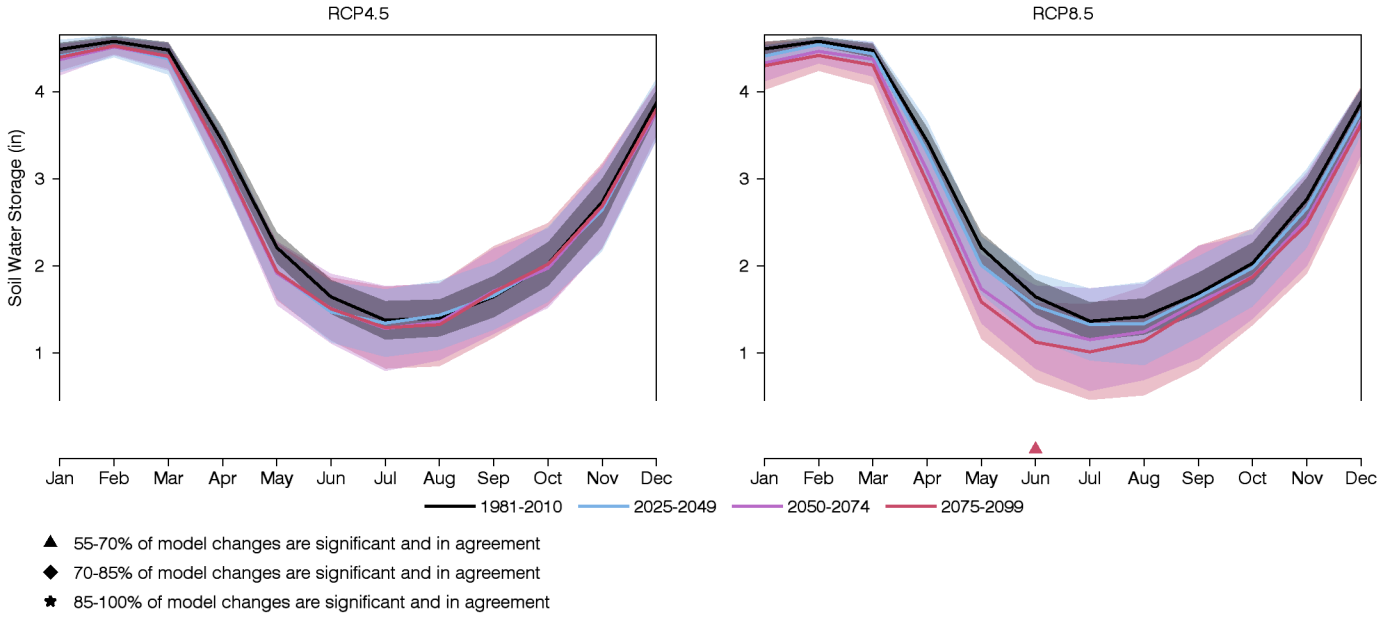


Figure 12: Monthly averages of soil water storage for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

7 Evaporative Deficit

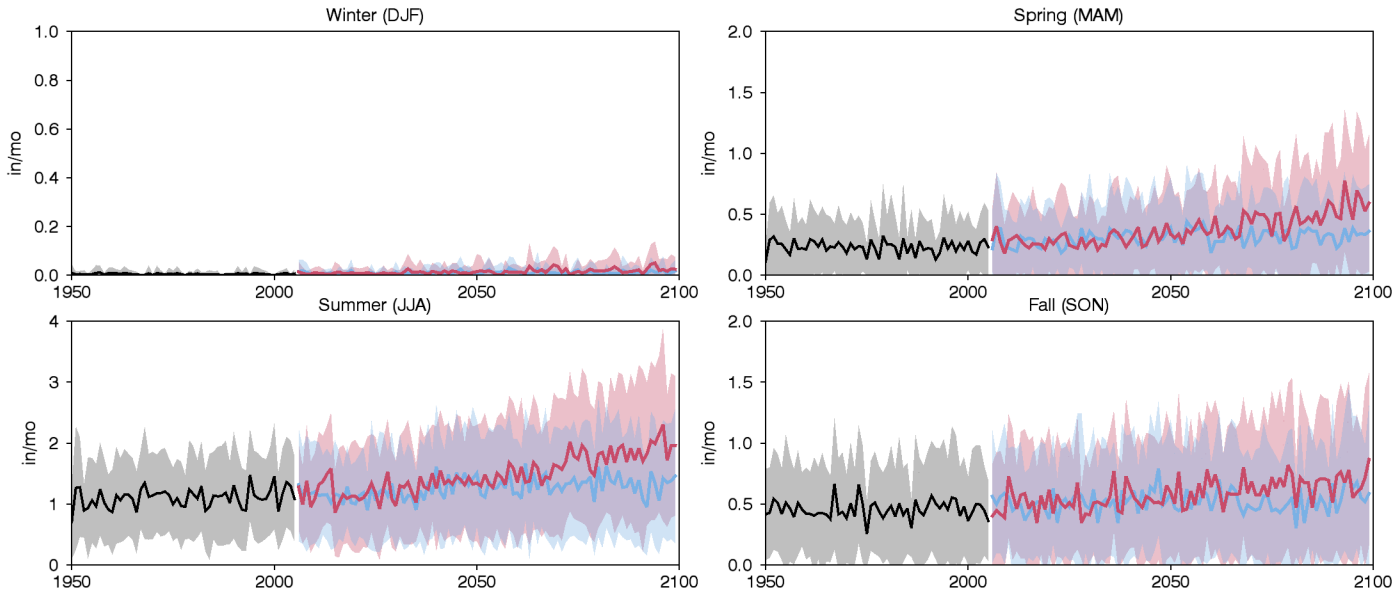


Figure 13: Seasonal average time series of evaporative deficit for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

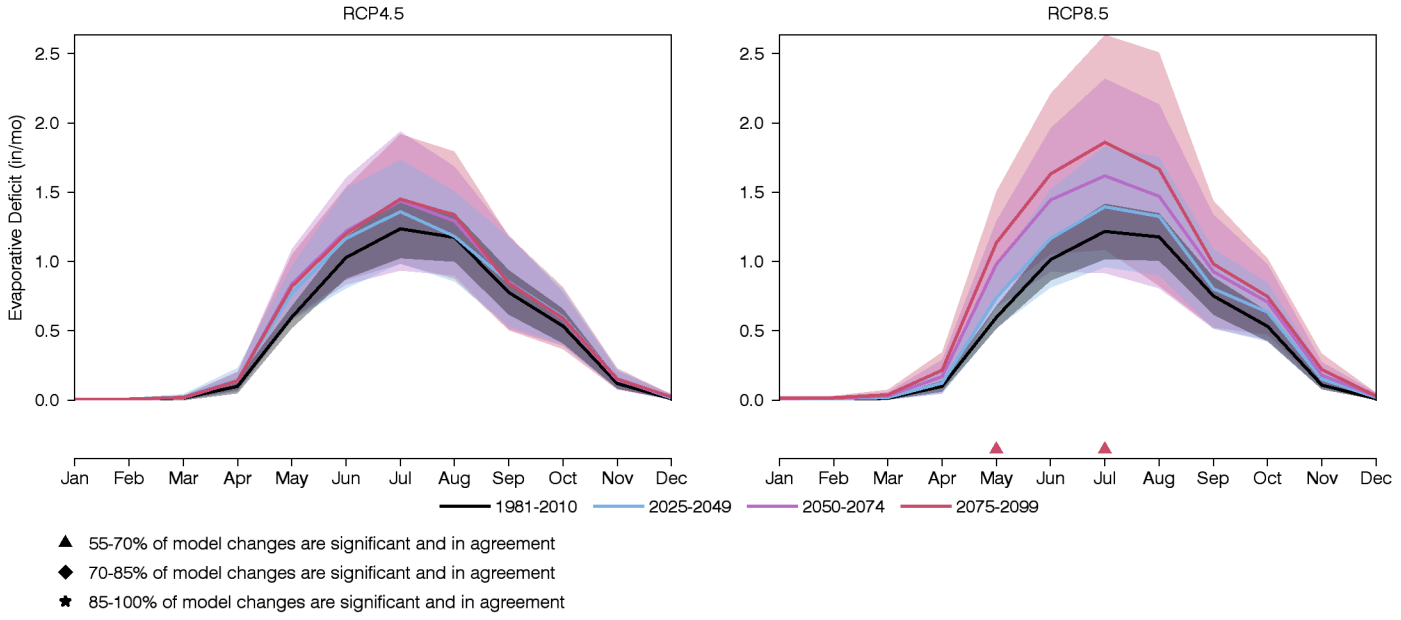


Figure 14: Monthly averages of evaporative deficit for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

8 Data

The temperature and precipitation summaries are created by spatially averaging the NASA NEX-DCP30 data set (Thrasher et al., 2013). The water-balance variables snow water equivalent, runoff, soil water storage and evaporative deficit are simulated by using the NEX-DCP30 temperature and precipitation as input to a simple model (McCabe and Wolock, 2007). The water-balance model accounts for the partitioning of water through the various components of the hydrologic system, but does not account for groundwater, diversions or regulation by impoundments.

9 Models

ACCESS1-0	bcc-csm1-1	bcc-csm1-1-m	BNU-ESM	CanESM2	CCSM4
CESM1-BGC	CMCC-CM	CNRM-CM5	CSIRO-Mk3-6-0	FGOALS-g2	FIO-ESM
GFDL-CM3	GFDL-ESM2G	GFDL-ESM2M	GISS-E2-R	HadGEM2-AO	HadGEM2-CC
HadGEM2-ES	inmcm4	IPSL-CM5A-LR	IPSL-CM5A-MR	IPSL-CM5B-LR	MIROC5
MIROC-ESM	MIROC-ESM-CHEM	MPI-ESM-LR	MPI-ESM-MR	MRI-CGCM3	NorESM1-M

10 Citation Information

Alder, J. R. and S. W. Hostetler, 2013. USGS National Climate Change Viewer. US Geological Survey `http://www.usgs.gov/climate_landuse/clu_rd/nccv.asp` doi:10.5066/F7W9575T.

Hostetler, S.W. and Alder, J.R., 2016. Implementation and evaluation of a monthly water balance model over the U.S. on an 800 m grid. Water Resources Research, 52, doi:10.1002/2016WR018665.

Thrasher, B., J. Xiong, W. Wang, F. Melton, A. Michaelis, and R. Nemani, 2013. New downscaled climate projections suitable for resource management in the U.S. Eos, Transactions American Geophysical Union 94, 321-323, doi:10.1002/2013EO370002.

11 Disclaimer

These freely available, derived data sets were produced by J. Alder and S. Hostetler, US Geological Survey (USGS). The original climate data are from the NEX-DCP30 dataset, which was prepared by the Climate Analytics Group and NASA Ames Research Center using the NASA Earth Exchange, and is distributed by the NASA Center for Climate Simulation. No warranty expressed or implied is made by the USGS regarding the display or utility of the derived data on any other system, or for general or scientific purposes, nor shall the act of distribution constitute any such warranty. The USGS shall not be held liable for improper or incorrect use of the data described and/or contained herein.

Appendix 5

Protected status of current populations throughout the range of the dwarf-flowered heartleaf. Protected status is as follows: 1-protected in perpetuity; 2-protected, but not in perpetuity; 3-not protected.

Population Number	Protection Status
1	1
2	1
3	1
4	1
5	3
2	2 (part)
23	3
29	3
31	2 (part)
44	1
59	2(part)
71	3
77	1
85	3
93	3
96	1 (part)
98	3
99	2 (part)
100	1 (part)
124	3
125	2
130	3
154	1
157	3
158	2/3
176	3
177	3
178	2
179	2(part)
183	1
195	3
206	3
208	2
214	2 (part)
216	2 (part)
217	1
219	3
226	1 (part)
227	1
229	1
232	3
243	1/2 (part)
245	2/3
247	1 (part)

248	3
252	?
261	3
271	1
272	3
274	3
275	3
276	2
279	3
287	1
291	2(part)
292	3
293	3
295	2 (part)
296	3
297	3
298	3
299	3
300	3
302	1 (part)
303	1/2
304	1
306	3
307	2(part)
308	2 (part)
309	3
311	1
312	1
316	?
317	3
318	2 (part)
320	3
321	3
Rock Barn Solar Farm	1

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Chapter 1: INTRODUCTION

The dwarf-flowered heartleaf (*Hexastylis naniflora*) is a species of plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. The dwarf-flowered heartleaf has been listed as threatened under the Endangered Species Act of 1973, as amended (Act), since 1989 (FR 54 14964-14967). The Species Status Assessment (SSA) framework (USFWS 2016, entire) summarizes the information compiled and reviewed by the US Fish and Wildlife Service (Service), incorporating the best available scientific and commercial data, to conduct an in-depth review of the species' biology and threats, evaluate its biological status, and assess the resources and conditions needed to maintain long-term viability. The intent is for the SSA to be easily updated as new information becomes available and to support all functions of the Endangered Species Program from listing to consultations to recovery.

A Recovery Plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to make significant progress toward recovery of the species. The Service is initiating this SSA to aid in determining the appropriateness of reclassifying the species. In the event that the SSA does not support reclassification, the SSA will be used to inform the development of a Recovery Plan. Importantly, the SSA does not result in a decision by the Service on whether this species should be proposed for reclassification under the Act. Instead, this SSA provides a review of the available information strictly related to the biological status of the dwarf-flowered heartleaf. The reclassification decision will be made by the Service after reviewing this document and all relevant laws, regulations, and policies. The results of a proposed decision will be announced in the *Federal Register*, with appropriate opportunities for public input.

For the purpose of this assessment, we generally define viability as the ability of the species to sustain populations in its natural systems over time. Using the SSA framework (Figure 1.1), we consider what the species needs to maintain viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation (Wolf *et al.* 2015, entire).

- **Resiliency** describes the ability of populations to withstand stochastic events (arising from random factors). We can measure resiliency based on metrics of population health;

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

for example, birth versus death rates and population size. Highly resilient populations are better able to withstand disturbances such as random fluctuations in birth rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic activities.

- **Redundancy** describes the ability of a species to withstand catastrophic events. Measured by the number of populations, their resiliency, and their distribution (and connectivity), redundancy gauges the probability that the species has a margin of safety to withstand or can bounce back from catastrophic events (such as a rare destructive natural event or episode involving many populations).
- **Representation** describes the ability of a species to adapt to changing environmental conditions. Representation can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. The more representation, or diversity, a species has, the more it is capable of adapting to changes (natural or human caused) in its environment. In the absence of species-specific genetic and ecological diversity information, we evaluate representation based on the extent and variability of habitat characteristics across the geographical range.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

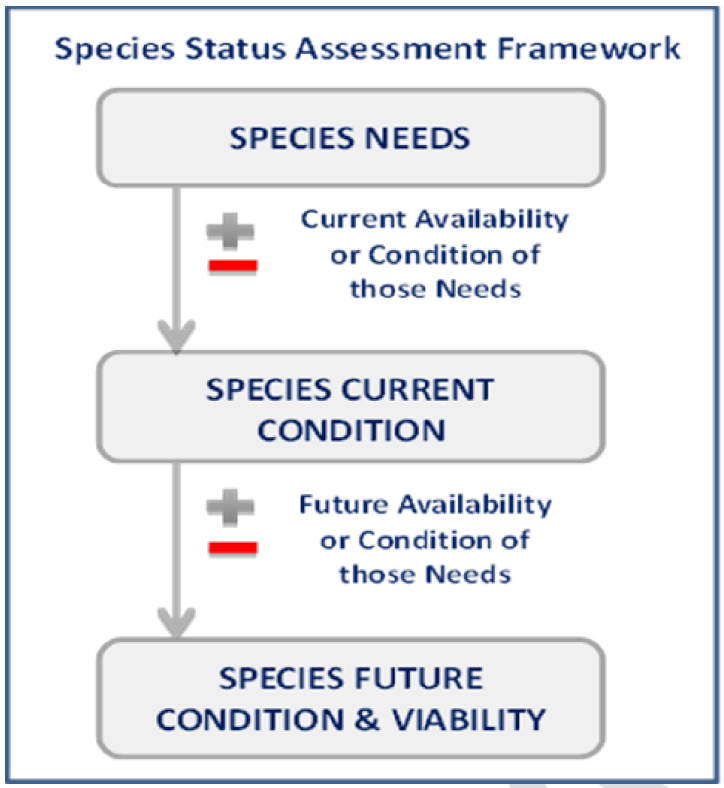


Figure 1.1. Species Status Assessment Framework

To evaluate the biological status of the dwarf-flowered heartleaf, both currently and into the future, we assessed a range of conditions to allow us to consider the species' resiliency, redundancy, and representation (together, the 3Rs). This SSA provides a thorough assessment of biology and natural history, and assesses demographic risks, stressors, and limiting factors in the context of determining the viability and risks of extinction for the species.

The format for this SSA includes: (1) Biology and Species Needs, (2) Current Conditions, (3) Influences on Viability, and (4) Future Conditions. This document is a compilation of the best available scientific and commercial information, and a description of past, present, and likely future risk factors to the dwarf-flowered heartleaf.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Chapter 2: SPECIES BIOLOGY

In this chapter, we provide basic biological information about the dwarf-flowered heartleaf, including its taxonomic history, species description, distribution, life history traits, and habitat characteristics. We then use this information to outline the resource needs within various life stages of dwarf-flowered heartleaf. Here we report those aspects of the life history of the dwarf-flowered heartleaf that are important to our analysis.

Taxonomy and species description

Dwarf-flowered heartleaf is a rare, low growing herbaceous plant in the birthwort family (Aristolochiaceae). The species was described by Blomquist (1957) in his revision of the North American members of the genus *Hexastylis*. The dwarf-flowered heartleaf has been recognized as part of the Virginica Group, and this group was further subdivided into three Subgroups: Virginica, Shuttleworthii, and Heterophylla (Blomquist 1957; Whittemore and Gaddy 1997). Three species have been recognized in the Heterophylla complex, *Hexastylis naniflora, H. heterophylla* and *H. minor*, and field biologist have generally recognized that considerable morphological overlap occurs (Murrell et al. 2007). One of the main concerns regarding this complex was the inability to distinguish between species without access to fresh flowers. Even with fresh flowers, Blomquist (1957) and Gaddy (1987) still recognized considerable overlap in flower morphology making species delineation difficult.

Murell et al. 2007, conducted a comparative genetic analysis using Inter Simple Sequence Repeats, and were unable to find banding patterns that could be used to separate *H. naniflora* from the other members within the complex. However, based on biogeographical, ecological, molecular, morphological, as well as micromorphological work, their results show that *H. naniflora* is a well-defined species.

Although there has been considerable disagreement on the generic distinctiveness of *Hexastylis* and *Asarum* (Barringer 1993 and Kelly 1997, 1998, 2001), a recent phylogeny estimate using chloroplast genes supports that *Hexastylis* is a monophyletic clade and therefore should be

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

recognized as a genus (Niedenberger 2010). Additionally, most North American publications recognize *Hexastylis* at the generic level (Flora of North America 1997, Weakley 2015).

The Service is not aware of any proposed changes in taxonomy that would affect the continued legal status of *H. naniflora* under the Act. However, within the range of *H. naniflora* there are populations which fall outside of the range of published values for key floral characteristics, overlapping with values described for *H. heterophylla* or *H. minor* (Figure 2.1; Weakley, 2010; Murrell et al. 2007; Gaddy 1987). These geographic areas of overlap in key characters have been the focus of recent genetic analyses (Murrell et al. 2007; Renninger, 2010; Murrell, 2015).

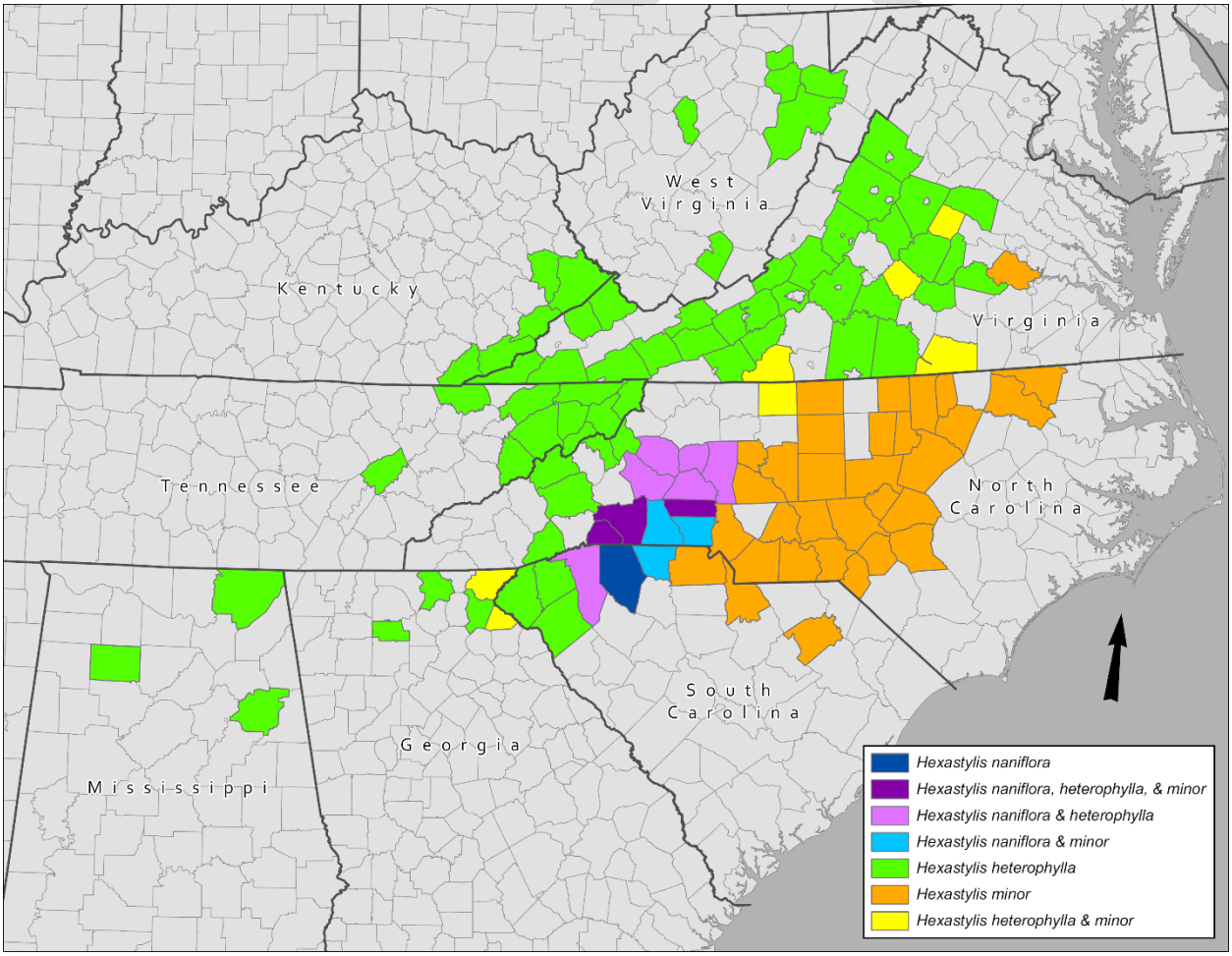


Figure 2.1. Distribution map showing county records for the three species in the *H. heterophylla* complex. Data was gathered from herbarium specimens, Element Occurrence Records (EORs) sheets and field studies. *Based on Murrell et al. 2007.*

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The most outstanding characteristic of this species is the small flowers, which are one of the smallest of any species in North America (Blomquist 1957). The plant's heart shaped leaves are dark green in color, evergreen, and leathery, and are supported by long thin petioles from a subsurface rhizome. The shape of the leaf blades, their pattern of variegation, and the ridged reticulation inside the calyx-tube, place this species inside the Virginica group. It differs from all the other members of this group, aside from the small flowers, in having no flare in the calyx-tube. Maximum height rarely exceeds 15 centimeters (cm). The jug shaped flowers are usually beige to dark brown in color and appear from mid-March to early June. The flowers are small and inconspicuous and are found near the base of the petioles. The fruit matures from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981). Characteristics that distinguish it from other *Hexastylis* species are found in floral structures and pollen characters (Gaddy 1987, Padgett 2004, Niedenberger 2010). *H. naniflora* has a smaller calyx tube orifice, which is typically 5mm or less (sometimes up to 7mm) and the ovary is half-inferior, rather than superior (Blomquist 1957, Gaddy 1987, Padgett 2004, HDR 2005). Pollen surface features have also been shown to be an effective character to identify *H. naniflora*, as it has a microporate surface and, unlike any other *Hexastylis* species, lacks gemmae entirely (Padgett 2004, Niedenberger 2010).

Distribution

Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (USFWS 2010, NCNHP 2016). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include four additional counties in North Carolina. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is in Cherokee, Greenville, and Spartanburg Counties. As of 2016, the distribution of this species consisted of 113 populations distributed across 13 counties in these two states (Figure 2.2).

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

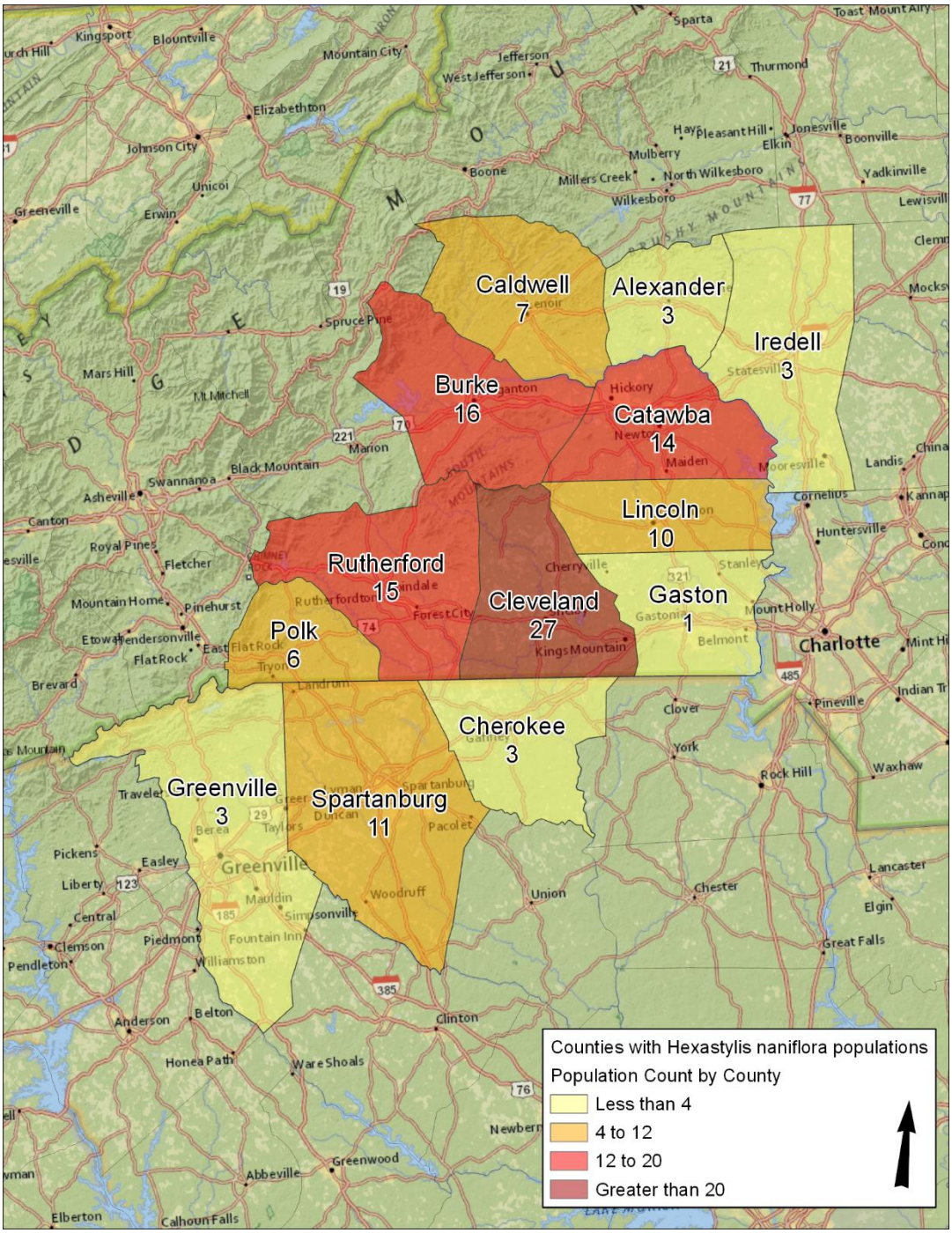


Figure 2.2. Current county distribution for dwarf-flowered heartleaf, with associated number of known populations within each county.

Many of those working with *Hexastylis naniflora* have used the terms “sub site”, “site”, “location”, “occurrence” (often, but not always, in reference to Natural Heritage Program Element Occurrence (EO) Records), “subpopulation” and “population” interchangeably. Others

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

have aggregated smaller sites into populations according to subjective criteria which have never been explicitly defined. This generates discrepancies among sources with respect to the abundance and distribution of the species, with the net result being that available data are usually not comparable from one source to the next. We describe how the numerous small, site-specific locations containing *H. naniflora* have been aggregated into proxies for 119 biological populations for purposes of this review, using mapping standards devised by NatureServe and its network of Natural Heritage Programs, in the Species Needs section of this report.

Life History

Demographics

The Service is aware of a single effort to collect demographic-level data (survivorship and recruitment of tagged individuals) for dwarf-flowered heartleaf. This effort was conducted during the 1990-1991 field seasons, within a portion of the Peters Creek population in Spartanburg County, SC (Newberry, 1993). This study demonstrated a 96.1% survival rate over these two consecutive seasons, with 50% of the mortality occurring in plants located at the highest position on the forested slope (away from the adjacent floodplain). Mortality was highest in small plants bearing fewer than four leaves. Plant size was variable, with the largest plant bearing 45 leaves and 33 flowers, and situated in the floodplain. In general, plants located in the floodplain were larger than plants located on adjacent slopes. The percentage of flowering plants averaged 70%, with the highest frequency of flowering occurring among plants situated in the floodplain (USFWS 2010).

Pollination and Dispersal

The pollination of *Hexastylis* has not been well studied but the genus was thought to be pollinated by insects including flies, wasps, and thrips (Otte 1977). Additionally, Lengyel et al. (2010) described how, within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal by ants). This supports Gaddy's work (1986), which found

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

three species within the Hexastylis Heterophylla subgroup (*H. heterophylla, H. naniflora, and H. minor*), which employ myrmecochory as a method for seed dispersal.

Ants appear to be a primary dispersal agent for the dwarf-flowered heartleaf (Gaddy 1986; Jones et al. 2014). All diaspores of *Hexastylis naniflora* presented to ants (*Aphaenogaster rudis*) were quickly removed (Gaddy, 1986). This is not to say that they are not occasionally, or even frequently, dispersed and/or pollinated by other means. Jones et al. (2014) suggests that the pollination mechanism is facultative, benefiting from more than one method of pollination/fertilization. Ants were the pollinators in a controlled experiment, and their data supports that when outside molesting forces/pollinators (biotic and abiotic) were limited by their caging procedure, the efficiency of pollination decreased by almost 50%, however, caged flowers did produce seeds, indicating pollination occurred via some alternative method.

Habitat

Dwarf-flowered heartleaf appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Wagner 2013). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of a given population. With the limited range and size in populations, questions arise regarding gene flow among populations. How much is occurring and how often does it occur? It is due, in part, to narrow habitat requirements that conservation measures have been implemented for the protection of the species. Any efforts made to protect this species must consider giving protection to the available habitat.

Dwarf-flowered heartleaf occurs on piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, Weakley 2015, USFWS 2015), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993).

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Wagner (2013) conducted a habitat suitability study to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants.

Soils

The species appears to be restricted to Pacolet sandy loam, Madison gravelly sandy loam, and Musella fine sandy loam soils (Gaddy 1981,1987). The species grows in acidic soils along bluffs and adjacent slopes, in boggy areas next to streams and creekheads, and along the slopes of nearby hillsides and ravines (Gaddy 1980, 1981). The plant is primarily found inhabiting north- to northwest-facing slopes, bluffs, and ravines in close proximity to creeks or streams. Within these areas exists the soil type required for *H. naniflora* to grow. It grows primarily on well-drained, sandy, acidic soils, and will not grow in heavy clay (Gaddy 1981).

The results of soil samples analyzed at the Clemson Soil Lab suggest that major differences in soil chemistry exist between the species in the *H. heterophylla* complex (Murrell et al. 2007). Statistical analysis of the soil samples showed that many of the basic elements were significantly different among the three species. Those significant differences occurred in Phosphorous (P), Potassium (K), Magnesium (Mg), Zinc (Zn), Manganese (Mn), (Na), Sodium, and Cation Exchange Capacity (CEC). Slightly significant differences were seen in Buffer pH (Bu pH), and Acidity.

Soil chemistry showed marked differences between the species in the complex (Murrell et al. 2007). The results indicated that soil chemistry is very different between *H. naniflora* and *H. minor* localities. The results also show that *H. heterophylla* and *H. naniflora* are found in soils where the chemistry is more similar, but still showed significant differences. It would appear that differentiation in soil types could be used as a proxy for species delineation. The soil analysis also indicates that soils must be considered when trying to select sites for relocation of imperiled populations of *H. naniflora*.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Thirteen population sites in North Carolina and South Carolina were examined using the Carolina Vegetation Survey (CVS) method to compare species richness between the three species of the *Hexastylis heterophylla* complex (Murrell et al. 2007). The analysis did not show statistically significant differences among the three species in the *H. heterophylla* complex. However, *H. naniflora* appears to have an association with three oak species that is lacking in the other two species in the complex. There are a number of oak species (*Q. coccinea*, *Q. prinus* (*Q. montana*), and *Q. velutina*), that tend to co-occur with only *H. naniflora*, but are not present with the other two species in the complex. This may be the result of some microbial need or specific soil nutrient required for those species to occur in the same habitat.

Fire

There are little data on the response to fire by *Hexastylis naniflora*, however, prescribed burns have been conducted within the population at Cowpens National Battlefield in Cherokee County, SC. Preliminary data at this site and recent annual monitoring data of this population support the theory that moderate controlled burns do not negatively affect this population (Walker et al. 2009). Additionally, a dormant season wildfire in Caldwell County did not show evidence of negative impacts to a population in Caldwell County (USFWS 2010). Fire suppression could be a hazard to *H. naniflora* by allowing fire intolerant, nonnative and invasive plants to thrive, as well as the accumulation of thick duff or leaf litter that may shade low growing species (Wagner 2013).

Genetics

Analyses on ecology, morphology, soil chemistry, pollen, and molecular genetics have been evaluated for *Hexastylis naniflora* to determine the boundaries within the *Hexastylis heterophylla* complex, which consists of *H. heterophylla*, *H. minor*, and *H. naniflora* (Murrell 2015, Wagner 2013, Niedenburger 2010, USFWS 2010, Murrell et al. 2007, Padgett 2004). These analyses support the continued recognition of these taxa as well-defined, discrete species. Scanning electron microscopy (SEM) consistently distinguished *H. naniflora* from other members of the *H. heterophylla* complex based on pollen microscopy. Principal Components

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Analysis of floral characters and soil chemistry also consistently distinguished *H. naniflora* from *H. minor* and *H. heterophylla*. However, efforts to obtain consistently distinct banding patterns using Inter Simple Sequence Repeats (ISSRs) were unsuccessful at distinguishing *H. naniflora* from other members of this group (Murrell et al., 2007). These results were based upon an extremely small sample size (n=10 *H. naniflora* individuals), and therefore warrant further investigation.

Field observations demonstrate that there are some populations of dwarf-flowered heartleaf with morphological characteristics that do not fit within the range of published values for key traits, overlapping with values for *H. heterophylla* or *H. minor* (Gaddy 1987, Murrell et al. 2007, USFWS 2010, Weakley 2015). These populations with overlap in key characteristics were the focus of a genetic analysis conducted at Appalachian State University (ASU) through funding provided by NCDOT (Murrell 2015). In some populations, floral characteristics are highly variable, which suggests the potential for hybridization or individuals with highly variable flower size and shape (Murrell 2015). Additionally, no vegetative characters were previously known to consistently distinguish *Hexastylis naniflora* from other close relatives. Given the difficulties with field identification of the species, particularly when not in flower, this study sought to develop a microsatellite library of molecular markers to resolve variation in populations of dwarf-flowered heartleaf and apply the markers to populations with highly variable characters, as identified by NCDOT biologists. The morphological and micromorphological information from those variable populations were compared to molecular results with morphological, micromophological, and distributional data to determine genetic structure, biological boundaries, and placement of putative hybrids or intermediate populations of *H. naniflora* (Murrell 2015).

The preliminary findings of this study suggest that populations in the southern range of dwarf-flowered heartleaf exhibit a more uniform genetic pattern, with some possible hybridization with *H. minor*. Populations in the northern part of the range appear to have hybridized with both *H. heterophylla* and *H. minor*, although there are still individuals with "pure" *H. naniflora* genotypes in the northern range (Murrell 2015). It is critical to note that although these data provide anecdotal evidence of hybridization with the *Hexastylis heterophylla* group, intraspecific variation may be caused by forces other than hybridization, such as convergent morphological

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

evolution (Dobzhansky 1937), or the species is in the process of speciation and this study shows a case of incomplete speciation (Murrell 2015), and/or other environmental factors are at play (Wagner 2013). On May 11, 2016, a meeting was held with USFWS, NCNHP, NCDOT, and ASU to discuss the status of *H. naniflora* and the current work being conducted among the agencies (Amoroso 2016). Based on discussions during this meeting, the results of this study reported by ASU to NCDOT in 2015 are preliminary. Dr. Matt Estep (ASU) provided additional preliminary results to NCNHP in May 2016, showing which populations were sampled, sample size, and percent of samples that show evidence of hybridization, and hybridizing with which species. ASU continues to work towards a more definitive explanation of the variation in the *H. heterophylla* complex (Murrell 2015, Amoroso 2016).

CHAPTER 3: SPECIES NEEDS

For the purpose of this report, we define viability as the ability of the species to sustain populations in the wild over time. Species with greater numbers (redundancy) of healthy populations (resiliency), encompassing a broad array of ecological and genetic diversity in a spatial arrangement that maintains adequate gene flow (representation), are more likely to be viable. Using the Species Status Assessment framework, we describe the species' viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation.

Delineating Populations

As stated in the USFWS five-year review, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to Natural Heritage Program Element Occurrence Records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This has generated considerable discrepancies among sources with respect to the number of known populations within a given area (or across the species' range), to the extent that numbers are not comparable from one source to the next. The tendency, in the past, to treat each location as a separate population also artificially inflated the actual number of populations known.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The Natural Heritage Program collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member Natural Heritage Programs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2002). Since USFWS does not maintain its own database of known locations of *Hexastylis naniflora*, it regards the NHP databases as the best repository for this information (USFWS 2010).

We delineate populations for the purposes of this SSA according to the NatureServe (2002) convention. Separation distances are a key component to delineating populations from EO records. For the dwarf-flowered heartleaf, we used the EO Data Standard which provides a Default Separation Distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several dwarf-flowered heartleaf populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Population Resiliency

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of dwarf-flowered

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

heartleaf ecology that determine whether populations can grow to maximize habitat occupancy, thereby increasing resiliency of populations. These factors and habitat elements are discussed below (Figure 3.1).

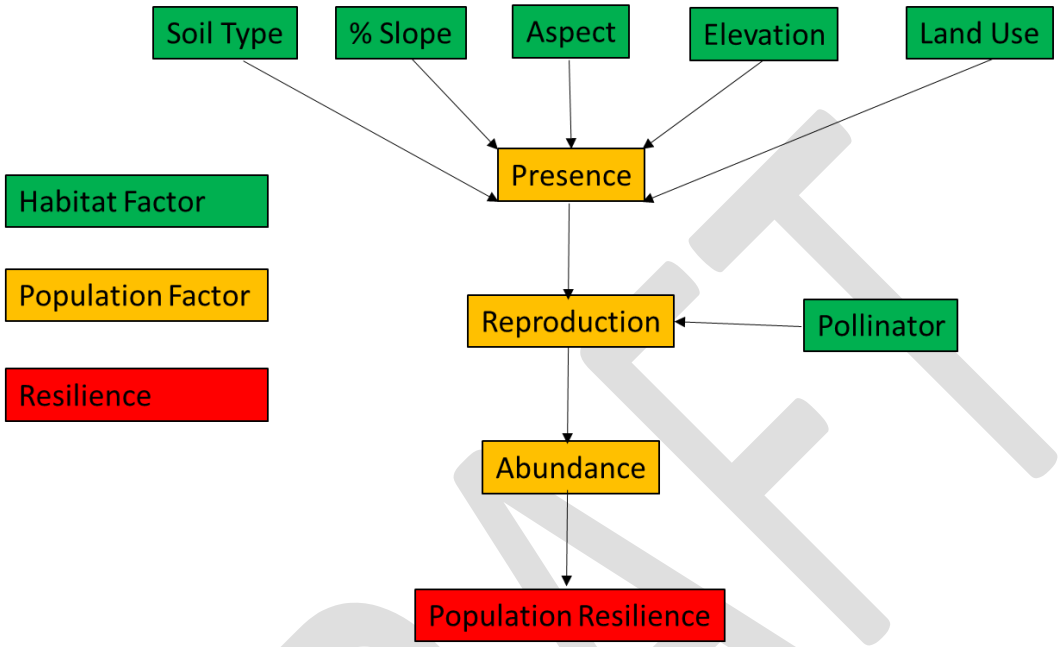


Figure 3.1. Conceptual diagram describing population and habitat factors influencing population resilience for dwarf-flowered heartleaf.

Habitat Factors: Slope, Aspect, Elevation, Soil, and Forest Type

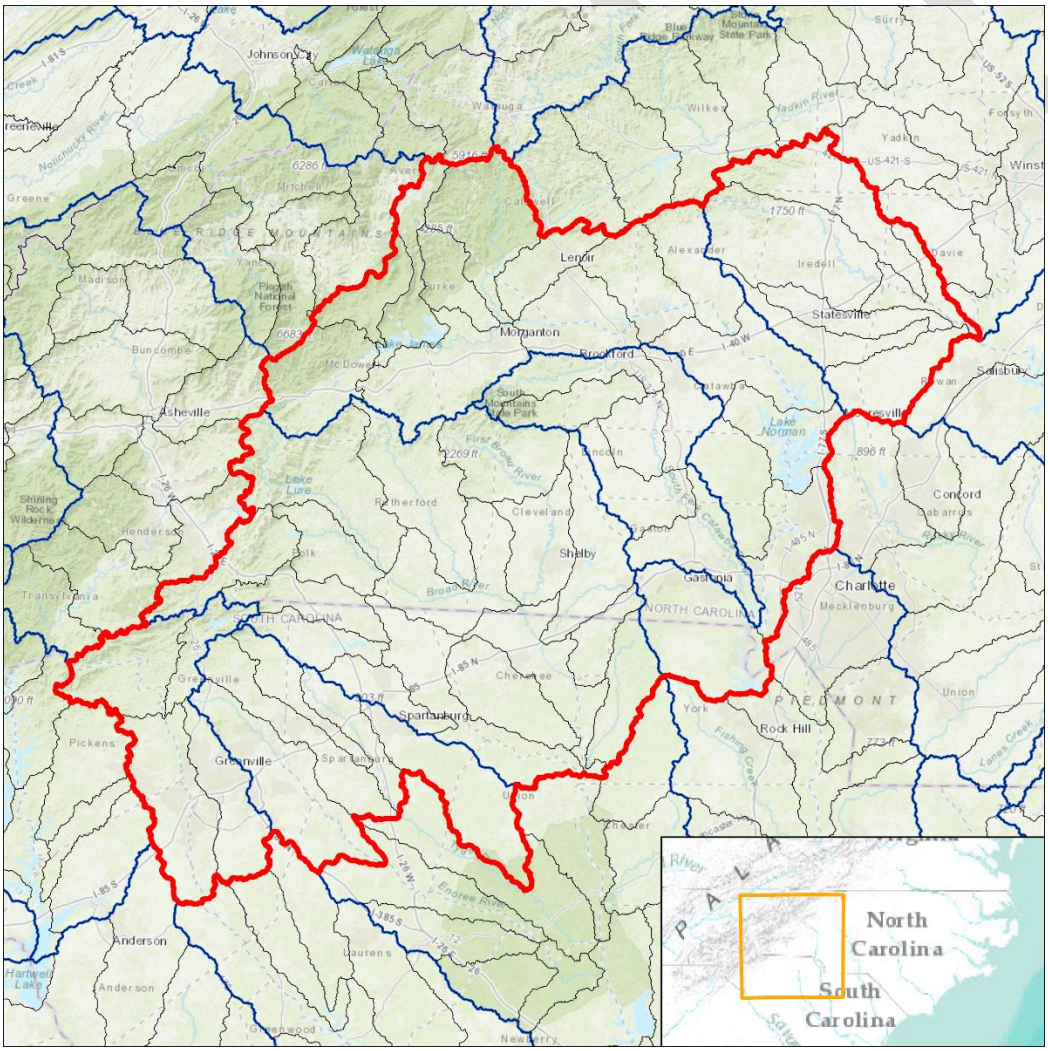
A previous habitat suitability study attempted to quantify the habitat requirements for dwarf-flowered heartleaf (Wagner 2013). With this model in mind, and the input of species experts as to important habitat factors for the species, we used updated habitat data, as well as inclusion of updated EOs, to create a new habitat model to identify potential habitat throughout the species range. All source datasets and variables created are described in Appendix 3.

Source Data and Model Variables

Fifty-three, 10-digit hydrologic units (HUC) comprise the analysis extent (Figure 3.2). In North Carolina, it includes all 10-digit HUC that fall within the boundaries of 8-digit HUC with known occurrence of *Hexastylis naniflora*. In South Carolina, we also included all 10-digit HUC that

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

382 fell within the boundaries of 8-digit HUC with known occurrence of *Hexastylis naniflora*, but
383 excluded the southern portions of the HUC-8 areas due to the boundaries being exceedingly large
384 and far away from any known occurrences.
385 *Hexastylis naniflora* element occurrence data was obtained from the North Carolina Natural
386 Heritage Program and the South Carolina Heritage Trust Program. Current populations of
387 *Hexastylis naniflora* were identified by reviewing the last observed data in the database and
388 excluding all populations that have not been observed since 2005 to remain consistent in our
389 approach of assessing resiliency described previously. To represent these current population
390 areas in Maxent, a raster cell center was retained for every 30 x 30 meter pixel that was situated
391 within the current element occurrence data polygons.
392
393



Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Figure 3.2. Analysis extent of the habitat model for *Hexastylis naniflora*. Red line indicates Maxent analysis extent, blue lines are 8-digit HUC boundaries, black lines are 10-digit HUC boundaries. The orange line in the inset map indicates where the analysis extent is situated in North and South Carolina

Model Development

We used Maxent software (version 3.4.1) for species habitat modeling (Philips et al., 2018). An initial single model Maxent run was done to determine which variables could be excluded due to limited percent contribution to the model. Any variable that contributed less than 1% to the single model run results was excluded in the final model. The following variables were excluded: landcover diversity, canopy height, SSURGO drainage class, SSURGO hydrologic group, aspect 9-class, aspect 5-class, slope, solar radiation, and maximum annual temperature. It is interesting to note that a previous habitat modelling effort (Wagner 2013) included aspect and slope, whereas the Maxent model excluded these variables. This does not mean these variables are not important components of dwarf-flowered heartleaf habitat, but rather these variables did not significantly improve the model. Also, landform data was included, and perhaps landform, which includes components of aspect and slope combined is a more meaningful variable than aspect or slope independently.

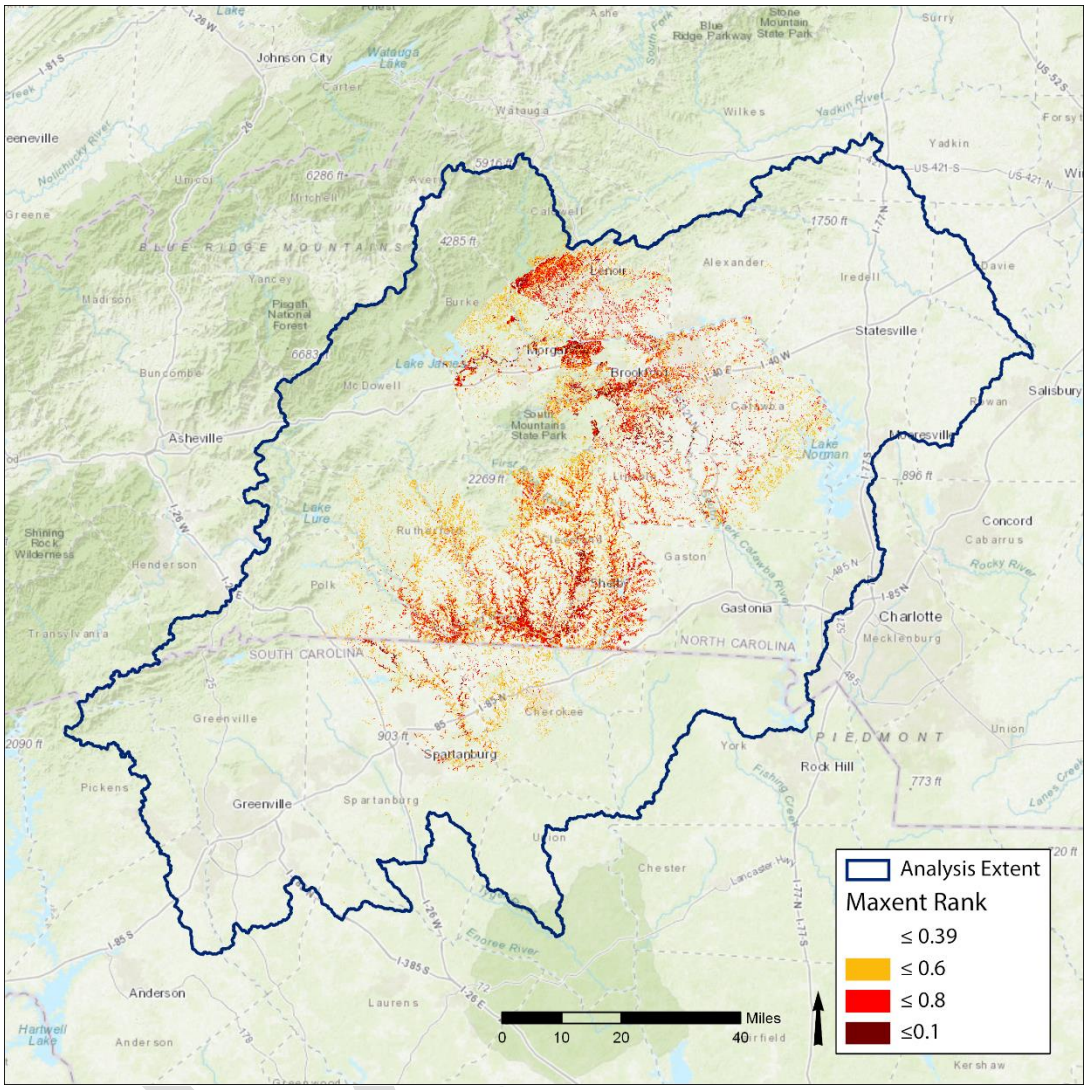
For the final model, a 10-run replicate Maxent model was created using cross-validation. For replicate models, the occurrence data is randomly split into a number of equal-sized groups called “folds”, and separate models are created leaving out each fold in turn. The individual model runs are then averaged together to derive the final model.

Results

Figure 3.3 shows the model output. The minimum cutoff value (to determine if an area is considered potential habitat for a species) of 0.39 was determined by using the average 10th percentile training presence. The 10th percentile training presence uses the suitability threshold associated with the presence record that occurs at the 10th percentile of presence records (Phillips 2018). This value excludes some of the outlier population areas in the Maxent

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

425 predictions to focus on the typical habitat conditions for this species. The total area ranked
426 greater than 0.39 in the Maxent model was just 6.00% of the total analysis area (Table 3.1).



427

428 **Figure 3.3.** Maxent model output map

429

430 **Table 3.1**-Area estimates of the Maxent model

Maxent Score	Acres	Square Miles	Percent of Total
0.39 and greater	302,834.13	473.18	6.02%
0.6 and greater	128,273.52	200.43	2.55%
0.8 and greater	22,115.97	34.56	0.44%

431

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The average area-under-curve (AUC) score for the replicate Maxent model is 0.86. The AUC is calculated from the receiver operating characteristic (ROC) plot. This value has a range of 0 – 1 and may be interpreted as a single test statistic that assesses model performance, indicating the ability of the model to correctly classify the occurrence data used. The model performed well in its predictions, with a mean AUC of 0.86 (AUC value of 0.5 is no better than random; AUC<0.5 is worse than random; AUC>0.5 is greater predictive power than random; Baldwin 2009).

The Maxent output supplies estimates of the relative contributions of the environmental variables to the Maxent model (Table 3.2). SSURGO map unit key) is the top contributing variable. One hundred and thirty-five individual soil types are present within the polygon boundaries of the *Hexastylis naniflora* element occurrences. Many of these individual soil types are part of soil complexes and are separated by things such as percent slope, erosion, how stony/rocky, and amount of clay. The most common individual soil type was Meadowfield-Rhodhiss complex, 25 to 60 percent slopes, very stony (14.1% of total). However, collectively the Meadowfield soils only comprised 14.3% of all soils). The individual Pacolet soil types were very common and collectively comprise 36% of all soil types present. Woolwine, Rion, and Fairview soils were also collectively common, comprising 10.4%, 9.7%, and 8.8% of all soils present respectively.

Table 3.2. Percent contribution of the environmental variables

Environmental Variable	Percent Contribution
SSURGO map unit key	23.5%
Minimum Annual Temperature	17.8%
Average Annual Precipitation	15.7%
Landcover	12.9%
Landcover Majority	12.0%
Landcover Hexastylis Grouping	5.4%
Geomorphons	4.9%
Elevation	4.6%
Canopy Cover	3.2%

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The minimum annual average temperature range in the analysis extent is 39 – 51 degrees Fahrenheit. The majority of the *Hexastylis naniflora* element occurrences (89%) are found at the 47 and 48 degrees. The average annual precipitation range in the analysis extent is 42 – 81 inches per year. The majority of the *Hexastylis naniflora* element occurrences (82%) are found in the 47 – 49 inches per year range.

Piedmont forested landcover habitats dominate the land area of the element occurrences. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier (53%), Southern Piedmont Mesic Forest (9%), Southern Piedmont Dry Oak-Pine Forest (5.2%), Southern Piedmont Small Floodplain and Riparian Forest (4.4%), and collectively comprise 71% of the element occurrences area. Evergreen Plantation or Managed Pine (9%), Harvested Forest (7.2%), Developed, Open Space (5%), Pasture/Hay (2.1%) collectively comprise 22% of the total element occurrence area. The remaining 6 percent of element occurrence area is comprised of a mix of 14 other natural and disturbed landcover classes, but each at small percentages. The landcover majority classification scheme reduces the total number of landcover classes present in the analysis extent from 23 to 11. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier is still the dominant landcover class (58%). However disturbed categories are increased in area (sum total of 35%). Evergreen plantation or managed pine (12%) and Pasture/Hay (12%) are the only other categories that have at least 10% or greater area. The increase in disturbed landcover area representation in the landcover majority layer suggests that many *Hexastylis naniflora* population areas are situated in areas impacted by disturbed landcover. This is likely due to urban encroachment and increasing fragmentation of habitats. The landcover *Hexastylis naniflora* grouping reveals the amount of disturbance present in *Hexastylis naniflora* population areas. Landcover classes grouped as disturbed comprises 27% of the total area. Mixed forest (deciduous and evergreen) comprises 58%, pasture/hay 12%, and hardwood forest 2%. Open water, evergreen and barren landcover groupings are all at less than 1% each.

Geomorphons revealed that the majority of *Hexastylis naniflora* element occurrence areas are situated in concave landforms. Geomorphon categories hollow (13%), valley (46%), and

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

depression (10%) collectively comprise 69% of all *Hexastylis naniflora* population areas. Flat landforms comprise 15.5% of the area and convex landforms the remaining 15.5%.

Within the analysis extent, the range of elevation present is 335 – 5,265 feet. For *Hexastylis naniflora*, the prime elevation range is from 666 – 908 feet (53% of total element occurrence area). A lesser elevation range is present from 935 – 1,184 (37% of total element occurrence area).

Canopy cover for the *Hexastylis naniflora* populations are dominated by Tree Cover 70-80% (20.2%) and Tree Cover 80-90% (63.9%). The rest of the canopy cover categories are 2% or less.

We performed a Kruskal-Wallis 1-way non-parametric Analysis of Variance (ANOVA) to investigate the relationship between Maxent scores and current resilience of populations (Table 3.3). There are significant differences in the average Maxent scores between the four resilience categories ($p = 0.04$) and the mean Maxent score increases as population resilience increases from low to very high. The model gives us some predictive ability regarding habitat suitability where higher Maxent scores, on average, result in higher population resilience.

Table 3.3 Results of the Kruskal-Wallis 1-way non-parametric ANOVA investigating relationships between Maxent scores and current resilience groups for dwarf-flowered heartleaf.

Groups	*Count*	*Mean Rank*
low	13	30.7
moderate	25	30.7
high	5	42.8
very high	28	45.7

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	4375.7	4	1093.92	2.65	0.0404

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Within Groups	28036.3	68	412.30
Total	32412.0	72	

Reproduction and Presence of Pollinators

The pollination of *Hexastylis* has not been well studied but the genus is thought to be pollinated by insects including flies, wasps, and thrips (Otte 1977). Additionally, Lengyel et al. (2010) described how, within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal via ants). This supports Gaddy's work (1986), which found three species within the Hexastylis Heterophylla subgroup (*H. heterophylla, H. naniflora, and H. minor*), which employ myrmecochory as a method for seed dispersal.

Because the flower for this species is oftentimes partially or completely covered with soil and leaf litter, possibly inhibiting pollinator activity (Gonzalez 1972), there is still uncertainty in the pollination mechanism for dwarf-flowered heartleaf. Otte (1977) suggests that a variety of possible pollinators reside in this leaf litter, however, the calyx opening is considered to be far too small for efficient pollinating (Gaddy 1981). There are, however, invertebrates within this proposed size limit that could theoretically act as pollinators. It is possible that the species employs self-pollination, with or without a vector, or that cross-pollination occurs by a number of invertebrates. Jones et al. (2014) investigated pollination of dwarf-flowered heartleaf under a manipulative experimental design, and found that while insects may play a significant role in pollination, even without them, flowers managed to produce a partial seed set. However, two points need to be considered here. First, although flowers managed to produce seeds in the absence of insect pollinators, the efficiency of pollination decreased by almost 50%. Also, even if successful pollination occurs in the absence of insect vectors, the dispersal of plants amongst populations would be limited, and could result in decreased resilience due to genetic concerns such as limited gene flow and issues associated with potential inbreeding depression.

Abundance

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

The influence of stochastic variation in demographic (reproductive and mortality) rates is much higher for small populations than large ones. Stochastic variation in demographic rates causes small populations to fluctuate randomly in size. In general, the smaller the population, the greater the probability that fluctuations will lead to extinction. There are also genetic concerns with small populations, including reduced availability of compatible mates, genetic drift, and inbreeding depression. Small populations of dwarf-flowered heartleaf have low resilience, leaving them particularly vulnerable to stochastic events.

As of 2016, the combined databases of the NCNHP and SCDNR contain 239 Element Occurrence Records (EORs) for *H. naniflora* (NCNHP 2016, SCDNR 2016). These EORs depict roughly 113 locations which are sufficiently geographically distinct to be regarded as proxies for populations of the species (See *Delineating Populations*). Thus, the total number of populations has increased more than four-fold (from 24 to 113) since the species was listed in 1989.

At this time, the largest known populations have been monitored by NCNHP and NCDOT. The estimates for entire populations are based on a consistent monitoring methodology developed by NCDOT, USFWS, and NCNHP with monitoring plots representing roughly 10% of a population. Populations were delineated to get a more accurate boundary and size of the area occupied. All rosettes are counted annually in each monitoring plot to estimate an extrapolated population size, based on the number and density in the plots. As a result of these efforts, better estimates of population sizes for the largest known populations are available, compared to when the last five-year review was completed in 2010 (Robinson and Padgett 2016).

The 113 EORs have been estimated to contain anywhere from a single rosette to over 100,000 rosettes. Appendix 1 was created by NCNHP (2016) to replicate the same format and population data as Table B2 of the most recent USFWS five-year review of *H. naniflora* (USFWS 2010), for comparison of changes since 2010, and summarizes the largest occurrences of *H. naniflora*, with the size of the population based on the number of rosettes it was last estimated to contain. The number of populations estimated to contain over 1,000 rosettes is 26. This is approximately 23%

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

of the total known populations and many of these populations contain well over 1,000 individuals.

There are, however, 13 populations (12% of all known) that are simply known to be extant, with no available estimate of population size (NCNHP 2016, SCDNR 2016). If the most recent population estimates for each EOR are compiled across years of observation, the 113 populations could conservatively be estimated to contain a collective total of more than 300,000 rosettes (NCNHP 2016, SCDNR 2016).

Population Trends

Although abundance is critical in assessing the resilience of dwarf-flowered heartleaf, trends in population growth can also be informative. Long-term growth trends are typically defined as the degree of change in population size over 200 years, whereas short-term growth is typically measured as that degree of change over a 10 year period. We lack a robust data set to assess trends at either of these time scales. However, from 2012-2016, NCNHP conducted systematic annual surveys of thirteen of the largest populations across the range.

Based on the results of the five-year monitoring efforts completed in 2016, nine out of thirteen populations remain stable during the five years of data collection (Robinson and Padgett 2016). The largest known population, Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop in Rutherford County, NC, is estimated to have over 100,000 rosettes (Robinson and Padgett 2016). This large population consists of many scattered subpopulations on private property; two of the subpopulations are protected as a Registered Heritage Area, although Registry is a non-binding agreement with landowners that can be cancelled at any time (NCNHP 2018).

Two of the thirteen populations increased in numbers from 2012-2016: Cliffside Steam Station and Broad River: Floyds Creek, Long Branch. The Cliffside Steam Station is protected with a voluntary agreement with Duke Energy and was estimated to contain over 39,000 rosettes in 2016. The Broad River: Floyds Creek, Long Branch population is not at all protected, but was last estimated to consist of over 12,000 individuals in 2016 (Robinson and Padgett 2016).

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Based on the results of recent surveys and a review of all known populations of *Hexastylis naniflora*, the overall trend over approximately 30 years is estimated to be declining 10-30%. This is estimated by a combination of documented declines of some populations, while many others appear to be remaining relatively stable, and some have increased.

Chapter 4: CURRENT CONDITIONS

Below we assess current resilience, representation, and redundancy as they relate to population and habitat factors known to be important for species viability. Based off of recent reports (Robinson and Padgett 2016; Robinson 2016), the species consists of 119 populations distributed across 12 counties in North Carolina and South Carolina. Populations are composed of both multiple EOs and stand-alone EO records. Recent genetic research discussed in Chapter 2, suggests that dwarf-flowered heartleaf, as originally described, is found in the southern portion of its presumed range based on current EO locations, and the northern portion could be a currently undescribed species (Figure 4.1; Estep pers. Comm. 2018). The genetic analysis to support this is complete, but a review of the morphology is ongoing and a new species has not yet been described (Estep pers. Comm. 2018). For the purpose of this SSA, we assume all EO detections are *H. naniflora*, and represent the best currently available scientific data.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

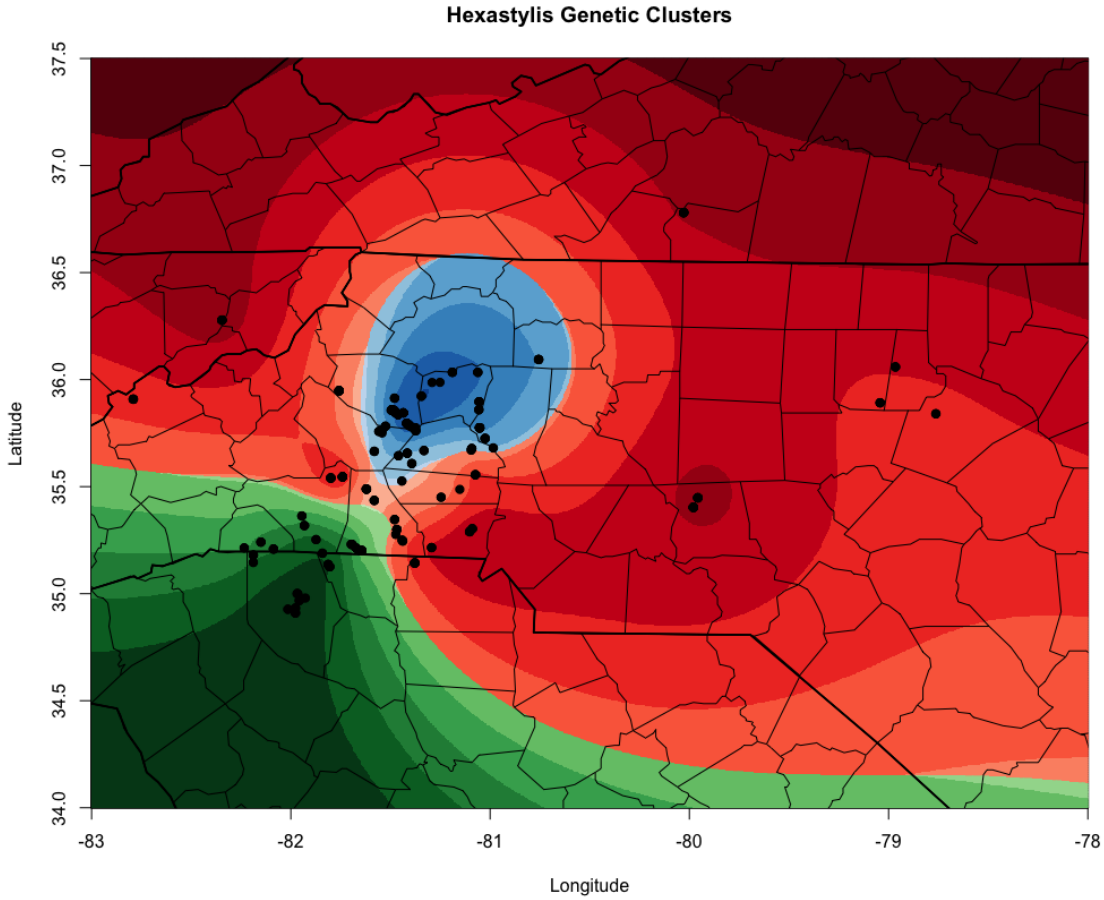


Figure 4.1. Recent genetic analyses detailing clustering of the genus Hexastylis. Black dots represent GIS locations of individual plants included in the genetic analysis. Green areas represent "true" *H. naniflora*; Blue represents a possible new species; Red represents other species in the genus (*H. minor*, *H. heterophylla*, etc.).

Current Population Resilience

Categorizing Resilience

For the purposes of this SSA, we use population size as the main driver of population resilience. The unit of measurement for population size in this species is a "clump" (rosette). As discussed previously, populations in North Carolina were delineated by NCNHP, whereas the Service defined populations in South Carolina. These delineations were based off of NatureServe criteria such as EO separation distance and intervening landscape matrix. EO data included a wide range

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

of years since the species was last observed at a given location (1964-2017), so although recent reports suggest the species consists of 113 populations, some of that data is fairly outdated. For the purposes of this SSA, we only used EOs that were observed since 2005. We did this for several reasons. First, we did not want to go back too far and assume a population was still present. Second, we wanted to be consistent in what we considered "current" for both categorizing resilience and use in the habitat model (discussed later). Also, experts concurred that records as old as 12 years are still likely to persist. Finally, there was a natural break in the data at the year 2005, coinciding with the year the last five-year review was initiated, where the number of EOs dropped off significantly in the years 2004 and earlier. It is important to note that many of the populations that we excluded from our analysis may still persist on the landscape. In fact, many EOs for this species have persisted for decades, despite not having intervening surveys to confirm their persistence.

Based on the criteria (excluding EOs prior to 2005), there are currently 78 populations distributed across the range of dwarf-flowered heartleaf, although this may be an underestimate as discussed above.

To determine overall resilience for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resilience categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are also incorporated secondarily. Appendix 2 shows the NCNHP EO rank specifications for dwarf-flowered heartleaf. The EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, given there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, depending on habitat conditions; poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016; Robinson and Padgett 2016) focus monitoring studies on populations with greater than 1,000 individuals, populations that are assumed to be very viable. Because we do not have habitat level information for every population we assessed, we synthesized all of the above population size information and created four resilience categories as follows:

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Occupancy and Abundance

There are 78 populations of dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). Table 4.2 shows the contribution of each resilience category as follows: 36% (very high); 7% (high); 34% (moderate); 23% (low). When looking at cumulative percentages of resilience, it is interesting to note that 77% of all of the populations are classified as moderate to very high resilience (Table 4.2).

Table 4.1. Current populations of dwarf-flowered heartleaf and associated resilience across the species range. Abundance and last observation date based on Natural Heritage Program data (2018).

Site Name	State	County	Last Observed	Total plants	Resilience
Glade Creek, Alex County	NC	Alexander	2017	>1000	very high
Catawba River: Hoyle Crk-Micol Crk	NC	Burke	2013	>1000	very high
Island Creek Heath Bluff	NC	Burke	2016	>1000	very high
Gunpowder Creek: South of Hudson	NC	Caldwell	2012	>1000	very high
Peaked Top Rare Plant Site/Foothills Landfill	NC	Caldwell	2014	>1000	very high
Jacob Fork West Corridor	NC	Catawba	2012	>1000	very high
Murrays Mill/Upper Balls Creek NA	NC	Catawba	2013	>1000	very high
NCDOT TIP: R-2824	NC	Catawba	2015	>1000	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	NC	Catawba	2013	>1000	very high
Cowpens NBF - Site 1	SC	Cherokee	2016	>1000	very high

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	State	County	Last Observed	Total plants	Resilience
Cliffside Steam Station	NC	Cleveland/Rutherford	2016	>1000	very high
Broad River/Sandy Run NA	NC	Cleveland	2012	>1000	very high
Broad River: Brushy Creek	NC	Cleveland	2016	>1000	very high
Buffalo Creek: Kings Mountain Res	NC	Cleveland	2016	>1000	very high
Buffalo Creek: Tributaries N and S of SR 2047	NC	Cleveland	2012	>1000	very high
Rhyne Conservation Preserve	NC	Lincoln	2016	>1000	very high
Mill Creek Forest and Seep	NC	Polk	2016	>1000	very high
New Hope Springhead Swamp	NC	Polk	2016	>1000	very high
Big Horse Creek Rare Plant Site	NC	Rutherford	2015	>1000	very high
Broad River: Floyds Creek	NC	Rutherford	2016	>1000	very high
Davenport Road/Mountain View Rare Plant Site	NC	Rutherford	2016	>1000	very high
Facebook Site	NC	Rutherford	2016	>1000	very high
Floyds Creek Tributray Rare Plant Site	NC	Rutherford	2012	>1000	very high
New Bethel Rare Plant Site	NC	Rutherford	2015	>1000	very high
Richardson Creek trib above Toms Lake	NC	Rutherford	2016	>1000	very high
DNR Peters Creek Heritage Preserve	SC	Spartanburg	2016	>1000	very high
Taylor Blalock Res	SC	Spartanburg	2016	>1000	very high
Leepers Creek Heartleaf Site	NC	Lincoln	2006	>1000	very high
Little Gunpowder Creek Rare Plant Site 1	NC	Caldwell	2015	500-1000	high
Little Gunpowder Creek Rare Plant Site 2	NC	Caldwell	2015	500-1000	high
Northern Catawba County	NC	Catawba	2017	500-1000	high
Rock Barn Solar Farm	NC	Catawba	2010-2011	500-1000	high
Buffalo Creek Rare Plant Site	NC	Cleveland	2012	500-1000	high
Third Creek Rare Plant Site	NC	Alexander	2010	100-500	moderate
Hickory Area	NC	Burke/Catawba/Caldwell	2016	100-500	moderate
Burke County - Drowning Creek UT	NC	Burke	2017	100-500	moderate
Simms Hill/Little River Uplands	NC	Burke	2015	100-500	moderate
Smith Cliff/Henry Fork River	NC	Burke	2015	100-500	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	NC	Catawba	2016	100-500	moderate
NCDOT TIP R-2824	NC	Catawba	2015	100-500	moderate
South Fork Catawba River, Henry Fork	NC	Catawba	2007	100-500	moderate
Broad River/Sandy Run NA	NC	Cleveland	2012	100-500	moderate
Brushy Creek Headwaters	NC	Cleveland	2014	100-500	moderate
First Broad River: Crooked Run Creek	NC	Cleveland	2010	100-500	moderate
No Business Creek, Boyd Tract	NC	Cleveland	2007	100-500	moderate

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	State	County	Last Observed	Total plants	Resilience
West Shelby Mesic Slope	NC	Cleveland	2016	100-500	moderate
UT of Kings Mountain Res	NC	Gaston	2012	100-500	moderate
Buffalo Shoals Creek	NC	Iredell	2014	100-500	moderate
Cat Square Heartleaf Forest	NC	Lincoln	2012	100-500	moderate
Collinsville (Hughes) Creek Slopes	NC	Polk	2016	100-500	moderate
Fox Knoll Farm	NC	Polk	2016	100-500	moderate
Forest City: Adj to Isothermal CC	NC	Rutherford	2010	100-500	moderate
Jonas Road Rare Plant Site	NC	Rutherford	2014	100-500	moderate
Knob Creek NA	NC	Cleveland	2005	100-500	moderate
Buffalo Creek	NC	Cleveland	2005	100-500	moderate
Kross Keys NA	NC	Polk	2005	100-500	moderate
Catawba River: North Fork Mountain Creek	NC	Catawba	2005	100-500	moderate
Catawba River: Lake James	NC	Burke	2006	100-500	moderate
Hogpen Branch Transplant Site	NC	Rutherford	2005	100-500	moderate
NCDOT TIP R-3603A	NC	Alexander	2017	<100	low
South Mountains Pleasant Grove Uplands	NC	Burke	2016	<100	low
Gunpowder Creek	NC	Caldwell	2012	<100	low
Killian Crossroads	NC	Catawba	2010	<100	low
Pott Creek	NC	Catawba	2012	<100	low
Beaverdam Crk at First Broad River	NC	Cleveland	2011	<100	low
Buffalo Creek: Potts Creek	NC	Cleveland	2012	<100	low
Buffalo Creek: Ravine	NC	Cleveland	2007	<100	low
Hickory Creek - UT (Shelby High School)	NC	Cleveland	2016	<100	low
Boulder Creek Subdivision - Jordan Road	SC	Greenville	2016	<100	low
Gateway Elementary School	SC	Greenville	2017	<100	low
Fanjoy Road Site	NC	Iredell	2015	<100	low
Levan Family Farm	NC	Iredell	2013	<100	low
Lincoln County, SR-1314	NC	Lincoln	2014	<100	low
Northeast Lincolnton: UT Walker Branch	NC	Lincoln	2009	<100	low
Sandy Spring Church Springhead Swamp	NC	Polk	2005	<100	low
First Broad River: Hickory Creek	NC	Cleveland	2006	<100	low
Smith Cliff/Henry Fork River	NC	Burke	2005	<100	low
First Broad River: Beaverdam Creek Tribs	NC	Cleveland	2006	<100	low

Table 4.2. Population resilience categories by county for dwarf-flowered heartleaf.

County	Very High	High	Moderate	Low	Totals
Alexander	1		1	1	3
Burke/Catawba/Caldwell			1		1
Burke	2		4	2	8
Caldwell	2	2		1	5
Catawba	4	2	4	2	12

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Cherokee	1				1
Cleveland/Rutherford	1				1
Cleveland	4	1	7	6	18
Gaston			1		1
Greenville				2	2
Iredell			1	2	3
Lincoln	2		1	2	5
Polk	2		3	1	6
Rutherford	7		3		10
Spartanburg	2				2
Totals	**28**	**5**	**26**	**19**	**78**
% of total	*36*	*7*	*34*	*23*	*100*
Cumulative %	*40*	*43*	*77*	*100*	--

Population Trends

Although we lack an adequate past time series of abundance data for all populations to estimate growth rates or population trends, NCNHP conducted surveys of thirteen of the largest populations across the range of the species from 2012-2016. Table 4.3 shows the results of all of these surveys. Two populations show an increasing trend, nine show a stable trend, and two show a decreasing trend.

Table 4.3. Summary of population trends over 5 years of monitoring data for 13 of the largest populations of dwarf-flowered heartleaf across its range (from: Robinson and Padgett 2016).

Trend	Survey	Site	2016 estimated number of plants (Rosettes)	2016 area occupied (Acres)
Increasing	NCNHP	Cliffside Steam Station (EO 276)	39,535	52
	NCNHP	Broad River: Floyds Creek, Long Branch (EO 177)	12,687	5.67
Stable	NCNHP	Island Creek Bluff/Love Lady Site (EO 029)	50,481	61.76
	NCNHP	Rhyne Preserve (EO 302)	19,873	22.43
	NCNHP	Mills Creek Forest and Seep (EO 023)	1,733	1.39
	NCNHP	New Hope Springhead Swamp (EO 125)	12,235	5.03

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

	NCNHP	Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop (EO099)	106,940	83.39
	NCNHP	Broad River: Cleghorn Creek, US 221 (EO 176)	6,750	7.24
	NCNHP	Cowpens National Battlefield (SC EO 016, 017, 018)	2,823	6.05
	NCNHP	Peters Creek Preserve (SC EO 011)	3,306	8.98
	NCNHP	Blalock Reservoir (SC EO 007, 031)	3,505	7.59
Decreasing	NCNHP	Second Broad River (Forest City Industrial Complex) (EO 154)	2,576	4.74
	NCNHP	South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)	123	0.09

Current Species Representation

Representation describes the ability of a species to adapt to changing environmental conditions. We lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species.

Current Species Redundancy

For the dwarf-flowered heartleaf to maintain viability, the species also needs to exhibit some degree of redundancy. Species-level redundancy reflects the ability of a species to withstand catastrophic events, and is best achieved by having multiple, widely distributed populations relative to the spatial occurrence of catastrophic events. Redundancy for dwarf-flowered heartleaf is the total number and resilience of population segments and their distribution across the species range.

An important question when investigating redundancy for dwarf-flowered heartleaf is, "what exactly is a catastrophe?" We consider a catastrophe to be any population level disturbance that

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

has the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, like hurricanes, and often with devastating effects, however they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010).

As stated previously, there are 78 populations of dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). The populations are spread across the range, although a majority occur in North Carolina. Although, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances, the species range is very small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

CHAPTER 5: INFLUENCES ON VIABILITY

Hexastylis naniflora populations occur in rapidly growing urban areas with expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. In addition to threats associated with residential, commercial, and industrial development, other documented threats include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of ponds, impacts from grazing cattle, ORV damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

752 siltation (NCNHP 2016, Robinson and Padgett 2016). Climate change may exacerbate these risk
753 factors through changes in temperature and precipitation.
754
755 Threats were assessed for populations monitored by NCNHP during 2012-2016 (Robinson and
756 Padgett 2016), and EOs were reviewed for other documented threats to populations. Indirect or
757 direct threats that were observed, inferred, or suspected to have an impact on populations were
758 recorded and assigned a ranking based on their severity, scope, and immediacy from field
759 observations. The rank for each threat factor determines the overall value for each threat
760 observed at each population. No significant changes in threats within populations were noted
761 from 2012-2016. Threats observed during these years included development, incompatible
762 forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and
763 road construction.
764
765 Below, we summarize primary threats to the viability of dwarf-flowered heartleaf. Primary
766 influences will be carried forward in our future projections in the next section.
767
768 ***Human Population Change***
769 Increasing human populations drive development. With increases in population, there will be
770 increasing conversion of open space to more impervious cover, with a subsequent increase in
771 roads and other associated infrastructure. Increases in roads and impervious cover have the
772 potential to lead to habitat loss and/or fragmentation, a primary risk factor for dwarf-flowered
773 heartleaf. Tables 5.1-5.2 and Figures 5.1-5.2 show the estimated human population increases for
774 North Carolina and South Carolina counties within the range of the species. The most populous
775 counties include Greenville and Spartanburg in South Carolina, and Catawba, Gaston and Iredell
776 counties in North Carolina.
777
778 **Table 5.1**-Human population projections for North Carolina counties within the range of dwarf-
779 flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

County	2018	2023	2028	2033	2037
Alexander	38,609	39,244	39,686	39,992	40,169
Burke	90,865	93,124	95,382	97,644	99,452

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Caldwell	83,919	86,723	88,689	91,126	92,870
Catawba	157,424	159,799	162,175	164,549	166,447
Cleveland	98,862	99,685	100,004	100,128	100,170
Gaston	221,112	227,667	237,344	245,276	252,388
Iredell	179,740	195,623	211,501	227,383	240,088
Lincoln	84,494	91,034	96,865	103,069	107,858
Polk	21,273	21,823	22,288	22,681	22,955
Rutherford	67,880	68,154	68,283	68,341	68,368

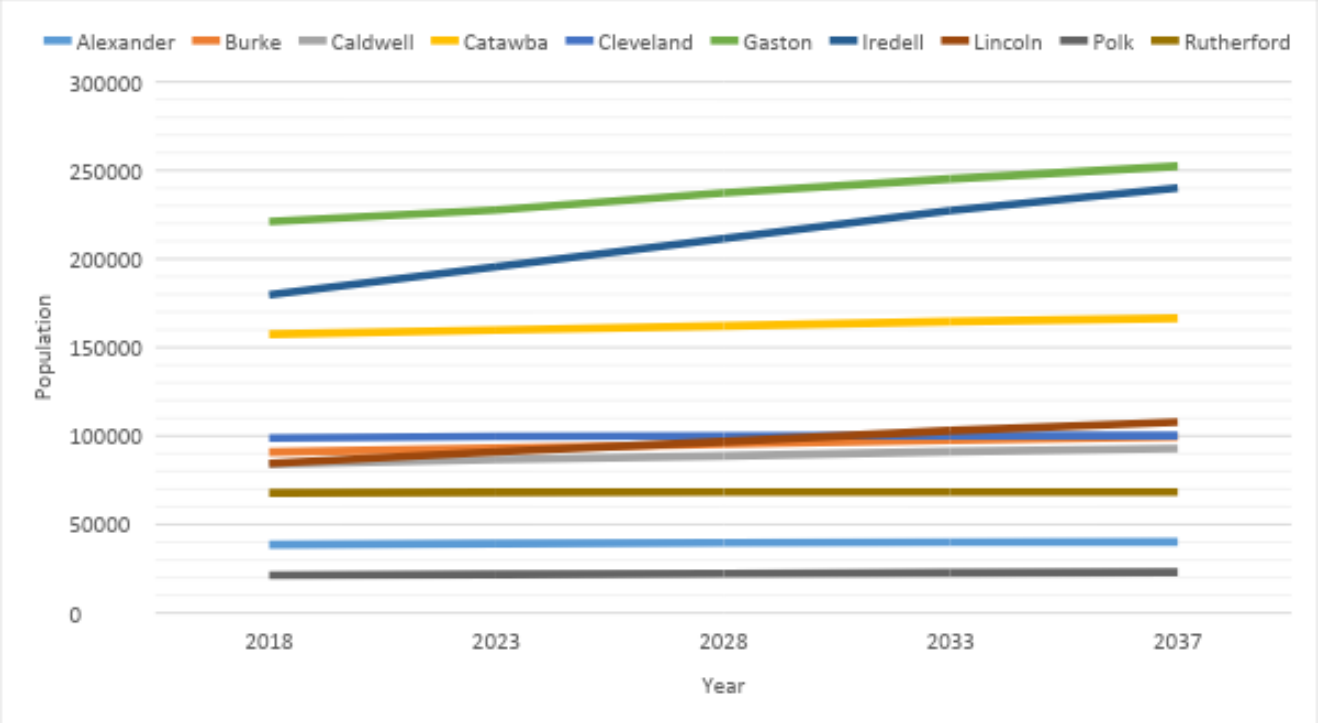


Figure 5.1- Human population projections for North Carolina counties within the range of dwarf-flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

Table 5.2- Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

County	2020	2025	2030	2035
Cherokee	61,760	64,760	67,350	70,170

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Greenville	492,890	517,740	542,290	567,010
Spartanburg	310,220	323,550	336,810	350,110

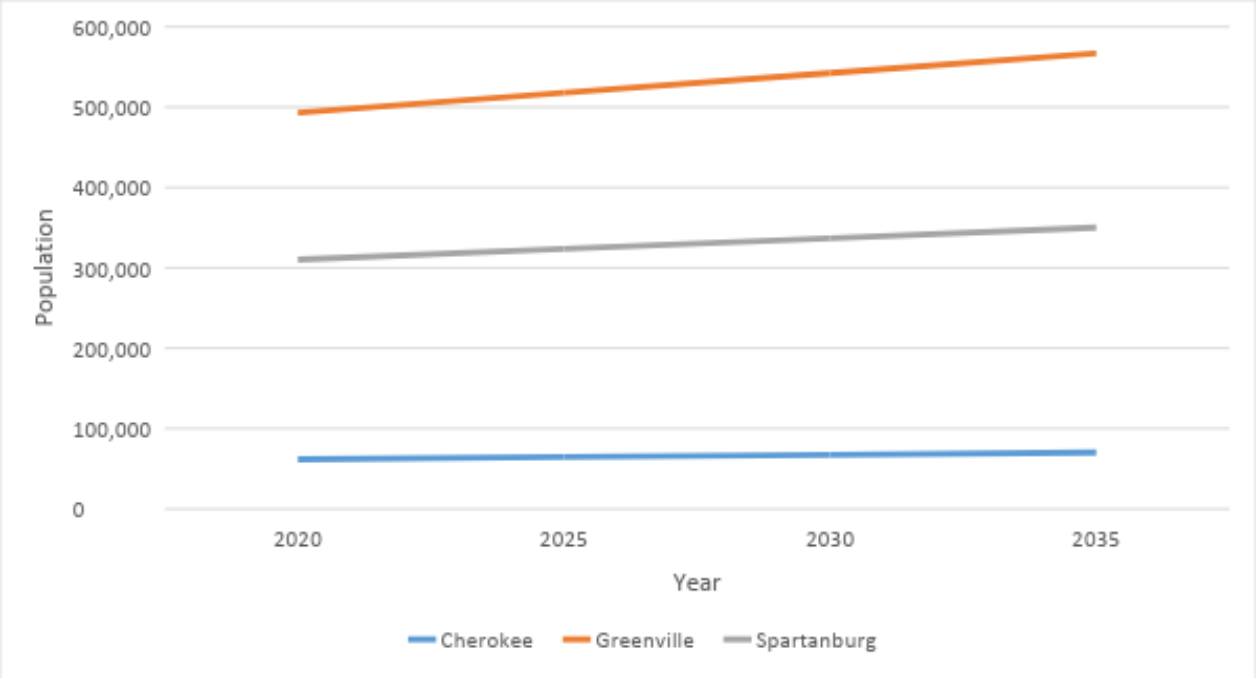


Figure 5.2. Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

Development

A large number of the known populations occur near expanding urban areas and are threatened by the residential, commercial, and industrial development associated with this growth. Populations occurring in more rural areas are threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds.

A 2010 review of existing NHP EOR data revealed that all or portions of 26 populations (24% of the total) had been directly or indirectly impacted through development projects or other causes such as trash disposal, expansion of residential lawns, cattle, or invasive exotics (NCNHP 2010;

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

SCDNR 2010). Another 16 populations have been specifically reported to be threatened by one or more of these same sources. Therefore, threats have either occurred or are reasonably foreseeable within 42 of the 113 populations (corresponding to 37% of all known populations). Of these 42 populations, all or portions of 22 (50%) had been adversely impacted by activities requiring ESA Section 7 consultation with the USFWS. The fact that nearly 20% of all known populations had been subject to formal Section 7 consultation illustrates the threats faced by the species.

In the same 2010 review, the most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving *H. naniflora* is road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations between the USFWS and the NCDOT. Collectively, these projects have adversely impacted or are currently expected to impact some 22,135 rosettes. In most cases the Section 7 process has resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection to those plants remaining (post-construction) within NCDOT right-of-way (ROW).

Other forms of economic development have also resulted in the destruction or modification of habitats occupied by *H. naniflora*; in many cases, these activities have also required Section 7 consultations with the USFWS. Examples of these activities include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities (in compliance with Federal Aviation Administration standards) at a regional airport. Collectively, these activities have involved the loss or relocation of several thousand rosettes.

Blalock Reservoir in Spartanburg County, South Carolina was once estimated to contain the largest population of *H. naniflora*, with over 11,000 rosettes reported here in 1997 (JJ&G, 1998). This population was the subject of a section 7 consultation as a result of a proposal to raise the elevation of Blalock Reservoir, which provides water supply storage to Spartanburg County and the City of Spartanburg (USFWS, 2001). Approximately one-third of this population was directly threatened by inundation, and the Federal agency committed to the relocation of some

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

3,054 rosettes to remaining areas of occupied habitat around the reservoir. At the conclusion of formal section 7 consultation, the USFWS anticipated that as many as 6,619 rosettes (assuming that all transplants survived) would be afforded protection through restrictive covenants placed on properties owned by the Spartanburg Water System (SWS) surrounding Blalock Reservoir. However, this population was last reported to contain a mere 1,400 rosettes (Newberry, 2006), and has twice since been impacted by encroachments from adjacent landowners (Newberry, 2009; Schneider, 2006, and JJ&G, 2006). Some of these apparent declines could be partially an artifact of incomplete survey effort, in that the exhaustive surveys which led to the 1997 estimate (of 11,000 rosettes) have never been repeated. However, it seems unlikely that plants occurring on privately owned shoreline not subject to restrictive covenants would be any more stable than those occurring on properties specifically protected and managed for the species (by SWS).

Invasive Species and Woody Encroachment

Several of the known populations of dwarf-flowered heartleaf occur on steep ravine slopes which also support stands of mixed hardwoods with an understory of mountain laurel (*Kalmia latifolia*) or *Rhododendron spp*. These stands are often very dense and reduce the amount of light reaching the dwarf-flowered heartleaf plants growing below. Under these conditions the plants often show reduced vigor and reduced flower and fruit production. Careful, selective logging or natural tree fall and limited understory removal would open up these populations to more light. Additional light, if not accompanied by increased siltation from the intensive soil disturbances associated with forest clear-cutting, probably would benefit these populations (Gaddy 1981).

Invasive exotic plant species are rampantly spreading throughout riparian corridors and ravines across the range of this species (USFWS 2011). Invasive exotics such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum* spp.), Japanese honeysuckle (*Lonicera japonica*) and Japanese Nepal grass (*Microstegium vimineum*) are known to threaten several populations; however, the scope and magnitude of this threat has not been comprehensively assessed. This threat requires active management in order to be successfully abated. At present, the majority of protected

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

870 populations are secured against habitat conversion, but lack designated managers with the
871 technical expertise and available resources (funding and personnel) to address this threat.
872
873
874
875 ***Climate Change***
876
877 There is a growing concern that climate change may lead to increased frequency of severe storms
878 and droughts (McLaughlin *et al.* 2002, p. 6074; Golladay *et al.* 2004, p. 504; Cook *et al.* 2004, p.
879 1015). Because typical habitats for this species include moist soils adjacent to creeks,
880 streamheads, or along lakes and rivers, and plants have been observed to grow larger and have
881 more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993),
882 specific effects of climate change to the dwarf-flowered heartleaf are likely related to changes in
883 soil moisture associated with potential increases in drought.
884
885 Warming in the Southeast is expected to be greatest in the summer (NCCV 2016) which is
886 predicted to increase drought frequency, while annual mean precipitation is expected to increase
887 slightly, leading to increased flooding events (IPCC 2013, p.7; NCCV 2016). Changes in
888 climate may affect ecosystem processes and communities by altering the abiotic conditions
889 experienced by biotic assemblages resulting in potential effects on community composition and
890 individual species interactions (DeWan et al. 2010, p.7).
891
892 Despite the recognition of potential climate effects on ecosystem processes, there is uncertainty
893 about what the exact climate future for the Southeastern US will be and how the ecosystems and
894 species in this region will respond. Although climate change was not a factor leading to the
895 original listing of the species, it should be recognized that the greatest threat from climate change
896 may come from synergistic effects. That is, factors associated with a changing climate may act as
897 risk multipliers by increasing the risk and severity of more imminent threats. As a result, impacts
898 from rapid urbanization in the region might be exacerbated under even a mild to moderate
899 climate future.
900

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Regardless of a pessimistic, optimistic, or status quo climate future, the following systematic changes are expected to be realized to varying degrees in the Southeastern US (IPCC 2013):

- More frequent drought
- More extreme heat (resulting in increases in air and water temperatures, Figure 5-3)
- Increased heavy precipitation events (e.g., flooding)
- More intense storms (e.g., frequency of major hurricanes increases)
- Rising sea level and accompanying storm surge

In recent years, the Southeast has experienced moderate to severe droughts that many observers have implicated in population declines and poor transplant survivorship (NCNHP, 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). The extent to which these climate changes will significantly affect populations of dwarf-flowered heartleaf is currently unknown.

Appendices 4a and 4b gives summary reports on historical and future predicted climate parameters from the USGS National Climate Change Viewer for both North Carolina and South Carolina. As discussed above, the trend for these States is consistent with the general trend in the Southeast: more frequent drought, more extreme heat, and increased precipitation events. If these predictions hold true, dwarf-flowered heartleaf habitat would likely be impacted through increased evaporative rates and decreased soil moisture (Appendices 4a and 4b), increased potential for catastrophic wildfire events, as well as potential disruption of stream bank morphology through increased flooding events. Our habitat model indicates a preferred temperature and precipitation range, indicating that the species would be sensitive to a changing climate.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Chapter 6: FUTURE CONDITION

Future Considerations

Our analysis of the past, current, and future influences on what the dwarf-flowered heartleaf needs for long term viability revealed that there are several influences that pose risks to future viability of the species. These risks are primarily related to habitat changes from development and long term climate change. We use projections of urban development to assess potential habitat loss and fragmentation. We also considered how climate change may exacerbate the impacts of development in a qualitative fashion using a narrative approach.

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below. Based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape, we chose to project populations out to the year 2040 under each scenario, but no further.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

DRAFT

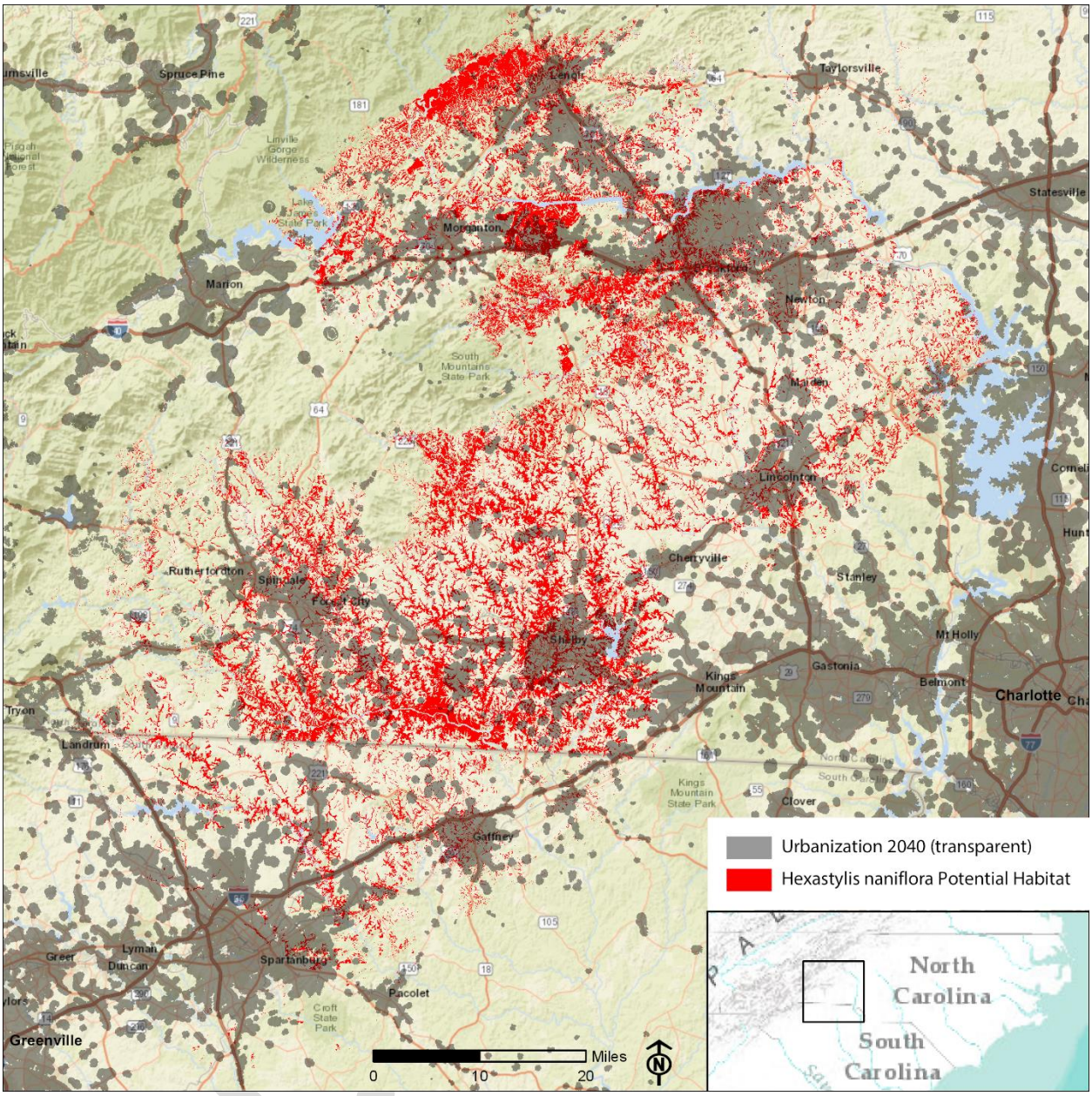
Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040 (Figure 6.1). SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995).

Figure 6.1. Results of the SLEUTH model with *Hexastylis naniflora* potential habitat predicted by the MAXENT model overlaid.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.



The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations (from Current Conditions—68 populations)

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There is no data available on the exact relationships between urbanization and the impacts to dwarf-flowered heartleaf. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative impacts; development increase of at least 50% was likely to have significant impacts to populations. We also assume that populations currently on protected lands are likely to see smaller impacts from urbanization compared to those that are not protected, but protection status (perpetuity vs non-perpetuity) matters. For example, Registered Heritage Areas are non-binding agreements with a land owner, and if the land changes ownership, or the owner decides not to continue with the agreement, then the Registry is no longer valid. Appendix 4 shows the protection status of each delineated population which helped to inform our assessment of resilience under each scenario.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. We believe this is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider for Current Conditions include detections that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to persist. Dwarf-flowered heartleaf is a long-lived perennial, and several EOs have been revisited after more than 10 years and the species was present. For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

habitat present within older EOs based on the Maxent model predictions that were not included as current populations.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future, was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resilience of that population.

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics including resilience category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resilience categories were assessed using last known abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score was calculated by taking the mean Maxent score of all potential habitat within the 1,000 foot buffer. The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 foot buffer that falls within the highest habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 foot buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

1047 flowered heartleaf is likely to persist. Table 6.1 (North Carolina) and 6.2 (South Carolina) show
1048 all of the EOs we considered and the corresponding metrics associated with resilience categories,
1049 urban development, and habitat scores.
1050
1051 **Table 6.1.** North Carolina raw data for metrics assessed to investigate potential sites where
1052 dwarf-flowered heartleaf was historically found and is likely to persist. Resilience categories are
1053 based on last known abundance estimates as follows: 1 = low; 2 = moderate; 3 = high; 4 = very
1054 high. MAXENT Average Mean refers to the mean Maxent score of all potential habitat. %
1055 Maxent classified as 0.8-1.0 represents the percentage of all potential habitat that falls within the
1056 highest habitat class. % Urban Development refers to the percentage of the 1,000 foot buffer
1057 around the EO that is projected to be urbanized in the year 2040.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

1058

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	2	34	1	3
2				
3	2	22	0	10
4	2	22	0	7
5	2	21	0	0
6				
8	1	27	0	6
9	3	44	4	0
10	4	33	2	0
11				
12	4	54	10	0
13	1	31	1	30
14	2	61	16	7
15				
16	4	18	0	47
17	1	50	13	0
18	1	36	8	2
19				
20	2	22	1	88
21	2	34	4	54
23	4	15	0	8
25	1	47	15	30
27				

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
28	2	43	12	29
29	4	43	8	30
30	4	27	2	74
31	4	30	3	86
32	2	34	2	47
33	2	33	3	0
34	1	49	13	63
35	1	42	10	23
36	1	19	0	12
37	4	41	6	17
38	2	14	0	46
39	1	19	0	11
40	2	37	2	32
44	4	20	0	59
45	1	27	5	13
46	3	42	6	6
47	1	28	1	96
48	1	14	0	12
49	4	61	14	5
50				
51	4	52	11	18
52	2	46	4	0
53	1	35	4	24
54	1	35	1	10
55	4	30	0	0
56	2	40	2	6
57	2	21	0	80
58	1	42	5	0
59	2	11	0	49
60	1	25	0	2
61	3	41	0	0
62	2	34	0	0
63	1	27	0	6
64	2	39	9	11
69	2	46	11	19
70	2	38	1	0
71	2	30	2	0
72	2	52	14	0
73	4	60	17	1

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
74	3	65	14	4
75	4	47	6	9
76	4	42	4	10
77	3	31	1	27
79	2	39	1	0
80	1	43	4	15
83	2	17	0	11
84	2	13	0	1
85	2	42	4	5
87				
89	2	13	2	0
90	2	28	2	0
91	1	49	5	0
92	2	15	0	30
106	4	39	4	38
107	1	14	0	40
113	4	46	4	7
114				
115	2	37	3	26
118	3	42	0	9
121	2	41	5	0
122	1	12	0	39
124	1	12	0	9
125	4	15	0	41
130	2	17	0	24
149	4	64	17	3
151	2	16	0	27
154	4	30	1	22
157	2	20	0	0
158	3	36	7	5
159	4	62	24	60
160	3	62	24	32
161	4	64	28	30
162	1	32	2	58
163	2	15	0	56
164	3	18	0	52
165	1	13	0	56
166	1	14	0	40
167	4	30	0	20

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
168	4	19	0	34
169	1	30	0	12
170	2	17	0	40
172	1	39	3	7
173	2	30	1	48
174	1	42	4	16
175				
180	2	21	1	0
181	4	29	2	0
182	4	45	4	0
183	2	15	0	5
184	4	19	0	19
187	2	20	1	35
188	2	24	0	53
189	1	25	0	14
190				
191	2	34	2	0
192	2	35	3	0
193	2	36	7	6
194	4	51	14	18
195	1	21	0	96
196	1	23	4	67
197	4	35	8	38
198	2	32	6	25
199	2	29	5	43
200	1	26	2	87
201	1	39	4	63
202	4	35	4	85
203	1	43	4	49
204				
205	2	43	1	49
206	1	37	3	66
207	2	33	2	85
208	1	32	1	67
209	2	33	2	94
210				
212	1	37	3	85
213	1	36	4	72
219	1	32	1	4

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
222	2	23	3	7
223				
224	1	22	3	17
225	2	24	2	12
227	4	55	2	5
229	2	28	0	21
230	1	54	15	13
231	1	41	7	0
233	4	53	12	14
235	2	50	8	6
236	2	62	14	5
237	2	67	16	5
238	4	51	15	0
239	2	63	14	5
240	1	57	18	0
241	2	62	16	3
242	1	53	9	0
246	1	62	13	4
249	4	47	5	0
250	4	45	4	0
251	4	43	4	0
254	2	54	18	6
255				
256	2	54	15	13
258	3	19	0	51
259	4	25	0	0
262	4	29	2	50
263				
264				
265				
266				
267	2	29	1	0
268	1	33	2	0
269	2	49	17	0
270	1	46	18	1
271	1	26	7	0
272	1	33	0	71
273	2	28	2	0
274	2	50	8	0

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
275	2	12	0	0
276	4	42	5	21
277				
278				
279	1	32	4	89
280	2	64	30	30
281	1	64	31	36
282	1	64	31	51
283	1	65	34	59
284	1	64	35	45
286				
287	2	15	0	35
291	2	21	1	84
292	2	14	0	83
293	1	8	0	16
294	2	36	4	61
296	2	3	0	5
297				
298	2	16	0	1
299	1	12	0	0
300	1	9	0	18
303	2	31	0	0
304	2	31	0	0
305	1	30	2	0
306	1	4	0	53
308	2	15	0	3
309	1	5	0	0
310	4	58	26	35
311	2	15	0	0
312	4	17	0	57
313				
314				
315	1	36	4	61
317	1	15	0	53
318	2	34	4	52
319	4	43	4	10
320	4	41	6	98
321				

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
Min	1	3	0	0
Max	4	67	35	98

Table 6.2. South Carolina raw data for metrics assessed to investigate potential sites where dwarf-flowered heartleaf was historically found and is likely to persist. Resilience categories are based on last known abundance estimates as follows: 1 = low; 2 = moderate; 3 = high; 4 = very high. MAXENT Average Mean refers to the mean Maxent score of all potential habitat. % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat that falls within the highest habitat class. % Urban Development refers to the percentage of the 1,000 foot buffer around the EO that is projected to be urbanized in the year 2040.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	2	21	0	0
2	2	1	0	4
3				
4	1	13	0	10
5	2	0	0	64
6	1	0	0	36
7	4	27	0	35
8	2	0	0	14
9				
10				
11	4	14	0	52
12				
13	1	7	0	100
14	4	14	0	43
15	1	0	0	4
16	4	22	0	38
17	4	22	0	33
18	3	19	0	52
19	1	12	0	65
20	2	5	0	100
21	3	5	0	90
22	1	0	0	0
23				

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
24	1	4	0	3
25	1	14	0	48
26	4	12	0	65
27	4	18	1	40
28	4	19	1	49
29				
30	2	7	0	88
31	4	0	0	0
32	2	7	0	93
33	2	2	0	20
34	1	31	3	1
35	1	23	1	53
36	2	6	0	0
37	1	24	2	0
38	4	5	0	37
39	1	6	0	1
40	2	6	0	20
41	1	11	0	87
42	2	3	0	6
43	1	23	0	43
44				
45				
46	1	10	0	96
47				
48				
49	3	8	0	70
50	2	5	0	54
51	1	0	0	35
52	3	0	0	0
53	2	10	0	66
54	2	9	0	91
55	1	4	0	99
56	2	14	0	96
57	3	15	0	38
59	2	4	0	17
60	4	17	1	12

Min	1	0	0	0
Max	4	31	3	100

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development

Next, we implemented a set of ranking rules using the data from Tables 6.1 and 6.2 to further assess which EOs had a higher likelihood of persistence on the landscape. We used SMART methodology to quantify and implement our ranking rules. Because the metrics of interest vary in data type (i.e. categorical vs continuous) and range of values (i.e. not all continuous variables have the same maximum and minimum), our first step was to normalize all of the data on a scale of 0-100. Normalization techniques allow for aggregation of criteria with numerical and comparable data. We decided to analyze North and South Carolina data separately because the Maxent model predicts habitat differently across state lines due to differences in soil classification. We weighted each variable according to our opinion of the level of contribution each variable had to the probability of persistence of that particular EO. This resulted in abundance having the highest weight (100%), with habitat (as calculated by average Maxent score) and urbanization given relatively similar weighting (80%). The results of the normalization procedure and weighting can be found in Tables 6.3 and 6.4.

Table 6.3. Normalized scores for SMART analysis of North Carolina EOs and weighting scores. Resilience category represents the normalized scoring based on the last known abundance (0=low; 33=moderate; 67=high; 100=very high); MAXENT Mean is the normalized score of the average Maxent rank of all potential habitat; MAXENT percent 0.8-1 represents the normalized score of the percentage of potential habitat that falls within the highest rank category; 80% or greater SLEUTH Percent of Total is the total amount of current urbanization plus predicted urbanization at year 2040 (>80% probability) from the SLEUTH model.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	33	49	3	97
2				
3	33	30	0	90
4	33	29	0	93
5	33	28	1	100
6				

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
8	0	37	0	94
9	67	65	11	100
10	100	46	6	100
11				
12	100	80	28	100
13	0	43	2	69
14	33	90	44	93
15				
16	100	23	0	52
17	0	73	37	100
18	0	52	22	98
19				
20	33	30	3	11
21	33	48	12	45
23	100	19	0	92
25	0	68	42	69
27				
28	33	62	33	71
29	100	63	22	69
30	100	38	5	24
31	100	43	8	12
32	33	48	5	52
33	33	47	8	100
34	0	73	37	35
35	0	60	29	77
36	0	25	0	88
37	100	60	17	82
38	33	17	0	53
39	0	24	0	89
40	33	54	7	67
44	100	26	1	40
45	0	37	14	86
46	67	60	18	94
47	0	39	2	2
48	0	17	0	88
49	100	91	39	95
50				
51	100	77	31	82
52	33	68	11	100

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
53	0	50	11	76
54	0	49	1	90
55	100	43	0	100
56	33	58	7	94
57	33	28	0	19
58	0	60	15	100
59	33	12	0	50
60	0	34	1	98
61	67	59	1	100
62	33	49	0	100
63	0	38	0	94
64	33	56	24	88
69	33	67	31	80
70	33	55	3	100
71	33	42	5	100
72	33	77	41	100
73	100	89	48	99
74	67	97	41	95
75	100	69	16	91
76	100	61	11	89
77	67	43	2	72
79	33	56	4	100
80	0	62	11	85
83	33	22	0	89
84	33	15	0	99
85	33	61	10	95
87				
89	33	15	5	100
90	33	38	5	100
91	0	71	13	100
92	33	18	0	70
106	100	56	10	61
107	0	16	0	59
113	100	68	11	93
114				
115	33	53	8	74
118	67	61	1	91
121	33	59	13	100
122	0	14	0	60

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
124	0	13	0	91
125	100	19	0	58
130	33	22	0	76
149	100	95	49	97
151	33	20	0	72
154	100	41	2	78
157	33	26	0	100
158	67	51	20	95
159	100	92	69	39
160	67	92	69	68
161	100	95	79	69
162	0	45	7	41
163	33	18	0	43
164	67	24	0	47
165	0	16	0	43
166	0	16	0	59
167	100	41	0	79
168	100	25	0	65
169	0	42	0	88
170	33	22	0	60
172	0	56	8	93
173	33	42	3	52
174	0	62	12	84
175				
180	33	28	2	100
181	100	41	6	100
182	100	66	12	100
183	33	18	1	95
184	100	24	0	81
187	33	27	2	64
188	33	33	0	46
189	0	33	1	86
190				
191	33	48	7	100
192	33	49	10	100
193	33	51	19	94
194	100	75	40	81
195	0	28	0	3
196	0	30	10	32

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
197	100	50	24	61
198	33	45	18	74
199	33	41	14	56
200	0	35	6	11
201	0	56	11	36
202	100	49	11	13
203	0	62	11	50
204				
205	33	62	4	50
206	0	52	8	33
207	33	47	4	14
208	0	45	4	32
209	33	46	5	4
210				
212	0	53	9	14
213	0	52	11	27
219	0	45	2	96
222	33	31	9	92
223				
224	0	29	8	83
225	33	32	6	88
227	100	81	7	95
229	33	39	0	79
230	0	80	44	87
231	0	59	20	100
233	100	79	34	86
235	33	74	22	94
236	33	93	41	95
237	33	100	46	95
238	100	74	41	100
239	33	94	40	94
240	0	85	51	100
241	33	93	47	97
242	0	78	27	100
246	0	93	38	95
249	100	68	13	100
250	100	65	12	100
251	100	62	11	100
254	33	80	51	93

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
255				
256	33	80	44	87
258	67	25	0	48
259	100	34	0	100
262	100	41	6	49
263				
264				
265				
266				
267	33	41	3	100
268	0	46	7	100
269	33	72	49	100
270	0	67	52	99
271	0	35	19	100
272	0	47	0	28
273	33	39	7	100
274	33	73	23	100
275	33	14	0	100
276	100	61	14	79
277				
278				
279	0	46	11	9
280	33	95	85	70
281	0	95	88	64
282	0	96	88	48
283	0	97	95	40
284	0	95	100	54
286				
287	33	18	0	64
291	33	28	4	14
292	33	16	0	16
293	0	7	0	84
294	33	52	11	38
296	33	0	0	95
297				
298	33	20	0	99
299	0	13	0	100
300	0	9	0	82
303	33	44	1	100

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
304	33	43	0	100
305	0	42	5	100
306	0	1	0	46
308	33	18	0	97
309	0	3	0	100
310	100	86	75	64
311	33	19	0	100
312	100	22	0	42
313				
314				
315	0	51	10	38
317	0	19	0	46
318	33	48	12	47
319	100	63	12	89
320	100	60	17	0
321				

Weights			
100	60	20	80

Table 6.4. Normalized scores for SMART analysis of South Carolina EOs and weighting scores. Resilience category represents the normalized scoring based on the last known abundance (0=low; 33=moderate; 67=high; 100=very high); MAXENT Mean is the normalized score of the average Maxent rank of all potential habitat; MAXENT percent 0.8-1 represents the normalized score of the percentage of potential habitat that falls within the highest rank category; 80% or greater SLEUTH Percent of Total is the total amount of current urbanization plus predicted urbanization at year 2040 (>80% probability) from the SLEUTH model.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	33	67	14	100
2	33	2	0	96
3				
4	0	42	3	90
5	33	0	0	36

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
6	0	0	0	64
7	100	87	2	65
8	33	0	0	86
9				
10				
11	100	43	0	48
12				
13	0	23	0	0
14	100	43	0	57
15	0	0	0	96
16	100	72	1	62
17	100	70	1	67
18	67	62	0	48
19	0	37	0	35
20	33	16	0	0
21	67	15	0	10
22	0	1	0	100
23				
24	0	13	0	97
25	0	44	0	52
26	100	40	0	35
27	100	56	18	60
28	100	60	28	51
29				
30	33	22	0	12
31	100	0	0	100
32	33	23	0	7
33	33	5	0	80
34	0	100	100	99
35	0	75	34	47
36	33	18	0	100
37	0	78	66	100
38	100	16	0	63
39	0	19	0	99
40	33	18	0	80
41	0	36	0	13
42	33	10	0	94
43	0	72	0	57
44				

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
45				
46	0	32	0	4
47				
48				
49	67	27	0	30
50	33	16	0	46
51	0	1	0	65
52	67	0	0	100
53	33	33	0	34
54	33	29	0	9
55	0	13	0	1
56	33	43	0	4
57	67	47	8	62
59	33	13	0	83
60	100	53	21	88

Weights			
100	60	20	80

To determine a final rank for likelihood of persistence, we calculated a weighted sum for each EO. We then converted the weighted sum to a final rank value that ranged from 0-100. Finally, we determined the top 10% or 90th percentile, and top 25% or 75th percentile ranking for EOs in each state. Table 6.5 summarizes the final ranks and top 10% and 25% percentile ranks for North and South Carolina. We will include the top 10% in the status quo scenario, and the top 25% in the conservation scenario.

Table 6.5. Final Rank Scores for EOs in North and South Carolina. Dark green represents the top 10% of scores, and light green includes the top 25% of scores.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

South Carolina

EO_Code	Final Score
60	79
7	79
17	75

North Carolina

EO_Code	Final Score
149	94
73	93
49	92

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

16	74
27	71
28	70
31	69
14	66
11	63
38	62
34	61
1	60
26	59
52	56
57	56
18	55
37	54
36	48
42	44
2	43
40	42
59	41
49	41
8	39
33	39
4	37
39	35
35	34
43	34
24	33
21	32
22	31
53	31
50	31
15	30
25	26
56	24
5	24
54	22
30	22
32	20
51	20
6	20
19	19

12	90
238	90
161	88
227	87
249	86
233	86
182	85
250	85
251	84
194	84
51	84
310	84
75	84
113	84
319	81
76	81
74	81
10	80
181	79
55	79
37	79
276	78
259	77
159	77
29	76
160	73
167	72
9	72
154	72
23	71
106	71
197	71
61	70
46	70
184	69
237	69
158	68
118	68
241	68
239	67
236	66

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

20	17
41	12
46	8
13	5
55	3
3	0
9	0
10	0
12	0
23	0
29	0
44	0
45	0
47	0
48	0

14	66
72	64
168	64
254	64
269	64
262	64
280	63
274	62
256	62
125	61
235	60
52	60
16	60
121	58
77	58
85	57
79	57
44	57
70	57
312	56
192	56
56	56
69	55
33	55
30	55
191	55
193	55
64	55
62	55
202	55
240	54
1	54
303	54
246	54
71	54
320	54
304	54
267	53
273	53
90	53
31	53

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

28	51
242	51
17	51
5	50
180	50
270	50
157	50
222	49
230	49
115	48
281	48
91	48
4	48
298	48
311	48
225	48
198	47
89	47
3	47
84	47
308	47
275	47
183	46
40	46
284	46
258	46
231	46
229	46
58	46
164	46
83	45
282	44
18	44
205	43
172	42
296	42
283	42
268	42
80	41
130	41
174	41

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

305	41
199	41
271	40
25	40
32	40
219	40
35	40
151	40
54	39
318	39
187	39
173	39
92	39
21	39
60	38
63	38
8	38
294	37
169	37
287	37
170	36
45	36
53	36
188	34
189	34
299	34
38	33
224	33
39	33
36	33
13	32
309	31
124	31
59	31
48	31
34	30
203	30
163	30
207	28
293	27
300	27

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

57	25
209	25
201	25
315	24
291	24
162	23
20	23
206	23
107	22
166	22
122	22
292	21
213	21
208	20
272	20
317	19
196	18
212	17
165	17
306	14
279	14
200	12
47	10
195	7
2	0
6	0
11	0
15	0
19	0
27	0
50	0
87	0
114	0
175	0
190	0
204	0
210	0
223	0
255	0
263	0
264	0

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

265	0
266	0
277	0
278	0
286	0
297	0
313	0
314	0
321	0

Below we describe how we integrated potential positive and negative influences across the scenarios. We can assume there is some tipping point at which an area becomes so urbanized it is unsuitable for dwarf-flowered heartleaf, but we don't know exactly what that tipping point is. Similarly, we can assume additional populations are likely to be found or rediscovered across the range, but there is no clear way to predict the exact number or location of these populations. Although there is great uncertainty associated with how the species will be influenced by these factors, the three scenarios are intended to capture the range of this uncertainty. Note, changes in climate have potential to exacerbate the effects of urbanization, but these effects are not likely to occur within our projection window (e.g. 2040).

Status Quo Scenario

Under the status quo scenario, we assume a few populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the % increase in urban development and whether a population is protected or not. We assessed population resilience under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

1137 ▪ Protected in perpetuity—no negative impacts from urbanization
1138 ▪ Voluntary protection/non-perpetuity—population drops 1 resilience rank if
1139 % increase in urbanization exceeds >50% threshold
1140 o Non-protected—population drops 1 resilience rank if % increase in urbanization
1141 exceeds >25% threshold; population drops 2 resilience ranks if % increase in
1142 urbanization exceeds >50% threshold
1143

1144 *High Development Scenario*

1145 Under the high development scenario, we assume no additional populations will be identified as
1146 persisting throughout the range, and that impacts from urbanization that are relatively high, and
1147 are also affected by whether a population is protected or not. We assessed population resilience
1148 under the following assumptions:

1149 ● No additional populations are identified as persisting
1150 ● Potential impacts of urban development based on SLEUTH Model projections focused on
1151 current delineated populations:
1152 o Protected areas
1153 ▪ Protected in perpetuity— population drops 1 resilience rank if % increase
1154 in urbanization exceeds >50% threshold
1155 ▪ Voluntary protection/non-perpetuity— population drops 1 resilience rank
1156 if % increase in urbanization exceeds >25% threshold; population drops 2
1157 resilience ranks if % increase in urbanization exceeds >50% threshold
1158 o Non-protected—population drops 1 resilience rank if % increase in urbanization
1159 exceeds >25% threshold; population drops 2 resilience ranks if % increase in
1160 urbanization exceeds >50% threshold; extirpation of populations if % increase in
1161 urbanization exceeds >90% threshold.
1162

1163 *Targeted Conservation Scenario*

1164 Under the targeted conservation scenario, we assume it is likely several additional populations
1165 (i.e. more than status quo scenario) will be identified as persisting throughout the range. The

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resilience under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

Future Resilience

Our focus on future resilience of dwarf-flowered heartleaf is on the potential impacts from urbanization. Table 6.6 shows a summary of currently delineated populations and the predicted urban development to occur within each of the populations. The table only includes those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Populations not included in this table are not predicted to be urbanized at all, so for the purposes of future analysis, will be assumed to retain the same resilience category as current. For those populations included in the table, we focus on those populations that are anticipated to increase in urbanization beyond a threshold value, depending on the scenario, but thresholds include >25% and >50% increases. Also taken into account is whether or not a population is on protected lands, and if so, whether the population is protected in perpetuity or not. Below is a summary of projected future resilience under each of the three scenarios.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Table 6.6. Results of the SLEUTH model. Populations consist of both stand-alone EOs and aggregates of multiple EOs following the definition of delineating demographic populations from Chapter 4. Included are only those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Red cells indicate populations that are predicted to increase >50% in urbanization. Orange cells indicate populations that are predicted to increase >25% in urbanization.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Population Number	Total Area (sq m)	Already classed Urban	80% chance	90% chance	95% chance	97.5% chance	100% chance	>80%
206	17346.37096	0.40%	0.00%	0.00%	0.00%	6.24%	93.41%	99.65%
306	7804.656249	0.00%	15.11%	49.91%	7.83%	0.00%	22.40%	95.24%
208	55360.86786	17.31%	0.00%	0.00%	0.00%	0.00%	82.69%	82.69%
279	1951.661571	0.00%	0.00%	0.00%	0.00%	0.00%	80.85%	80.85%
214	15043.2984	0.00%	0.00%	1.44%	10.97%	0.00%	55.72%	68.13%
248	25486.15611	28.80%	0.00%	3.22%	0.02%	0.02%	53.03%	56.30%
316	43177.79587	20.06%	0.00%	16.68%	7.08%	0.00%	20.67%	44.43%
247	49898.17159	5.87%	0.00%	6.37%	0.00%	0.00%	23.35%	29.73%
291	11666.76374	35.39%	12.28%	13.53%	2.43%	0.00%	0.23%	28.47%
287	7901.775408	0.00%	0.00%	11.50%	0.00%	0.00%	14.25%	25.75%
312	6535.273235	0.00%	25.28%	0.00%	0.00%	0.00%	0.00%	25.28%
32	31220.60253	60.74%	0.00%	20.39%	0.00%	0.00%	0.00%	20.39%
177	26954.54153	25.34%	12.19%	0.92%	0.10%	5.31%	0.13%	18.66%
292	15611.18205	0.00%	0.00%	0.00%	0.00%	0.00%	18.40%	18.40%
261	21644.22924	0.00%	0.00%	13.21%	3.35%	0.00%	0.00%	16.56%
295	23486.00987	18.20%	0.00%	3.41%	11.99%	0.25%	0.00%	15.65%
125	20742.3249	0.00%	1.02%	5.65%	0.00%	6.67%	0.00%	13.34%
59	8172.007769	0.00%	13.09%	0.00%	0.00%	0.00%	0.00%	13.09%
302	120342.0641	1.46%	2.55%	2.55%	0.77%	2.33%	3.98%	12.19%
178	376781.2214	28.59%	2.79%	2.40%	0.68%	0.59%	2.64%	9.11%
93	43754.11642	0.19%	0.00%	0.00%	0.00%	0.00%	7.82%	7.82%
77	6044.427562	0.00%	1.51%	6.14%	0.00%	0.00%	0.00%	7.64%
179	15145.19453	85.06%	1.14%	0.00%	5.12%	0.00%	0.49%	6.75%
44	15081.76951	61.17%	0.27%	0.00%	0.00%	0.00%	4.68%	4.95%
252	39595.93143	63.47%	0.00%	3.80%	0.00%	0.00%	0.00%	3.80%
100	423621.7376	9.01%	1.32%	1.10%	0.72%	0.14%	0.00%	3.27%
276	123688.7819	0.61%	0.36%	1.87%	0.01%	0.00%	0.00%	2.24%
216	66424.06073	0.00%	0.91%	0.00%	0.00%	0.00%	0.00%	0.91%
154	33924.92259	0.00%	0.00%	0.37%	0.00%	0.00%	0.00%	0.37%
29	249998.8742	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.05%
1	30711.68144	0.41%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2	36339.91976	11.32%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3	24498.03483	24.77%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
31	42929.76479	100.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
96	95947.32128	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
130	1168.240433	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
176	39787.48373	0.89%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
195	7805.599588	99.94%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
317	584.7346337	99.70%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
318	5396.859208	99.74%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
320	125.5182447	98.79%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Status Quo Scenario

In the Status Quo scenario, there are predicted to be 75 populations of dwarf-flowered heartleaf on the landscape (Table 6.7). The predicted resilience of the extant populations are as follows:

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the seven additional populations predicted to persist under this scenario, four are in South Carolina, and three in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), and moderate (4).

Table 6.7. Predicted resilience categories for *Hexastylis naniflora* populations under the Status Quo scenario, and comparison to current condition.

Site Name	Current Resilience	Status Quo
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	high
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributray Rare Plant Site	very high	very high

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	Status Quo
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	high
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	Status Quo
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	low
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low
First Broad River (North Carolina)	n/a	present
Cherokee Creek/Bonner and Robin School Roads	n/a	present

High Development Scenario

In the High Development scenario, there are predicted to be 72 populations of dwarf-flowered heartleaf on the landscape (Table 6.8). The predicted resilience of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No new future populations are predicted to be discovered. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to moderate resilience; one high resilience population is predicted to drop to moderate; two moderate populations are predicted to drop to low resilience; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Table 6.8. Predicted resilience categories for *Hexastylis naniflora* populations under the High Development scenario, and comparison to current condition.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	High Development
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	moderate
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributary Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	moderate
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	High Development
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	extirpated
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	High Development
Gateway Elementary School	low	low

Targeted Conservation Scenario

In the Targeted Conservation scenario, there are predicted to be 79 populations of dwarf-flowered heartleaf on the landscape (Table 6.9). The predicted resilience of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations discovered to persist, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the sixteen additional populations predicted to persist under this scenario, ten are in South Carolina, and six in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), moderate (11), and low (2).

Table 6.9. Predicted resilience categories for *Hexastylis naniflora* populations under the Targeted Conservation scenario, and comparison to current condition.

Site Name	Current Resilience	Targeted Conservation
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	Targeted Conservation
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	high
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributray Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	high
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Site Name	Current Resilience	Targeted Conservation
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	low
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low
First Broad River (North Carolina)	n/a	present
First Broad Hop-Hornbeam NA	n/a	present
Big Island Carolina Hemlock Bluff	n/a	present
Cherokee Creek/Bonner and Robin School Roads	n/a	present
Arrowood Branch	n/a	present
Cherokee Creek/SC 11	n/a	present

Viability Summary

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resilience and extirpation of a few populations is offset by the fact that several additional populations were found to persist in the Status Quo and Targeted Conservation scenarios. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resilience in several additional populations. Regardless of the scenario, the majority of the populations expected to persist on the landscape in 2040 are of at least moderate resilience.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances, however the species range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

Given that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where we have relatively few current populations. As discussed below, we believe there are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, we believe our scenarios do not predict declines in species representation.

Table 6.10. Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	CURRENT	STATUS QUO	HIGH DEVELOPMENT	TARGETED CONSERVATION
VERY HIGH	28	27	27	27
HIGH	5	6	4	6
MODERATE	26	23	25	23
LOW	19	17	16	17

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

EXTIRPATED	n/a	5	6	5
PERSISTING	n/a	2	0	6
TOTAL	**78**	**75**	**72**	**79**

Opportunities for Additional Conservation

Although our scenarios focus on areas where dwarf-flowered heartleaf have been found in the past, the Maxent model identifies a number of areas as high quality potential habitat for the species that falls outside the immediately known occurrence areas. A few of these areas are detailed below (Figure 6.2).

1. West of the city of Lenoir, south of Highway 90/Adako Rd., north of Highway 64 within Caldwell County. This area identifies a large block of potential habitat. This area falls just outside the administrative boundary of the Pisgah National Forest. The bluffs and tributaries along the Johns River are identified as the best habitat, but there is also ample habitat identified along the forested areas of Celia, Husband, Abingdon and Greasy Creeks. The only known occurrence within this area is associated with Abingdon Creek and is under a conservation easement.

2. Henry Fork River bluffs and tributaries east of Highway 18 within Burke County. A historic element occurrence is present by the Burke County line, but the entire area is identified as good quality potential habitat for the species where forested habitats remain.

3. South West corner of Catawba County west of Highway 321. Several disjointed patches of high quality potential habitat are identified in this region associated with the river and creek slopes. Rock Creek, Jacob Fork River, Pott Creek, and their associated tributaries all contain blocks of potential habitat. A number of element occurrences are identified within this area, but additional habitat is identified both upstream and downstream of the known occurrences.

4. Clark, Pinch Gut, Maiden, and Allen Creeks, north of the town of Maiden. The slopes along these creeks all contain quality potential habitat. Known element occurrences are in the general area, but none are situated within the creeks listed.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

5. First Broad River North of Highway 74, Rutherford County. Two older element occurrences are located within this area, however, the forested bluffs along the First Broad River and associated tributaries are identified as good quality potential habitat in many additional upstream and downstream areas in this system.

6. Hickory Creek, Sulphur Springs Branch (Little Hickory), Shoal Creek, and tributaries draining into First Broad River South of the Town of Shelby, north of the South Carolina border. The town of Shelby has likely disconnected this site from area 5 listed above. Here, slopes along the creeks and tributaries draining into the First Broad River are identified as potential habitat more so than the slopes along the First Broad River themselves. There in only a single element occurrence known upstream along Hickory Creek.

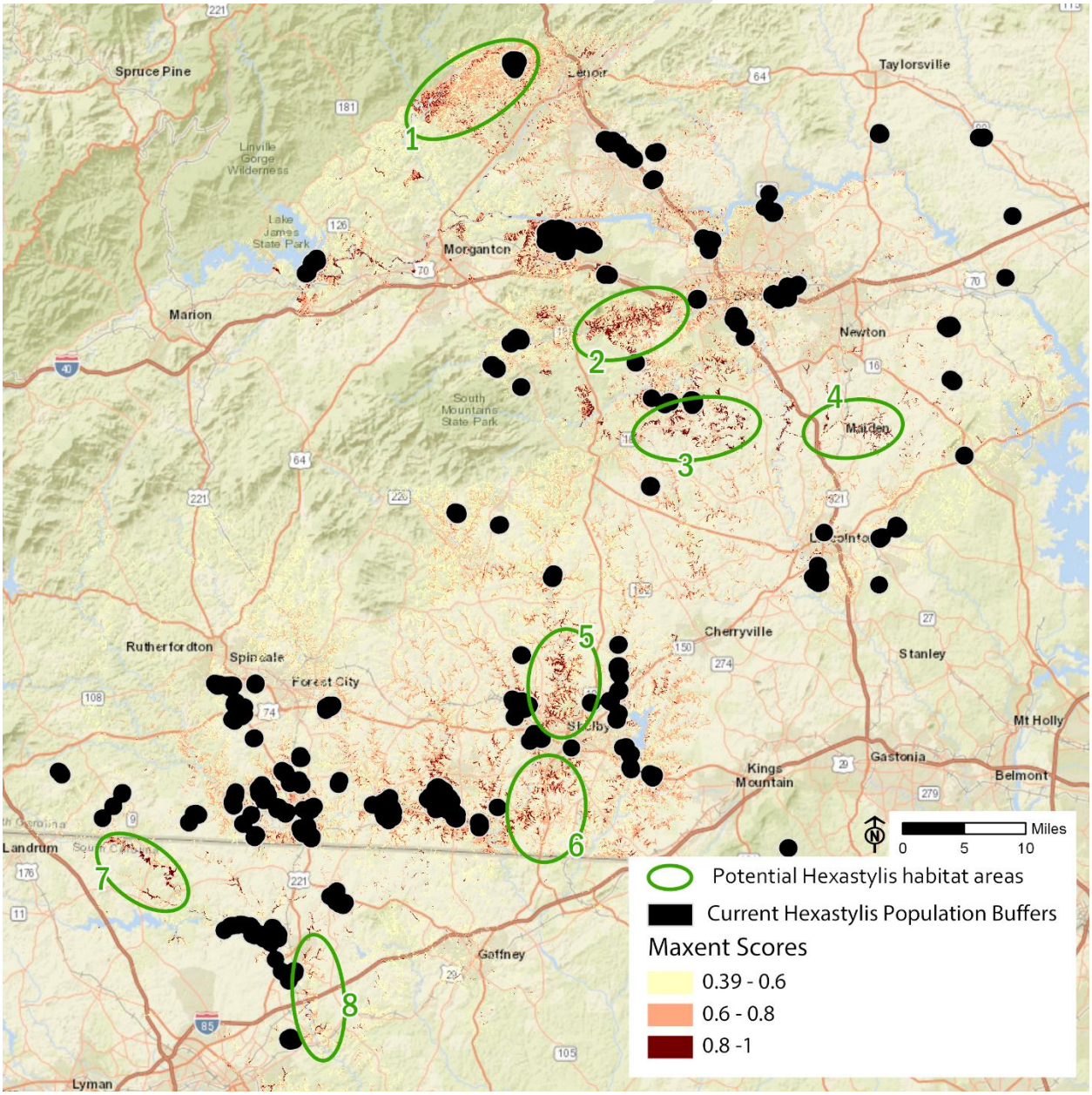
7. North Pacolet River and Obed Creek, north of where they join. The majority of potential habitat falls along the slopes of the North Pacolet River. Two older element occurrences (1991 last observation) are found in the tributaries draining into the North Pacolet River, and many occurrences are found further upstream. The habitat model suggests that additional undiscovered habitat areas are present.

8. Pacolet River and Island Creek, north of Peters Creek, downstream of the Pacolet River dam. This area displays limited amounts of good quality potential habitat. Recent element occurrences are present in the upper headwaters of Peters and Zekial Creeks (Zekial Creek drains into Peters Creek) and in areas north of the Pacolet River dam, but none are known along the areas identified in this immediate area.

DRAFT

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Figure 6.2. Areas identified as high quality potential habitat by Maxent model for *Hexastylis naniflora* that fall outside the immediately known occurrence areas.



Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Literature Cited

Amoroso, J.L. 2016. *Hexastylis naniflora* status meeting with USFWS, NCNHP, ASU, and NCDOT [meeting minutes]. North Carolina Department of Natural and Cultural Resources office, Asheville, NC, 11 May 2016.

Baldwin, R.A. 2009. Use of maximum entropy modeling in wildlife research. Entropy. 11:854-866.

Barringer, K. 1993. New combinations in North American *Asarum* (Aristolochiaceae). Novon 3:225-227.

Blomquist, H.L. 1957. A Revision of *Hexastylis* in North America. Brittonia 8:255-281.

Clarke, K.C., Riggan, P., and Brass, J.A., 1995. A cellular automaton model of wildfire propagation and extinction, Photogram. Eng. Rem S. 60, 1355-1367.

Dobzhansky, T. 1937. Genetics and the origin of species. Columbia University Press, New York, NY.

DeWan, A., N. Dubois, K. Theoharides, and J. Boshoven. 2010. Understanding the impacts of climate change on fish and wildlife in North Carolina.

Flora of North America 1997. Flora of North America north of Mexico. Volume 3, Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York, NY. 590 pp. Contains Whittemore and Gaddy's treatment of *Asarum* and *Hexastylis*.

Gaddy, L.L. 1980. Status Report on *Hexastylis naniflora* Blomquist. Prepared for and submitted to USFWS, Endangered Species Office, Region 4, Atlanta, Georgia. July 1980.

Gaddy, L.L. 1981. The status of *Hexastlylis naniflora* Blomquist in North Carolina. Unpublished report prepared under contract to the Plant Conservation Program, North Carolina Department of
Agriculture, Raleigh.

Gaddy, L. 1986. Twelve new ant-dispersed species from the southern Appalachians. *Bulletin of the Torrey Botanical Club* 113: 247-251.

Gaddy, L.L. 1987. A review of the taxonomy and biogeography of *Hexastylis* (Aristolochiaceae). Castanea 52(3):186-196.

Golder Associates, Inc. 2009. Year 5 Monitoring Report, *Hexastylis naniflora*, Foothills Conservation Area, Caldwell County, North Carolina. Submitted to: Republic Services of North Carolina, LLC; copies (per cover letter) distributed to US Army Corps of Engineers, Asheville Regulatory Office and USFWS Asheville ES Office. June 26, 2009.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Golladay SW, Gagnon P, Kearns M, Battle JM. Hicks DW. Response of freshwater mussel assemblages (Bivalvia: Unionidae) to a record drought in the Gulf Coastal Plain of southwest Georgia. J. N. Am. Benthol. Soc. 2004;23:494–506.

Gonzalez, V. C. 1972. The ecology of *Hexastylis arifolia*, an evergreen herb in the North Carolina deciduous forest. Ph.D. disseration, Duke University. Durham, North Carolina, USA. HDR. 2005. Identification of *Hexastylis naniflora*. Notes on characteristics and field observations provided to the North Carolina Natural Heritage Program, Raleigh.

IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

Jones M.S., T. H. Jones, and J. J. English. 2014. The Pollination of *Hexastylis naniflora* in Cleveland County, North Carolina. Castanea: June 2014, Vol. 79, No. 2, pp. 74-77.

Jordan, Jones and Goulding (JJ&G), Inc. 1998. Section 404 Application and Conceptual Mitigation Plan, Lake Blalock Expansion Project. USFWS Log number 4-6-97-358. ACOE Project # 80-97-1732 (S). Section 9: *Hexastylis naniflora* Biological Assessment. Received by the Asheville Field Office July 16, 1998.

Jordan, Jones and Goulding (JJ&G), Inc. 2006. Lake Blalock Buffer Disturbance – Vicinity of Casey Creek Road. Memorandum to: Eddie Dearbury, Spartanburg Water Systems. Date: October 25, 2006.

Karl, T. R., Melillo, J. M., & Peterson, T. C. (Eds.). (2009). Global Climate Change Impacts in the United States. Washington, DC: U.S. Global Change Research Program.

Kelly, L. M. 1997. A Cladistic Analysis of *Asarum* (Aristolochiaceae) and Implications for the Evolution of Herkogamy. American Journal of Botany 84:1752-1765.

Kelly, L. M. 1998. Phylogenetic Relationships in *Asarum* (Aristolochiaceae) Based on Morphology and ITS Sequences. American Journal of Botany 85:1454-1467.

Kelly, L. M. 2001. Taxonomy of *Asarum* Section *Asarum* (Aristolochiaceae). Systematic Botany 26:17-53.

Lengyel, S., A. D. Gove, A. M. Latimer, J. D. Majer, and R. R. Dunn. 2010. Convergent evolution of seed dispersal by ants, and phylogeny and biogeography in flowering plants: A global survey. *Perspectives in Plant Ecology, Evolution and Systematic*s 12: 43-55.

McLaughlin, J.F. et al. (2002). Climate change hastens population extinctions. Proceedings of the National Academy of Sciences 99(9): 6070–6074.

Murrell, Z. et al. 2007. Ecological, Morphological, Micromorphological and Molecular Analyses of the Species in the *Hexastylis heterophylla* Complex. A report to the North Carolina

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Department of Transportation. NCDOT and CTE Joint Project 2002-2004, FHWA/NC/2004-01. May 2007.

Murrell, Z. 2015. Development of molecular and morphological tools to circumscribe and identify the Dwarf Flowered Heartleaf (*Hexastylis naniflora*). Report to the North Carolina Department of Transportation, NCDOT Project 2012-2111, July 2015.

National Climate Change Viewer. 2016. USGS. Accessed at https://www2.usgs.gov/climate_landuse/clu_rd/nccv.asp, January 2018.

NatureServe. 2002. Element Occurrence Data Standard, 6 February 2002. NatureServe, Arlington, Virginia. Accessed at http://www.natureserve.org/library/deliminting_plant_eos_Oct_2004.pdf, August 2016.

NCOSBM. North Carolina Budget and Management County and State Population Projections. Accessed at https://www.osbm.nc.gov/demog/county-projections, March 2018.

Newberry, G. 2006. South Carolina Populations of *Hexastylis naniflora*: 2006 updates. Received by the USFWS Asheville Field Office, September 7, 2006.

Newberry, G. 2009. University of South Carolina at Spartanburg. Evaluation of damage to *Hexastylis naniflora* plants on acreage bordering the hunt club. Letter to Jon Morgan, Lake Warden, Spartanburg Water Systems. Dated February 24, 2009.

North Carolina Natural Heritage Program (NCNHP). 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: August 5, 2016.

North Carolina Natural Heritage Program (NCNHP). 2018. Natural Heritage Element Occurrences. Accessed at https://www.ncnhp.org/activities/conservation/natural-heritage-element-occurrences, January 2018.

Newberry, G. 1993. Progress Report on Monitoring Studies of *Hexastylis naniflora*. Unpublished report. Copy submitted to the USFWS Asheville Field Office, on September 7, 2006.

Niedenberger, B.A. 2010. Molecular phylogeny and comparative pollen morphology of the genus *Hexastylis* (Aristolochiaceae). M.S. thesis. Appalachian State University, Boone, NC.

Otte, D. 1977. The pollination biology of *Hexastylis arifolia* (Michx.) Small var. *arifolia* and *H. minor* (Ashe) Blomquist (Aristolochiaceae) in the area of Chapel Hill, North Carolina. M.S. Thesis, University of North Carolina Chapel Hill, Chapel Hill, North Carolina, USA.

Padgett, J. E. 2004. Biogeographical, ecological, morphological, and micromorphological analyses of the species in the *Hexastylis heterophylla* complex. M.S. thesis. Appalachian State University, Boone, NC.

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

Phillips, S. J. 2018. A Brief Tutorial on Maxent. Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-02/21.

Renninger, H. 2010. North Carolina Department of Transportation (NCDOT). E-mail communication to Carolyn Wells, USFWS Asheville Field Office. Date: May 28, 2010. Subject: Dwarf-flowered heartleaf research proposal.

Robinson L.G. 2016. Dwarf-flowered Heartleaf range-wide status report. Final report to U.S. Department of Interior—U.S. Fish and Wildlife Service by North Carolina Natural Heritage Program. August 2016.

Robinson, L.G. and J.E. Padgett. 2016. Dwarf-flowered Heartleaf (*Hexastylis naniflora*) comprehensive review and monitoring report. Final report to the U.S. Department of Interior—U.S. Fish and Wildlife Service by the North Carolina Natural Heritage Program. August 2016.

Schneider, S. 2006. Spartanburg Water System (SWS) & Sanitary Sewer District, Assistant General Manager. E-mail communication to Lora Zimmerman, USFWS (formerly with the Charleston Field Office), dated December 18, 2006. Subject: Meeting at SWS on December 21, 2006 [to discuss Lake Blalock Buffer Disturbance].

South Carolina Department of Natural Resources (SCDNR) Heritage Trust. 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: February 4, 2016.

USFWS. 2001. Biological Opinion for Spartanburg Water System, Lake Blalock, P/N 2000-IP-194-W, USFWS log number 4-6-01-F-115. May 10, 2001.

USFWS. 2010. Draft Five Year Review for *Hexastylis naniflora* (dwarf flowered heartleaf). September 30, 2010. Submitted to the USFWS Southeast Regional Office September 30, 2010.

USFWS. 2015, August. Fact sheet for *Hexastylis naniflora*. Retrieved from https://www.fws.gov/raleigh/species/es_dwarf-flowered_heartleaf.html.

USFWS. 2016. USFWS species status assessment framework: an integrated analytical framework for conservation. Version 3.4.8, August 2016.

Wagner, J. 2013. Developing new morphological, geographic, and molecular tools to circumscribe *Hexastylis naniflora*. M.S. thesis. Appalachian State University, Boone, NC.

Walker, J. et al. 2009. What are the effects of prescribed fire on *Hexastylis naniflora*, a federally protected plant species? Unpublished final report prepared by U.S. Forest Service, Southern Research Station, Clemson University, Clemson, SC. Submitted to Timothy Stone, Superintendent, Cowpens National Battlefield. In partial fulfillment for Agreement

Disclaimer: THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE USFWS. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

04-IA-11330138-234, between the NPS and USFS Southern Research Station. Revised March 19, 2009.

Warren II, R. J., 2008. Mechanisms driving understory evergreen herb distributions across slope aspects: as derived from landscape position. *Plant Ecology* 198: 297-308.

Weakley, A. 2010. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Working Draft as of March 8, 2010.

Weakley, A. 2015. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Working Draft as of 21 May 2015.

Whittemore, A. T., and L. L. Gaddy. 1997. Hexastylis. In Flora of North America Editorial Committee [Eds.], Flora of North America north of Mexico, vol. 3, 54–58. Oxford University Press, New York, New York, USA.

Wolf. S., B. Hartl, C. Carroll, M.C. Neel, and D.N. Greenwald. 2015. Beyond PVA: why recovery under the Endangered Species Act is more than population viability. BioScience 65:200-207.

DRAFT

Dwarf-flowered heartleaf peer review sent

London, Paula K <paula_london@fws.gov>

Fri 5/11/2018 3:00 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Marshall, Michael E <michael_marshall@fws.gov>; Reid, Rebekah N <rebekah_reid@fws.gov>; Merritt, Timothy <timothy_merritt@fws.gov>

I sent the draft SSA for peer review along with the conflict of interest form and the comment matrix to the following from the list:

Wesley Knapp
NC Natural Heritage Program
wesley.knapp@ncdcr.gov

Tim Bassette
NC Department of Transportation
tpbassette@ncdot.gov

Dr. Gillian Newberry
University of South Carolina – Upstate (retired)
gnewberry@charter.net
gnewberry@uscupstate.edu

Dr. Doug Rayner
Wofford College
raynerda@wofford.edu

Dr. LL “Chick” Gaddy
Terra Incognita
llgaddy2@gmail.com

Dr. Zack Murrell
Appalachian State University
murrellze@appstate.edu

Herrick Brown
SC Heritage Trust Program
brownh@dnr.sc.gov

(I also requested a read receipt so will let you know when those come in to ensure the e-mail made it to the intended reviewers.)

Kaye London
Endangered Species Listing Biologist
Species Assessment Team (SAT) Member

U.S. Fish and Wildlife Service

Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.
Atlanta, GA 30345
(404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

Re: [EXTERNAL] Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment

London, Paula K <paula_london@fws.gov>

Mon 5/21/2018 7:37 AM

To: Rayner, Doug A. <RaynerDA@wofford.edu>
Cc: Merritt, Timothy <timothy_merritt@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>; Reid, Rebekah N <rebekah_reid@fws.gov>; Marshall, Michael E <michael_marshall@fws.gov>

Good day Dr. Rayner.

We would appreciate your input in the Dwarf-flowered heartleaf species status assessment. Your review is a valuable part of our peer review process to ensure our document provides the best available scientific and commercial information. Thank you for taking the time to review the document and provide comments.

Kaye London

Kaye London
Endangered Species Listing Biologist
Species Assessment Team (SAT) Member

U.S. Fish and Wildlife Service
Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.
Atlanta, GA 30345
(404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Sat, May 19, 2018 at 11:29 AM, Rayner, Doug A. <RaynerDA@wofford.edu> wrote:

> If you still need another person to review the report, I can do it.
>
> Doug
>
> ---
>
> **From:** Kaye London <kaye_london@fws.gov>
> **Sent:** Monday, May 14, 2018 7:27 AM
> **To:** wesley.knapp@ncdcr.gov; tpbassette@ncdot.gov; gnewberry@uscupstate.edu; Rayner, Doug A.; L L Gaddy; Zack Murrell; brownh@dnr.sc.gov
> **Cc:** Byron Hamilton; Tim Merritt; Rebekah Reid; Michael Marshall; gnewberry@charter.net
> **Subject:** Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment
>
> I have attached the supplemental appendices the go along with the SSA report. You may find these useful when reviewing the document.
>
> Thank you for your time and consideration.

Kaye London

Kaye London
Endangered Species Listing Biologist
Species Assessment Team (SAT) Member

U.S. Fish and Wildlife Service
Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.
Atlanta, GA 30345
(404) 679-7094

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Fri, May 11, 2018 at 2:57 PM, Kaye London <kaye_london@fws.gov> wrote:

> Request for Peer Review for dwarf-flowered heartleaf SSA
>
> The Fish and Wildlife Service would like to request your help by asking you to serve as a peer reviewer of our draft Species Status Assessment (SSA) for the dwarf-flowered heartleaf. The SSA process is a tool we are using to improve transparency while conducting listing determinations and other ESA actions, and peer review of the biology of the species is part of that process.
>
> We ask for your comments on the draft SSA report to focus specifically on the quality of the scientific information and analyses and whether the best available information was used. Please identify any oversights, omissions, and inconsistencies; provide advice on reasonableness of judgments made from the scientific evidence; help us ensure that scientific uncertainties are identified and characterized; provide advice on the overall strengths and limitations of the scientific data used in the document; and inform us of any scientific information that we did not use. We request that you direct your review to the scientific issues and assumptions relating to your expertise.
>
> We have attached the report for your review. We need your comments by **4 June 2018** to ensure adequate time to incorporate them into our final report. While we welcome your peer review comments in any format you are most comfortable using, it would be especially helpful if you could use the Comment Matrix Excel spreadsheet we have created. This will make it easier to compile and keep a record of all the comments received and then incorporate them into our report.
>
> As you review the document, please note that this draft SSA report does not result in or predetermine a decision by the Service on whether the dwarf-flowered heartleaf warrants protections of the Act and should be proposed for listing as threatened or endangered under the Act. This document is strictly a characterization of the viability of the species.

The species lead for this report is Rebekah Reid in our Asheville Ecological Services field office. If you have questions specific to the SSA report or would like any of the literature cited, please feel free to contact Rebekah at 828-258-3939 or rebekah_reid@fws.gov for any species-specific information.

I have also attached a Conflict of Interest form that we ask that you fill out and send back with your comments. Thank you very much for your time, and please do not hesitate to contact Tim Merritt if you have questions related to the peer review process.

Sincerely,

Kaye London

U.S. Fish and Wildlife Service

Southeast Regional Office
Ecological Services Program
1875 Century Blvd., NE.

Atlanta, GA 30345

(404) 679-7094

on behalf of Tim Merritt

Timothy Merritt
Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
404-679-7081 fax
615-574-8812 cell

NOTE: This e-mail correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

Appendix 1

Populations of *Hexastylis naniflora* estimated to contain over 1,000 rosettes in 2010, with updated information in 2016[1], and protection measures for these populations.

Populations known to be afforded some protection are indicated in **bold**.[2]

USFWS population number	State	County	NHP EO numbers (2016)[3]	NHP EO rank (2016)[4,5]	Site	Latest estimate of population size (year)	Estimate of plants on-site protection (year)	Protection comments
1	NC	Burke	029	A	Island Creek Heath Bluff (Lovelady Sites)	50,000+ (2016)	0	Not protected.
2	NC	Burke	178.159-178.161 178.254-178.256 178.280-178.282	A	Catawba River: Love Lady (Hoyle and Micol Creek)	~6,738 (2008-2011)	Awaiting data from NCDOT.	Possible NCDOT protected R-O-W, protection unconfirmed. In early 2016, the Town of Valdese applied to CWMTF to acquire part of this population.
3	**NC**	**Caldwell**	**227**	**A**	**Peaked Top Rare Plant Site (Foothills Landfill)**	**16,463 (2014)**	**16,463 (2014)**	**Conservation Easement (Foothills Conservancy of NC).**
4	**NC**	**Caldwell**	**044**	**AB**	**Little Gunpowder Creek Rare Plant Site 1**	**2,707 (2015)**	**2,424 (2015)**	**DOT mitigation site.**
5	NC	Catawba	158	D	South Fork Catawba River: Jacob Fork, Camp Creek	123 (2016)	27 (2015)	Some plants occur within an undetermined acreage within NCDOT R-O-W (Bassette 2016). Protection unconfirmed.
6	**NC**	**Catawba**	**243.012,** 243.242 243.269, **243.270**	**A**	**Catawba Wildlife Club**	**1,000-1300 (1995-2007)**	**>1,000 (1995-2007)**	**Catawba County Wildlife Club Registered Heritage Area (EO 12) The Nature Conservancy Conservation Easement (EO 270).**
7	NC	Catawba	031	C?	US 321, southeast Hickory	1,202 (2010)	161 (2010)	161 plants within NCDOT R-O-W (Bassette 2016).
8	**NC**	**Catawba**	**96.184,** 96.038 96.039	**A**	**Murrays Mill/Upper Balls Creek**	**~9,150 (2005)**	**11,860 (2013)**	**Fee title by NCDOT (~34 acres).**
9	**NC**	**Cleveland**	100.014, **100.049, 100.050, 100.051, 100.073, 100.074 100.149, 100.233**	**A**	**Broad River/Sandy Run Natural Areas (aka "Broad River Tract")**	**~33,500 (2001-2015)**	**32,702 (2015)**	**Fee title by Broad River Greenway (1,000 acres).**

USFWS population number	State	County	NHP EO numbers (2016)[3]	NHP EO rank (2016)[4,5]	Site	Latest estimate of population size (year)	Estimate of plants on-site protection (year)	Protection comments
			100.236, 100.237 **100.238, 100.239 100.240, 100.241,** 100.246					
10	NC	Cleveland	208	A?	Buffalo Creek: Potts Creek	3,572 (2007)		Awaiting verification that plants are protected in NCDOT R-O-W. Protection unconfirmed.
11	NC	Cleveland	211.072, 211.194		First Broad River: Hop-Hornbeam Natural Area	1,965 (2000)		Awaiting verification that plants are protected in NCDOT R-O-W. Protection unconfirmed.
12	NC	Cleveland	214.201, **214.202, 214.203,** 214.204, **214.205, 214.209,** 214.212, **214.213,**	A	Buffalo Creek: tributaries north and south of SR2047	6,447 (200-2007)		Awaiting verification that plants are protected in NCDOT in R-O-W, bold in EO column. Protection unconfirmed (EO 202, 203, 205, 209, 213).
13	NC	Cleveland	216.028, 216.196, 216.197, 216.198, **216.199, 216.200**	A	Buffalo Creek: Kings Mountain Reservoir	3,310 (200-2016)	~500? (2000-2007) (awaiting updates)	Awaiting verification that plants are protected in NCDOT in R-O-W, bold in EO column. Protection unconfirmed (EO 199, 200).
14	NC	Cleveland	157	AB	First Broad River: Crooked Run Creek	330 (2010)		None of the population is protected within NCDOT R-O-W, determined too far away from roadside, DOT stopped monitoring in 2010 (Bassette 2016).
15	**NC**	**Cleveland/ Rutherford**	**276**	**A**	**Cliffside Steam Station**	**39,545 (2016)**	**~39,545 (2016)**	**Voluntary agreement with Duke Energy; protected acreage unknown.**
16	NC	Lincoln	261.252, 261.259, 261.263	B	Lincoln County Airport and Leepers Creek	7,032 (2005-2006)		Not protected.
17	NC	Polk	023	A	Mills Creek Forest and Seep	1,459 (2016)		Not protected.

USFWS population number	State	County	NHP EO numbers (2016)[3]	NHP EO rank (2016)[4,5]	Site	Latest estimate of population size (year)	Estimate of plants on-site protection (year)	Protection comments
18	**NC**	**Polk**	**125**	**A**	**Broad River: New Hope Springhead Swamp**	**12,235 (2016)**	**1,000-3,000 estimated (2016)**	**New Hope Springhead Swamp Registered Heritage Area (voluntary conservation agreement).**
19	**NC**	**Rutherford**	**154**	**C**	**Second Broad River (Forest City Industrial Complex)**	**2,576 (2016)**	**2478 (2008)**	**Deed restrictions (12 acres). Significant threats from industrial development, invasive exotics, erosion, sedimentation in a fragmented landscape.**
20	**NC**	**Rutherford**	99.009, 99.010, 99.037, 99.052, 99.053, 99.055, 99.061, 99.063, 99.075, **99.076,** 99.079, 99.090, 99.121, **99.172,** 99.181, 99.182, 99.249-.251, 99.267, 99.268	**A**	**Broad River: Hensons Creek Ravine, Brice Rare Plant Site, Sandy Mush Outcrop**	**106,940 (2016)**	**~200-250 (2007-2012)**	**Parris Heartleaf Registered Heritage Area (voluntary conservation agreement on subEO 076 and 172).**
21	NC	Rutherford	176.167-176.170	A	Broad River: Cleghorn Creek Tributary/US221	6,750 (2016)		Not protected.
22	NC	Rutherford	177.016, 177.107, 177.122, 177.063, 177.164, 177.165, 177.166	A	Broad River: Floyds Creek, Long Branch	12,687 (2008-2016)		Not protected.
23	**NC**	**Rutherford**	247.013, 247.056, 247.080, **247.106,** 247.114, 247.115, 247.173, 247.174, **247.286**	**A**	**Broad River: Floyds Creek (aka New Bethel Rare Plant Site)**	**~5,480 (2003-2015)**	**4,873 (2015)**	**Tate Conservation Easement (8 acres) (SubEOs 106 and 286).**
24	**SC**	**Cherokee**	**016, 017, 018**	**BC**	**Cowpens Battlefield**	**2,823 (2016)**	**2,823? (2016)**	**National Park Service, National Battlefield.**

USFWS population number	State	County	NHP EO numbers (2016)[3]	NHP EO rank (2016)[4,5]	Site	Latest estimate of population size (year)	Estimate of plants on-site protection (year)	Protection comments
25	SC	Greenville /Spartanburg	002, 004, 024, 032, 033, 036, 038, 039, 040, 041, 042, 049, 050, 054	Various AB-BD	South Pacolet River and tributaries	5,205 (1991-1998)		Not protected.
26	**SC**	**Spartanburg**	**011, 014, 026--028, 047, 048, 057**	**Various AB-BD**	**Peters Creek Heritage Preserve**	**3,306 (2016)**	**3,306 (2016)**	**State Heritage Preserve (194 acres).**
27	**SC**	**Spartanburg**	**007, 029**	**BD, H?**	**Blalock Reservoir**	**3,505 (2016)**	**3,505? (2016)**	**Restrictive covenants (protected acreage unknown); significant threats to remaining population.**
28[6]	**NC**	**Lincoln**	302.046, **302.262**	**A**	**Rhyne Preserve**	**19,880 (2016)**	**19,873 (2016)**	**Rhyne Preserve (fee title by Catawba Lands Conservancy).**

[1]This table was replicated in the same format and populations as Table B.2 from the most recent USFWS five-year Review of *Hexastylis naniflora* (USFWS 2010) for comparison of changes since the time of the five-year review. Populations that are not believed to contain over 1,000 rosettes but were included in the original Table B.2 are included here, but the "NHP EO rank" and in the "Latest estimate of population size" reflects the smaller size.

[2] In the case of partially protected populations, the column "NHP EO numbers" indicates the specific portions of the population afforded protection in bold font.

[3]NHP EO numbers use the following format: Principal EO.SubEO. Only one number is listed if it is a stand-alone principal EO.

[4]NHP EO rank specifications are defined in Appendix B2. In cases involving principal/sub EOs, only the rank for the principal EO is given.

[5] EO ranks with two letters indicate a degree of uncertainty within the range provided (e.g. a rank of "AB" indicates possibly excellent to good viability).

[6]Population that is currently estimated to have over 1,000 rosettes that was not known to be large populations in 2010 have been added to this table.

Appendix 2

NC Natural Heritage Program (NCNHP) Element Occurrence Rank Specifications for *Hexastylis naniflora*

"A" Rank Specifications (excellent viability)
An A-ranked population of *Hexastylis naniflora* should have more than 500 clumps (rosettes) occurring in greater than one acre of high quality forest such as Dry-Mesic Oak Hickory Forest or Mesic Mixed Hardwood Forest.

“B” Rank Specifications (good viability)
A B-ranked population of *Hexastylis naniflora* should have 200-500 clumps (rosettes) occurring in greater than one acre of high quality forest such as Dry-Mesic Oak Hickory Forest or Mesic Mixed Hardwood Forest - OR - more than 500 clumps occurring in less than one acre of high quality forest or on land impacted by human disturbance such as logging, grazing, mowing, etc.

"C" Rank Specifications (fair viability)
A C-ranked population of *Hexastylis naniflora* should have 100-200 clumps (rosettes) occurring in greater than one acre of high quality forest such as Dry-Mesic Oak Hickory Forest or Mesic Mixed Hardwood Forest - OR - 200- 500 clumps occurring in less than one acre of high quality forest or on land impacted by human disturbance such as logging, grazing, mowing, etc.

"D" Rank Specifications (poor viability)
A D-ranked population of *Hexastylis naniflora* should have fewer than 100 clumps (rosettes) occurring in greater than one acre of high quality forest such as Dry-Mesic Oak Hickory Forest or Mesic Mixed Hardwood Forest - OR - less than 200 clumps occurring in less than one acre of high quality forest or on land impacted by human disturbance such as logging, grazing, mowing, etc.

“E” Rank Specifications (extant)
An E-ranked population of *Hexastylis naniflora* is an occurrence that has recently been verified as still existing, but sufficient information for the factors used to estimate viability has not yet been obtained.

“H” Rank Specification (historical)
An H-ranked population of *Hexastylis naniflora* lacks recent field information verifying the continued existence of the occurrence. In the absence of known disturbance and with the habitat still extant, H is generally recommended for occurrences that have not been reconfirmed for approximately 30 or more years.

“F” Rank Specification (failed to find)
An F-ranked population of *Hexastylis naniflora* has not been found despite a search by an experienced observer at a time and under conditions appropriate for the Element at a location where it was previously reported, but the occurrence still might be confirmed to exist at that location with additional field survey efforts. For occurrences with vague locational information, the search must include areas of appropriate habitat within the range of locational uncertainty.

“X” Rank Specification (failed to find)
An X-ranked population of *Hexastylis naniflora* is considered destroyed based on adequate surveys by one or more experienced observers at times and under conditions appropriate for the species at the occurrence location, or other persuasive evidence indicates that the species no longer exists there or that the habitat has been destroyed to such an extent that it can no longer support the species.

“U” Rank Specification (failed to find)
A U-ranked population of *Hexastylis naniflora* cannot be assigned a rank due to lack of sufficient information on the occurrence or the species identification has not been confirmed.

Rank Specifications Justification
The unit of measurement for population size in this species is "clump" (rosette). EO size (as quantified by number of clumps or rosettes) is the primary rank factor. Condition of habitat (vegetation community and structure) and Landscape context (extent of suitable habitat and physical factors) are also incorporated secondarily. The species thrives most in undisturbed habitat. However, disturbed lands, that have been logged, grazed, mown, or converted to pasture, orchards, or tree plantations have been found to support remnant patches of *Hexastylis naniflora*. The extent to which this species can withstand disturbance is unknown. Populations in disturbed habitat are considered at risk, with relatively poor viability (C or D). Care should be taken when estimating population size, as population estimates have been found to vary widely from the number counted in population censuses. Specifications are based on largest known populations and expert opinion (including James Padgett, Carolyn Wells, Misty Buchanan (formerly Franklin), and Brenda Wichmann).

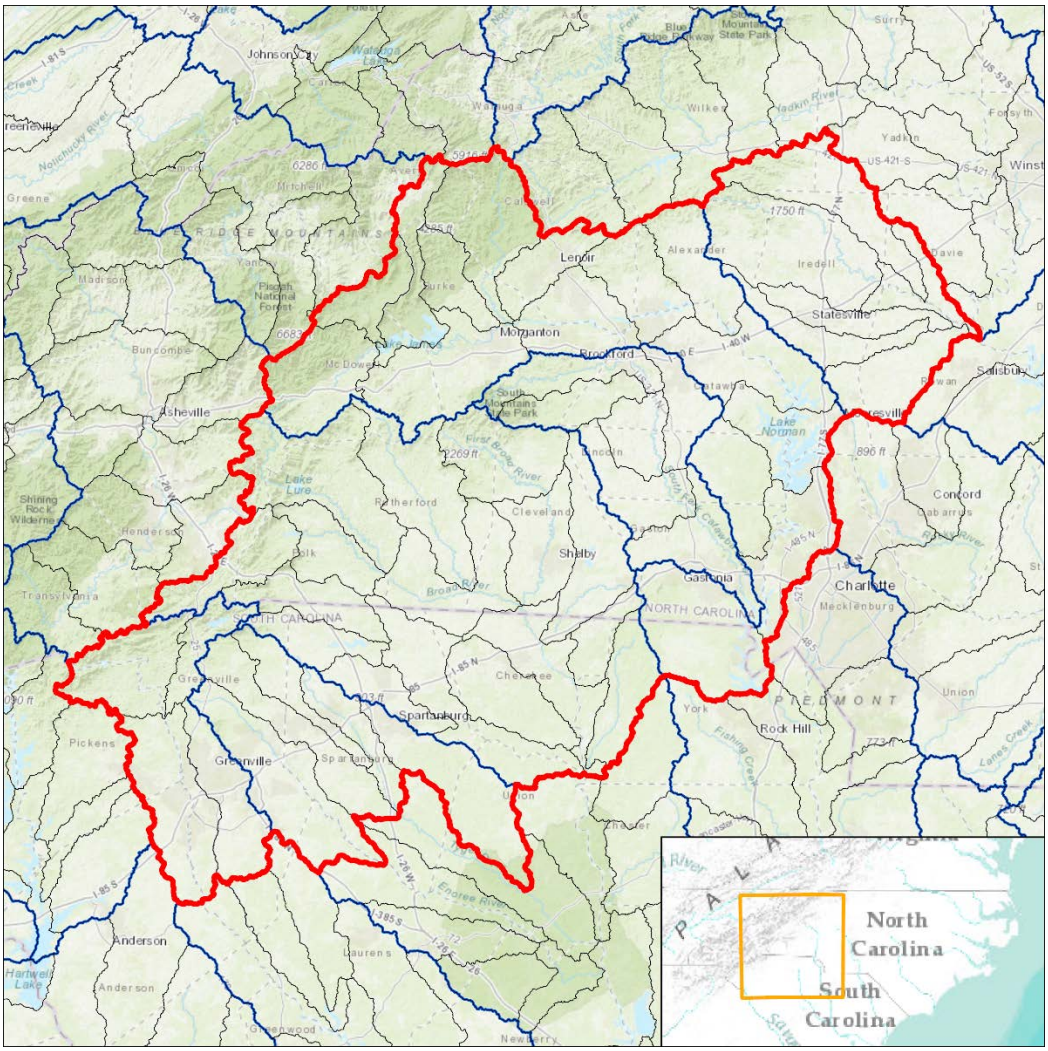
Appendix 3

Maxent Model Methodology

Study Extent, Coordinate System, and Cell Size

Fifty three 10-digit hydrologic units (HUC) comprise the analysis extent (Figure 1). In North Carolina it includes all 10-digit HUC that fall within the boundaries of 8-digit HUC with known occurrence of Hexastylis. In South Carolina we also included all 10-digit HUC that fell within the boundaries of 8-digit HUC with known occurrence of Hexastylis, but excluded the southern portions of the HUC-8 areas due to the boundaries being exceedingly large and far away from any known occurrences.

Figure 1. Analysis extent. Red line indicates Maxent analysis extent, blue lines are 8-digit HUC boundaries, black lines are 10-digit HUC boundaries. The orange line in the inset map indicates where the analysis extent is situated in North and South Carolina



Coordinate System: USA Contiguous Albers Equal Area Conic USGS version

Cell Size: 30 x 30 meters derived from the USGS National GAP Landcover

Source Element Occurrence Data

Hexastylis naniflora element occurrence data was obtained from the North and South Carolina Natural Heritage Programs. These data were in polygon format and digitized at scale that accurately identified the boundaries of the individual population areas. Current populations of Hexastylis naniflora were identified by reviewing the last observed data in the database and excluding all populations that have not been observed in the last 10 years (2007). To represent these current population areas in Maxent, a raster cell center was retained for every 30 x 30 meter pixel that was situated within the current element occurrence data polygons.

Source Datasets Used:

USGS National GAP Landcover - The GAP National Terrestrial Ecosystems – Ver 3.0 is a 2011 update of the National Gap Analysis Program Land Cover Data – Version 2.2 for the conterminous U.S. The GAP National Terrestrial Ecosystems – Version 3.0 represents a highly thematically detailed land cover map of the U.S at a 30 x 30 meter pixel resolution. The map legend includes types described by NatureServe's Ecological Systems Classification (Comer et al. 2002) as well as land use classes described in the National Land Cover Dataset 2011 (Homer et al. 2015). These data cover the entire continental U.S. and are a continuous data layer. The land cover map identifies 49 different land cover types within the range of Hexastylis Naniflora.

LandFire - Landscape Fire and Resource Management Planning Tools, is a shared program between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior, providing landscape scale geo-spatial products to support cross-boundary planning, management, and operations.

SSURGO Soils - The SSURGO database contains information about soil as collected by the National Cooperative Soil Survey over the course of a century. The information was gathered by walking over the land and observing the soil. Many soil samples were analyzed in laboratories. The maps outline areas called map units. The map units describe soils and other components that have unique properties, interpretations, and productivity. The information was collected at scales ranging from 1:12,000 to 1:63,360.

National Elevation Dataset - The NED is a seamless dataset with the best available raster elevation data of the conterminous United States, Alaska, Hawaii, and territorial islands. The NED is derived from diverse source data that are processed to a common coordinate system and unit of vertical measure. NED data are available nationally (except for Alaska) at resolutions of 1 arc-second (about 30 meters) and 1/3 arc-second (about 10 meters), and in limited areas at 1/9 arc-second (about 3 meters). The 1/3 arc-second database was used for HENA modelling purposes.

PRISM Climate Data - The PRISM Climate Group gathers climate observations from a wide range of monitoring networks, applies sophisticated quality control measures, and develops spatial climate datasets to reveal short- and long-term climate patterns. The resulting datasets incorporate a variety of modeling techniques and are available at multiple spatial/temporal resolutions, covering the period from 1895 to the present.

Model Variables Created:

Landcover – Landcover represented by the default landcover classification (Table 1).

Landcover Hexastylis Grouping – Landcover represented by a grouping of landcover types. For the purposes of discussing Hexastylis naniflora habitat, many of the default landcover classifications are similar and could be grouped together. The definition of each landcover classification was reviewed and categorized using a much broader habitat definition (Table 1).

Table 1. Landcover classification

Default Landcover Classification	Hexastylis Grouping
Southern Piedmont Glade and Barrens	Barren
Southern Ridge and Valley / Cumberland Dry Calcareous Forest	Barren
Undifferentiated Barren Land	Barren
Cultivated Cropland	Disturbed
Deciduous Plantations	Disturbed
Developed, High Intensity	Disturbed
Developed, Low Intensity	Disturbed
Developed, Medium Intensity	Disturbed
Developed, Open Space	Disturbed
Disturbed/Successional - Grass/Forb Regeneration	Disturbed
Disturbed/Successional - Shrub Regeneration	Disturbed
Evergreen Plantation or Managed Pine	Disturbed
Harvested Forest - Grass/Forb Regeneration	Disturbed
Harvested Forest-Shrub Regeneration	Disturbed
Introduced Upland Vegetation - Annual Grassland	Disturbed
Introduced Upland Vegetation - Shrub	Disturbed
Introduced Upland Vegetation - Treed	Disturbed
Pasture/Hay	Disturbed
Quarries, Mines, Gravel Pits and Oil Wells	Disturbed
Ruderal forest	Disturbed
Southern Appalachian Low Mountain Pine Forest	Evergreen
Southern Appalachian Montane Pine Forest and Woodland	Evergreen
Southern and Central Appalachian Cove Forest	Hardwood
Southern and Central Appalachian Oak Forest	Hardwood
Southern and Central Appalachian Oak Forest - Xeric	Hardwood
Southern Piedmont Mesic Forest	Hardwood

Central and Southern Appalachian Montane Oak Forest	High Elevation
Central and Southern Appalachian Northern Hardwood Forest	High Elevation
Central and Southern Appalachian Spruce-Fir Forest	High Elevation
Southern Appalachian Grass and Shrub Bald	High Elevation
Southern Appalachian Grass and Shrub Bald - Shrub Modifier	High Elevation
Appalachian Hemlock-Hardwood Forest	Mixed
Southern Piedmont Dry Oak-(Pine) Forest - Hardwood Modifier	Mixed
Southern Piedmont Dry Oak-(Pine) Forest - Loblolly Pine Modifier	Mixed
Southern Piedmont Dry Oak-(Pine) Forest - Mixed Modifier	Mixed
Southern Ridge and Valley Dry Calcareous Forest	Mixed
Southern Ridge and Valley Dry Calcareous Forest - Pine modifier	Mixed
Open Water (Fresh)	Open Water/Wetland
Southern and Central Appalachian Bog and Fen	Open Water/Wetland
Southern Piedmont/Ridge and Valley Upland Depression Swamp	Open Water/Wetland
Southern Appalachian Granitic Dome	Outcrop
Southern Appalachian Montane Cliff	Outcrop
Southern Appalachian Rocky Summit	Outcrop
Southern Piedmont Cliff	Outcrop
Southern Piedmont Granite Flatrock	Outcrop
South-Central Interior Large Floodplain - Forest Modifier	Riparian
South-Central Interior Small Stream and Riparian	Riparian
Southern Piedmont Large Floodplain Forest - Forest Modifier	Riparian
Southern Piedmont Small Floodplain and Riparian Forest	Riparian

Landcover Diversity – Identifies the number of landcover classes (default classification) within a 10-cell radius (300 meters) of an individual pixel.

Landcover Majority – Identifies the dominant landcover class (default classification) within a 10-cell radius (300 meters) of an individual pixel.

Landfire Canopy Height – Represents the vertically projected percent cover of the live vegetation canopy.

Landfire Canopy Cover – Represents the average height of the dominant vegetation across the landscape.

SSURGO mukey – SSURGO soils dataset represented by the Map Unit Key (mukey)

SSURGO Drainage Class – SSURGO soils dataset represented by wettest drainage class. Drainage class refers to the frequency and duration of wet periods in conditions similar to those under which the soil formed.

SSURGO Hydrologic Group – SSURGO soils dataset represented by hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

Elevation – National elevation dataset elevation values. This 10-meter dataset was reclassified to 30-meters.

Aspect 9-class – Using the national elevation dataset, the aspect was derived and categorized into the following classes: Flat, North, Northeast, East, Southeast, South, Southwest, West, and Northwest.

Aspect 5-class – Using the national elevation dataset, the aspect was derived and categorized into the following classes: Flat, North, East, South, and West.

Slope – The national elevation dataset represented by degree of slope.

Geomorphons – A pattern recognition analysis that converts a digital elevation dataset into 10 common landform elements: flat, peak, ridge, shoulder, spur, slope, pit, valley, footslope, and hollow. The national elevation dataset was used as the source elevation for the analysis.

Solar Radiation – An analysis of the amount of solar radiation (radiant energy) reaching the earth's surface using the national elevation dataset as the elevation model. The output solar model is reported in watt hours per square meter (WH/m^2)

Average Annual Precipitation – Climate dataset of average annual precipitation according to a model using point precipitation and elevation data for the 30-year period of 1971-2000.

Maximum Average Annual Temperature – Climate dataset of average annual maximum temperature according to a model using point temperature data for the 30-year period of 1981-2010.

Minimum Average Annual Temperature – Climate dataset of average annual minimum temperature according to a model using point temperature data for the 30-year period of 1981-2010.

Maxent Model Development

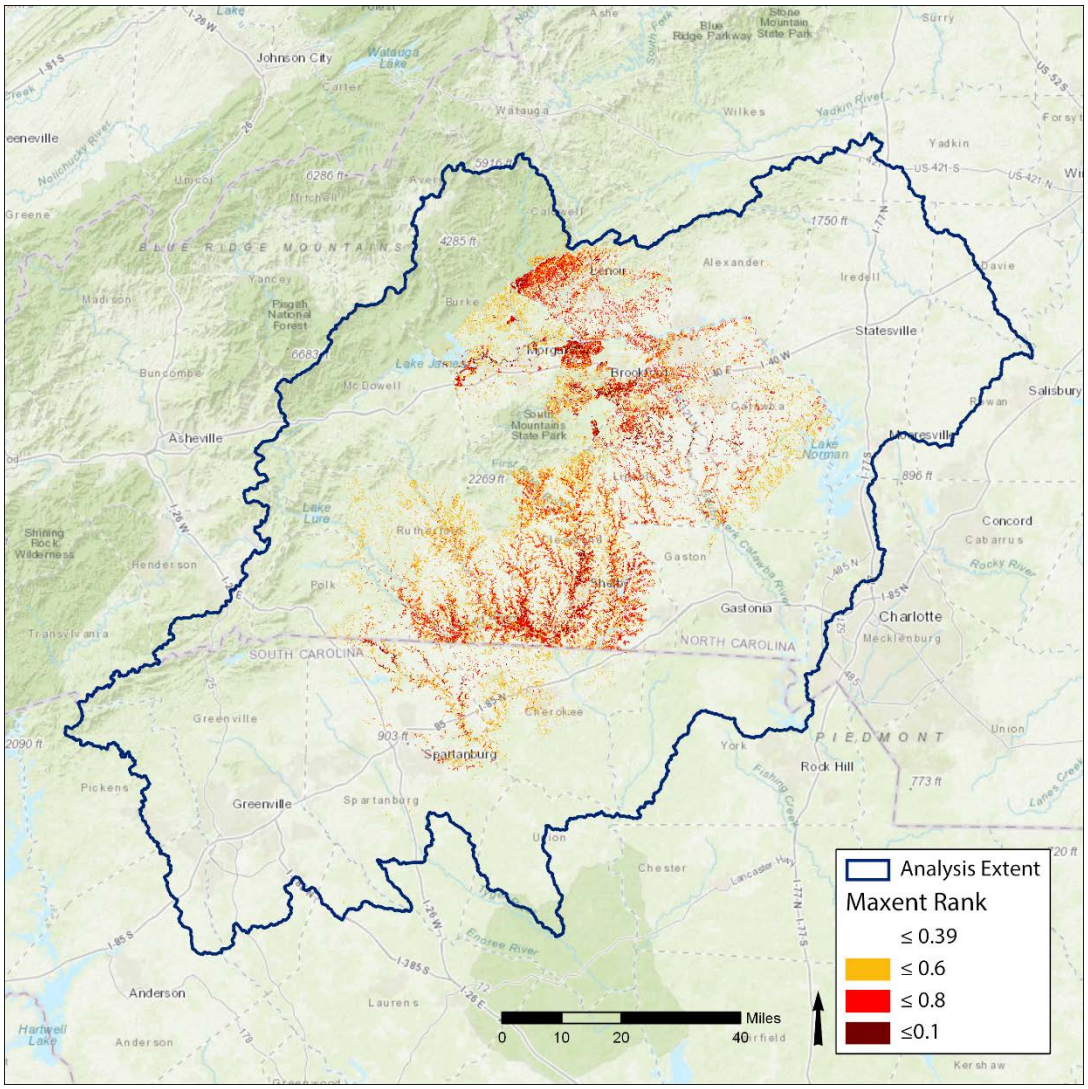
Maxent software for species habitat modeling (version 3.4.1) was used (Philips et al., 2018).

An initial single model Maxent run was done to determine which variables could be excluded due to limited percent contribution to the model. Any variable that contributed less than 1% to the single model run results was excluded in the final model. The following variables were excluded:

landcover diversity, canopy height, SSURGO drainage class, SSURGO hydrologic group, aspect 9-class, aspect 5-class, slope, solar radiation, and maximum annual temperature.

For the final model a 10-run replicate Maxent model was created using crossvalidation. For replicate models, the occurrence data is randomly split into a number of equal-sized groups called "folds", and separate models are created leaving out each fold in turn. The individual model runs are then averaged together to derive the final model. Cloglog output format was used. Cloglog output gives an estimate between 0 and 1 of probability of presence assuming an appropriate sampling design.

Figure 2. Maxent model output map.



Results

Figure 2 shows the model output. The minimum cutoff value (to determine if an area is considered potential habitat for a species) of 0.39 was determined by using the average 10th percentile training presence. The 10th percentile training presence uses the suitability threshold associated with the presence record that occurs at the 10th percentile of presence records (Phillips 2018). This value excludes some of the outlier population areas in the Maxent predictions to focus on the typical habitat conditions for this species. The total area ranked greater than 0.39 in the Maxent model was just 6.0% of the total analysis area (Table 1).

Table 1. Area estimates of the Maxent model

Maxent Score	Acres	Square Miles	Percent of Total
0.406 and greater	302,834.13	473.18	6.02%
0.6 and greater	128,273.52	200.43	2.55%
0.8 and greater	22,115.97	34.56	0.44%

The average area-under-curve (AUC) score for the replicate Maxent model is 0.86. The AUC is calculated from the receiver operating characteristic (ROC) plot. This value has a range of 0 – 1 and may be interpreted as a single test statistic that assesses model performance, indicating the ability of the model to correctly classify the occurrence data used. AUC values close to 0.50 indicate a model fit no better than random, values less than 0.5 indicate a model fit worse than random, a value of 1.0 indicate a perfect fit (Baldwin 2009). A value of 0.86 is a good fitting model.

The Maxent output supplies estimates of the relative contributions of the environmental variables to the Maxent model (Table 2.)

Table 2. Percent contribution of the environmental variables

Environmental Variable	Percent Contribution
SSURGO mukey	23.5%
Minimum Annual Temperature	17.8%
Average Annual Precipitation	15.7%
Landcover	12.9%
Landcover Majority	12.0%
Landcover Hexastylis Grouping	5.4%
Geomorphons	4.9%
Elevation	4.6%
Canopy Cover	3.2%

SSURGO mukey is the top contributing variable. 135 different individual soil types are present within the polygon boundaries of the Hexastylis element occurrences. Many of these individual soil types are part of soil complexes and are separated by things such as percent slope, erosion, how stony/rocky, and amount of clay. The most common individual soil type was Meadowfield-Rhodhiss complex, 25 to 60 percent slopes, very stony (14.1% of total). However, collectively the Meadowfield soils only comprised 14.3% of all soils). The individual Pacolet soil types were very common and collectively comprise 32.2% of all soil types present. Woolwine, Rion, and Fairview

soils were also collectively common, comprising 10.4%, 9.7%, and 8.8% of all soils present respectively.

The minimum annual average temperature range in the analysis extent is 39 – 51 degrees Fahrenheit. The majority of the Hexastylis element occurrences (89%) are found at the 47 and 48 degrees. The Average annual precipitation range in the analysis extent is 42 – 81 inches per year. The majority of the Hexastylis element occurrences (82%) are found in the 47 – 49 inches per year range.

Piedmont forested landcover habitats dominate the land area of the element occurrences. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier (53%), Southern Piedmont Mesic Forest (9%), Southern Piedmont Dry Oak-Pine Forest (5.2%), Southern Piedmont Small Floodplain and Riparian Forest (4.4%), and collectively comprise 71% of the element occurrences area. Unfortunately, non-native habitats are also present. Evergreen Plantation or Managed Pine (9%), Harvested Forest (7.2%), Developed, Open Space (5%), Pasture/Hay (2.1%) collectively comprise 22% of the total element occurrence area. The Remaining 6 percent of element occurrence area is comprised of a mix of 14 other natural and disturbed landcover classes, but each at small percentages.

The landcover majority classification scheme reduces the total number of landcover classes present in the analysis extent from 23 to 11. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier is still the dominant landcover class (58%). However disturbed categories are increased in area (sum total of 35%). Evergreen plantation or managed pine (12%) and Pasture/Hay (12%) are the only other categories that have at least 10% or greater area. The increase in disturbed landcover area representation in the landcover majority layer suggests that many Hexastylis population areas are situated in areas impacted by disturbed landcover. This is likely due to urban encroachment and increasing fragmentation of habitats.

The landcover Hexastylis grouping reveals the amount of disturbance present in Hexastylis population areas. Landcover classes grouped as disturbed comprises 27% of the total area. Mixed forest (deciduous and evergreen) comprises 58%, pasture/hay 12%, and hardwood forest 2%,

Geomorphons revealed that the majority of Hexastylis element occurrence areas are situated in concave landforms. Geomorphon categories hollow (13%), valley (46%), and depression (10%) collectively comprise 69% of all Hexastylis population areas. Flat landforms comprise 15.5% of the area and convex landforms the remaining 15.5%.

Within the analysis extent, the range of elevation present is 335 – 5,265 feet. For Hexastylis, the prime elevation range is from 666 – 908 feet (53% of total element occurrence area). A lesser elevation range is present from 935 – 1,184 (37% of total element occurrence area).

Canopy cover for the Hexastylis populations are dominated by Tree Cover 70-80% (20.2%) and Tree Cover 80-90% (63.9%). The rest of the canopy cover categories are 2% or less.

Citations

Baldwin, R.A. 2009. Use of maximum entropy modeling in wildlife research. Entropy. 11:854-866.

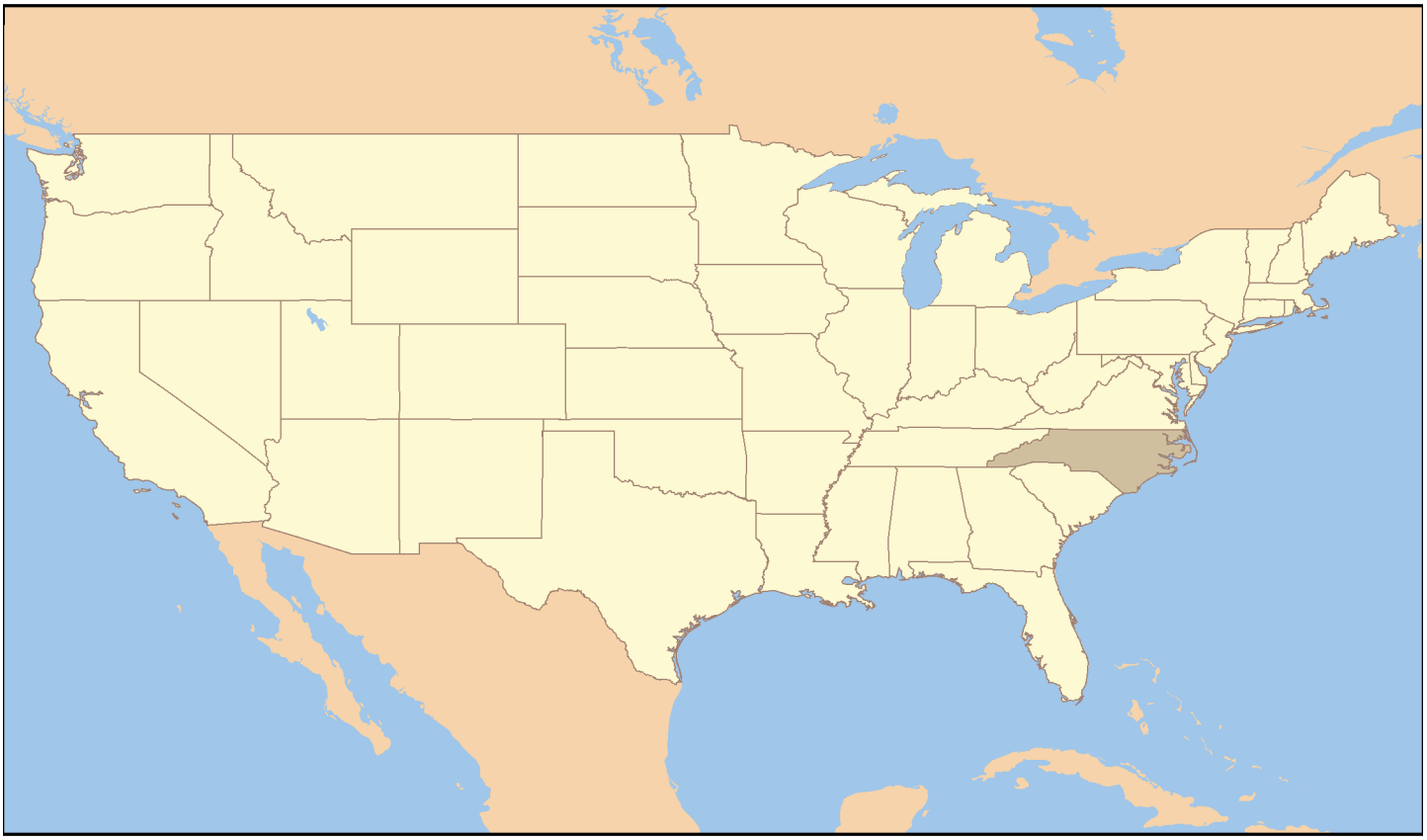
Phillips, S. J. 2018. A Brief Tutorial on Maxent. Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-02/21.

Steven J. Phillips, Miroslav Dudík, Robert E. Schapire. [Internet] Maxent software for modeling species niches and distributions (Version 3.4.1). Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-2-20.

Appendix 4a

U.S. Geological Survey - National Climate Change Viewer

Summary of North Carolina



December 1, 2016

1 Maximum 2-m Air Temperature

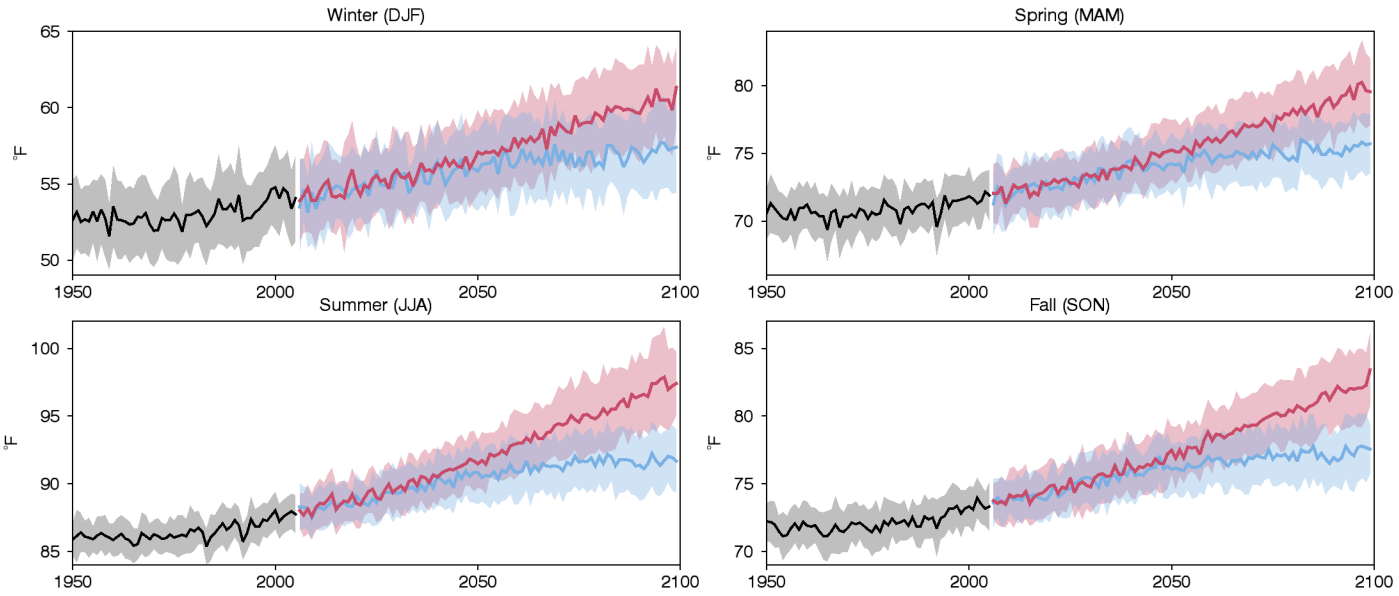


Figure 1: Seasonal average time series of maximum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

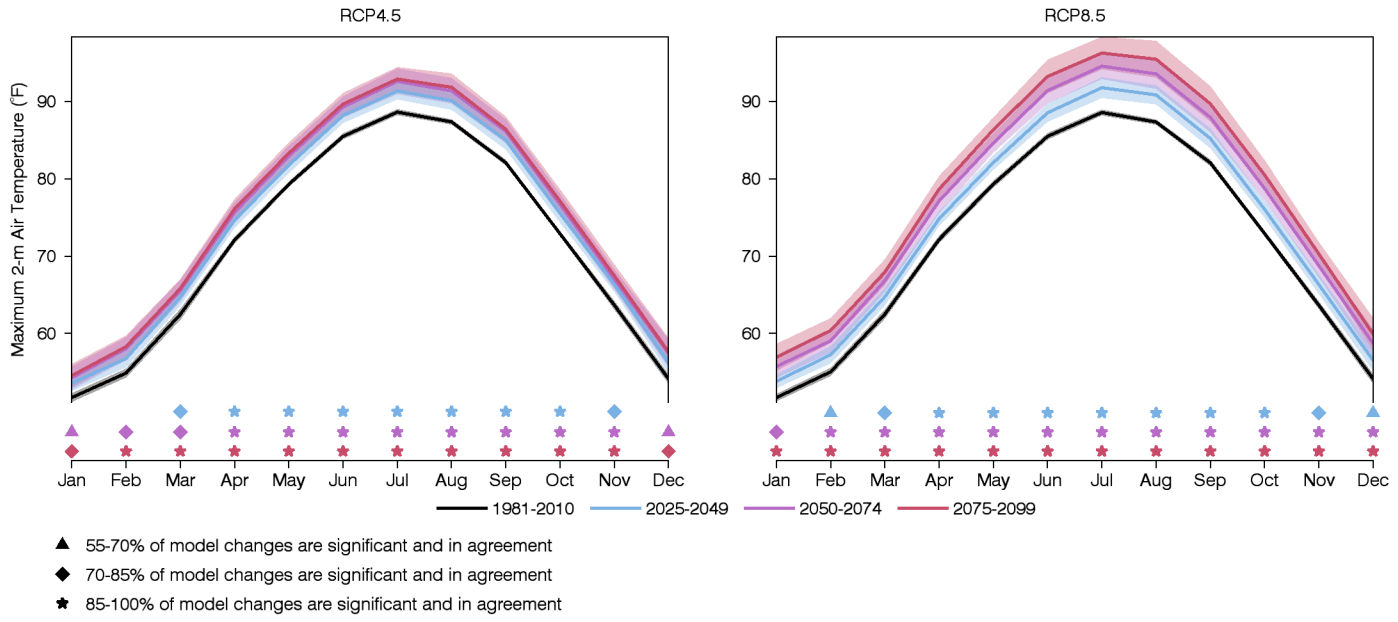


Figure 2: Monthly averages of maximum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

2 Minimum 2-m Air Temperature

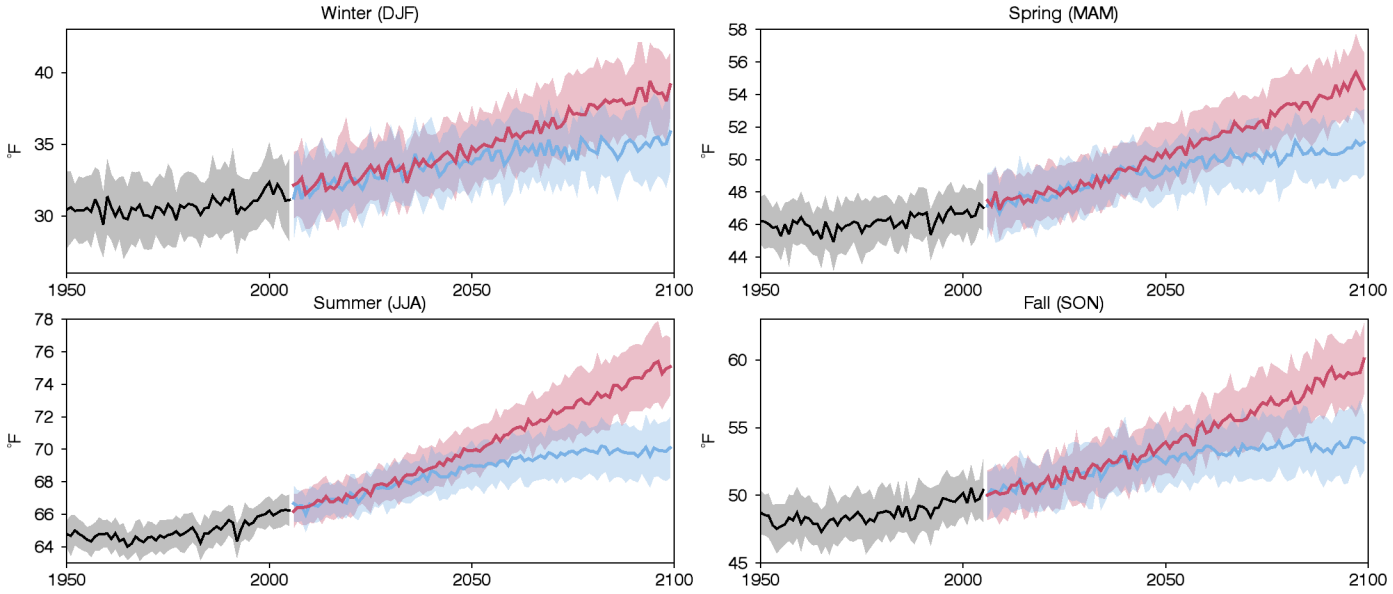


Figure 3: Seasonal average time series of minimum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

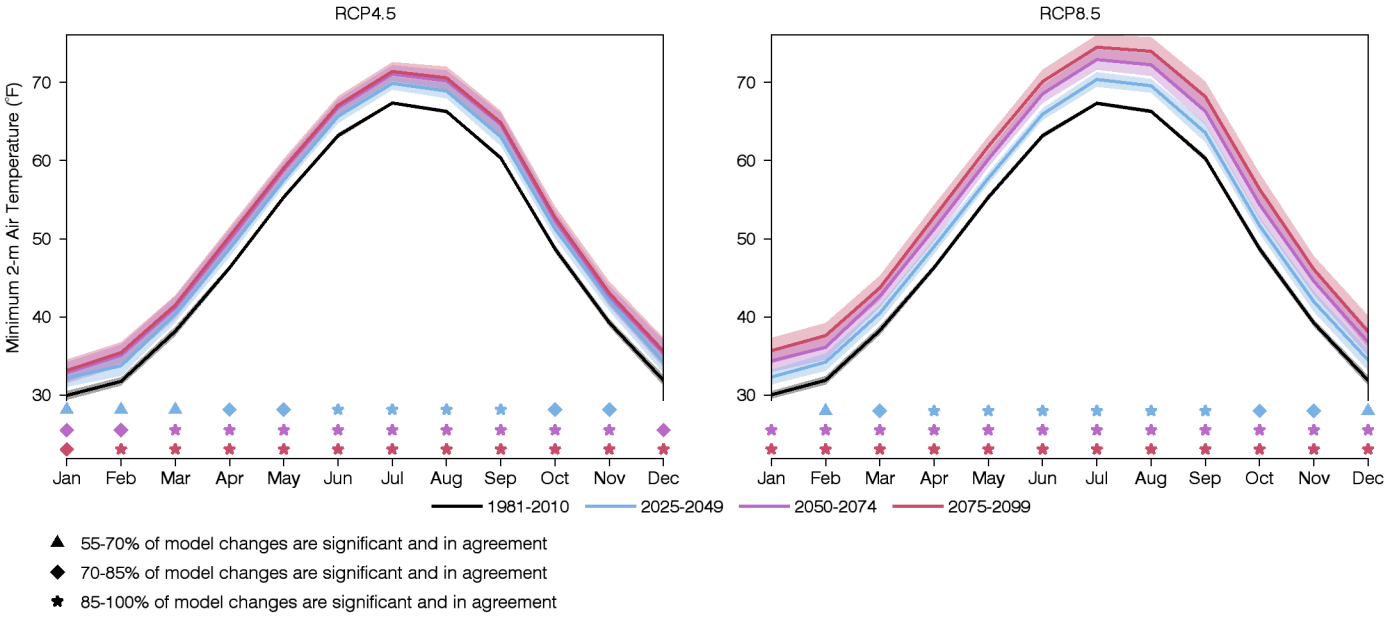


Figure 4: Monthly averages of minimum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

3 Precipitation

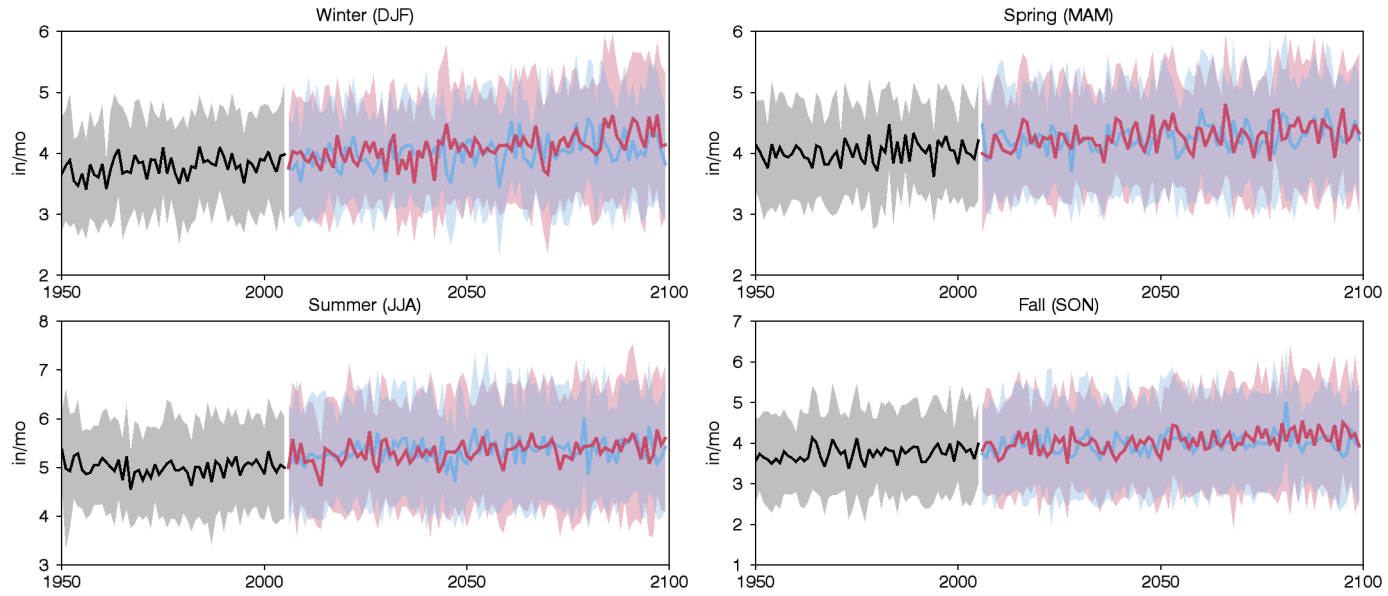


Figure 5: Seasonal average time series of precipitation for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

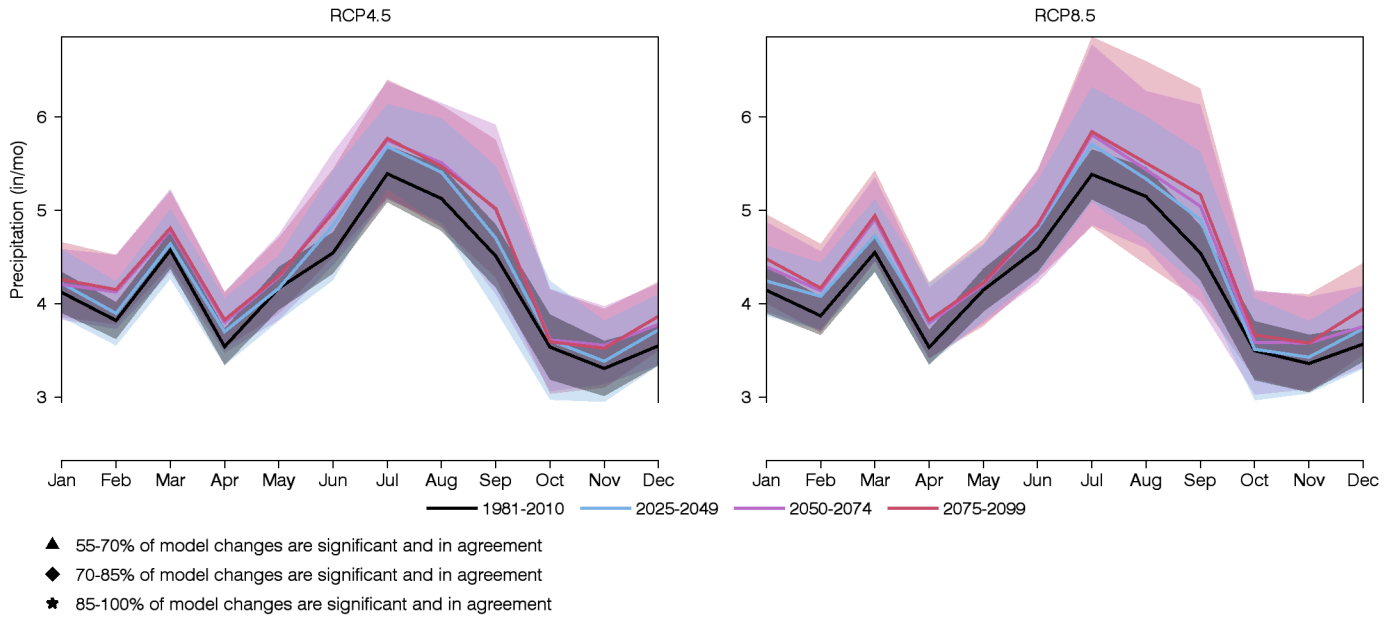


Figure 6: Monthly averages of precipitation for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

4 Snow Water Equivalent

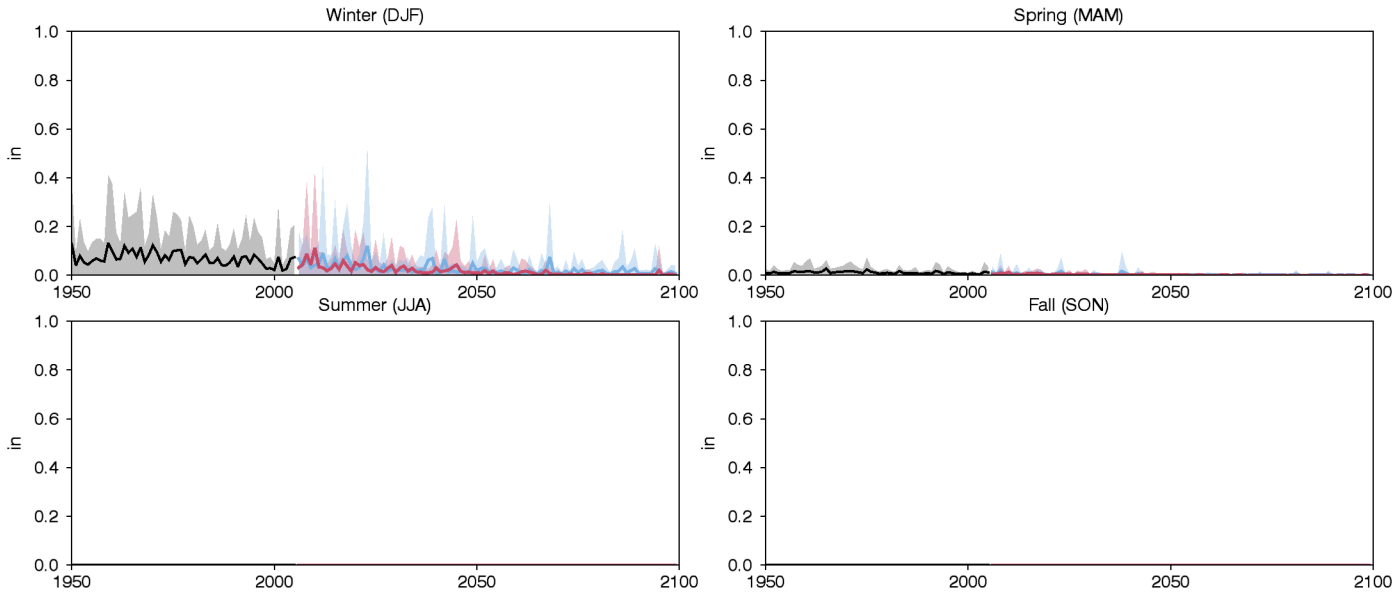


Figure 7: Seasonal average time series of snow water equivalent for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

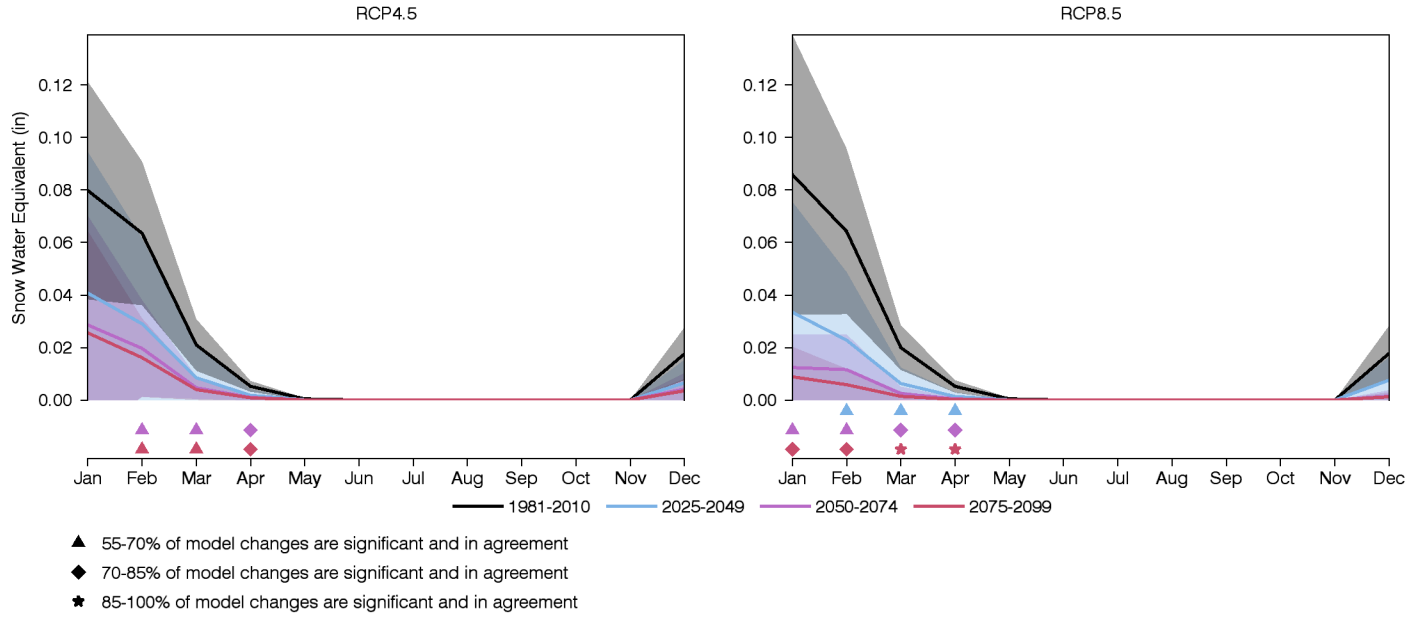


Figure 8: Monthly averages of snow water equivalent for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

5 Runoff

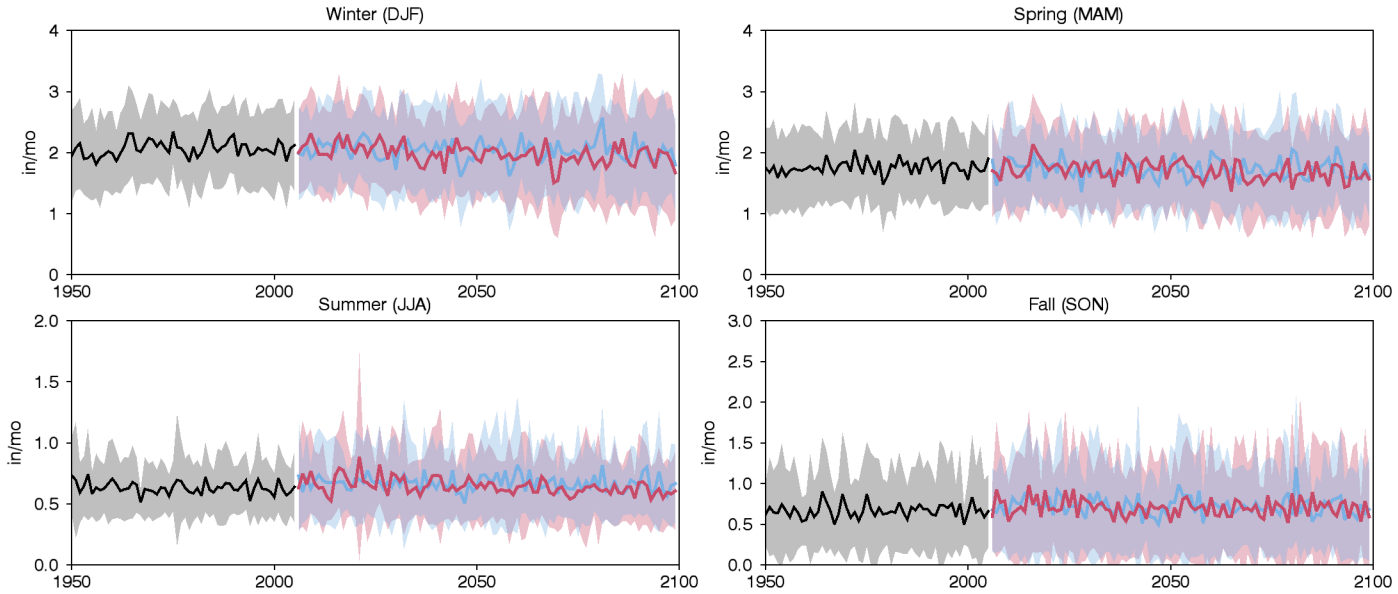


Figure 9: Seasonal average time series of runoff for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

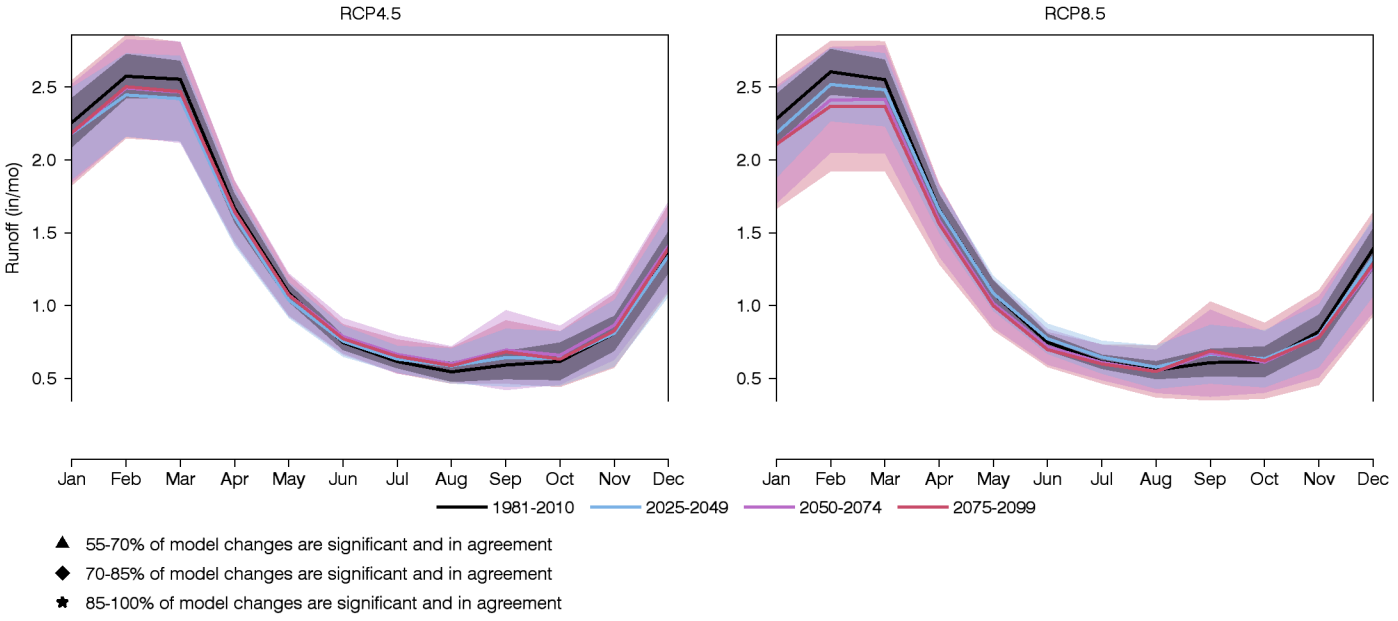


Figure 10: Monthly averages of runoff for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

6 Soil Water Storage

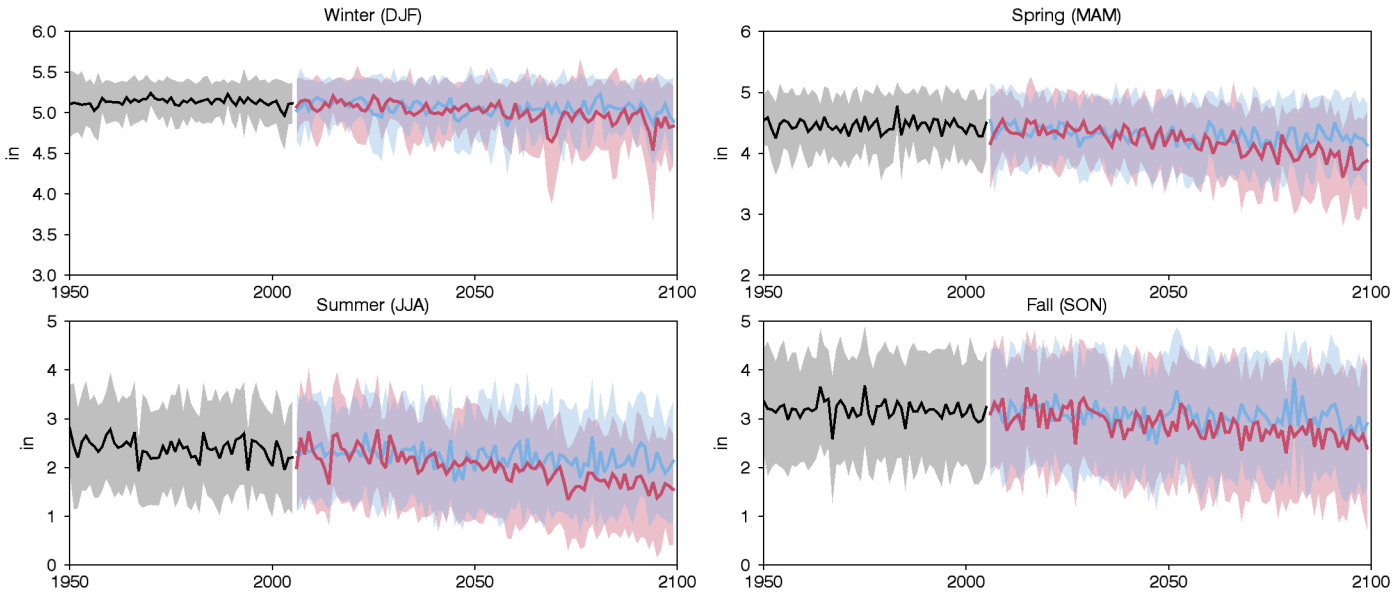


Figure 11: Seasonal average time series of soil water storage for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

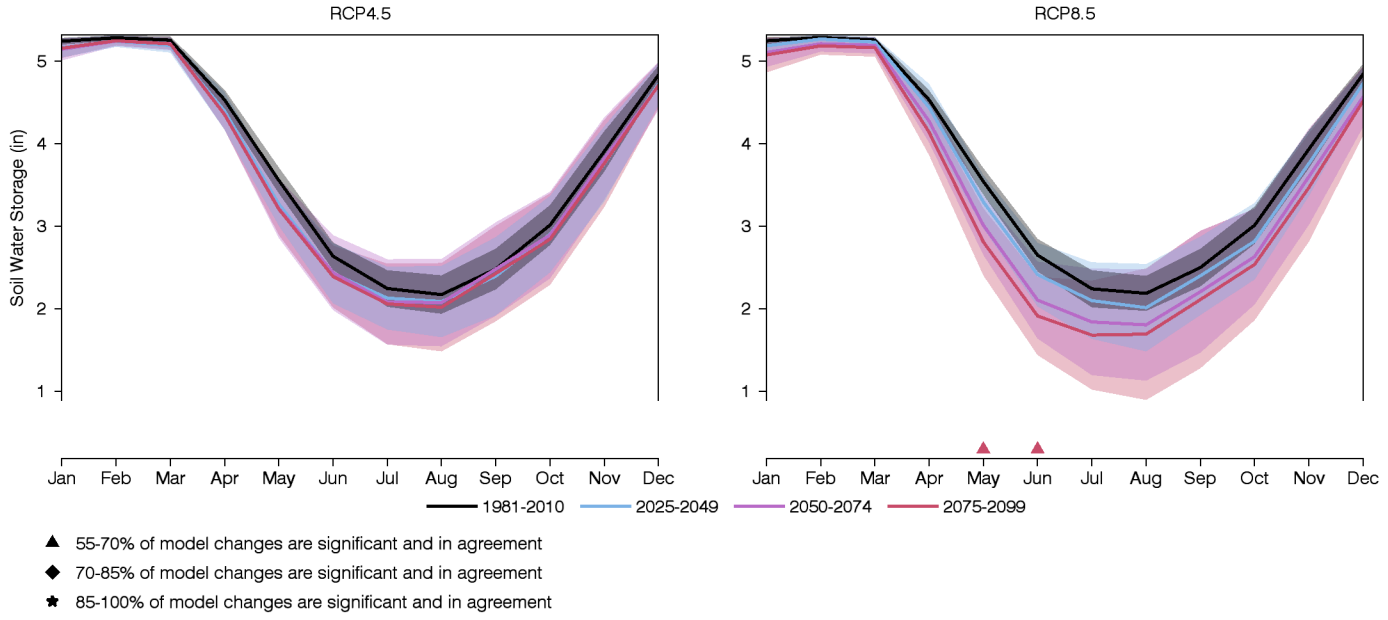


Figure 12: Monthly averages of soil water storage for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

7 Evaporative Deficit

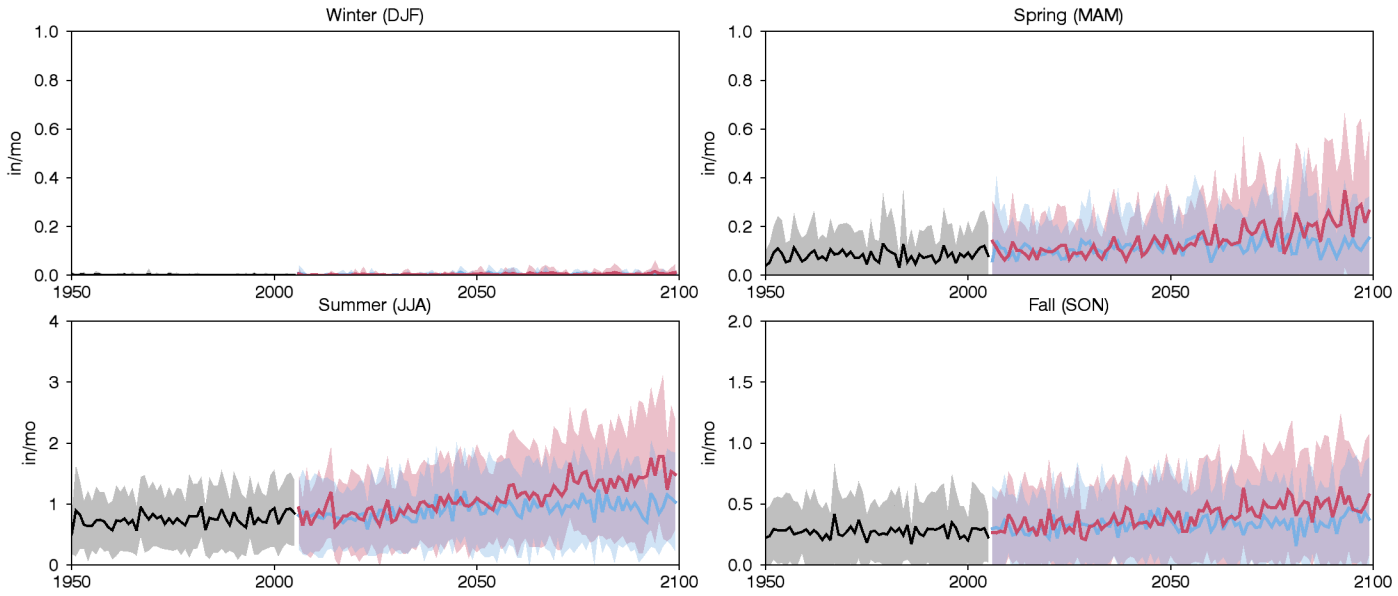


Figure 13: Seasonal average time series of evaporative deficit for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

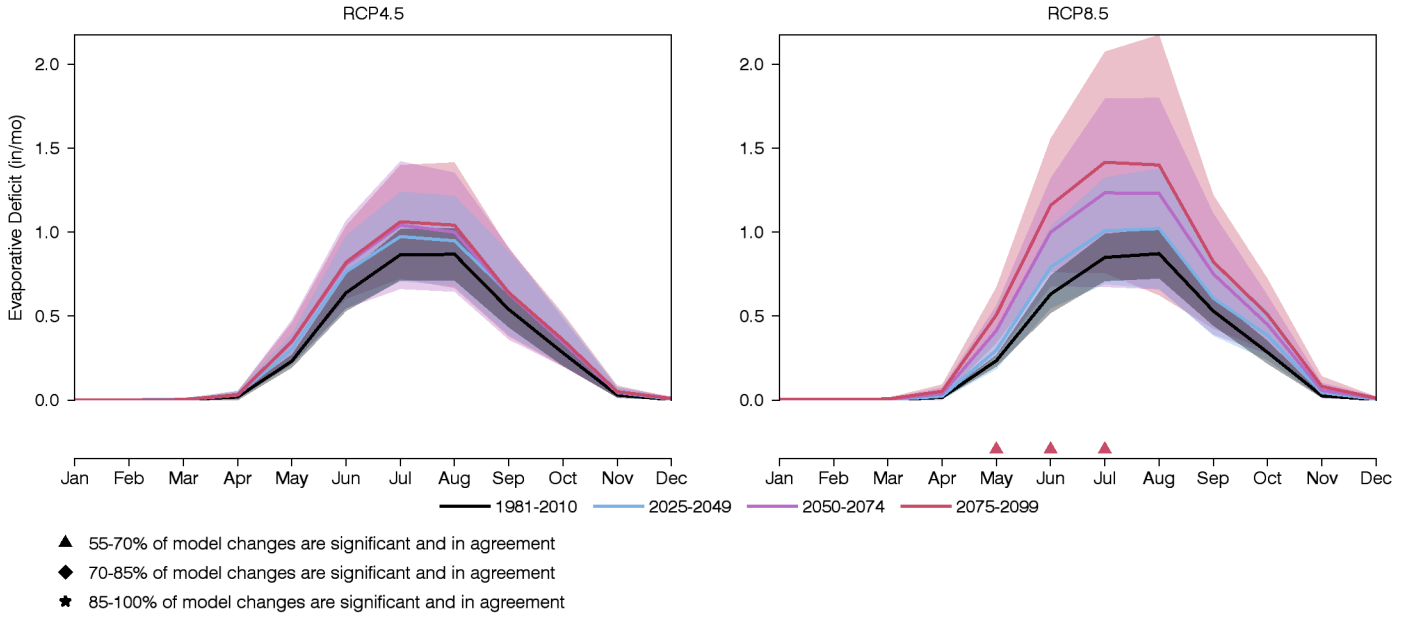


Figure 14: Monthly averages of evaporative deficit for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

8 Data

The temperature and precipitation summaries are created by spatially averaging the NASA NEX-DCP30 data set (Thrasher et al., 2013). The water-balance variables snow water equivalent, runoff, soil water storage and evaporative deficit are simulated by using the NEX-DCP30 temperature and precipitation as input to a simple model (McCabe and Wolock, 2007). The water-balance model accounts for the partitioning of water through the various components of the hydrologic system, but does not account for groundwater, diversions or regulation by impoundments.

9 Models

ACCESS1-0	bcc-csm1-1	bcc-csm1-1-m	BNU-ESM	CanESM2	CCSM4
CESM1-BGC	CMCC-CM	CNRM-CM5	CSIRO-Mk3-6-0	FGOALS-g2	FIO-ESM
GFDL-CM3	GFDL-ESM2G	GFDL-ESM2M	GISS-E2-R	HadGEM2-AO	HadGEM2-CC
HadGEM2-ES	inmcm4	IPSL-CM5A-LR	IPSL-CM5A-MR	IPSL-CM5B-LR	MIROC5
MIROC-ESM	MIROC-ESM-CHEM	MPI-ESM-LR	MPI-ESM-MR	MRI-CGCM3	NorESM1-M

10 Citation Information

Alder, J. R. and S. W. Hostetler, 2013. USGS National Climate Change Viewer. US Geological Survey `http://www.usgs.gov/climate_landuse/clu_rd/nccv.asp` doi:10.5066/F7W9575T.

Hostetler, S.W. and Alder, J.R., 2016. Implementation and evaluation of a monthly water balance model over the U.S. on an 800 m grid. Water Resources Research, 52, doi:10.1002/2016WR018665.

Thrasher, B., J. Xiong, W. Wang, F. Melton, A. Michaelis, and R. Nemani, 2013. New downscaled climate projections suitable for resource management in the U.S. Eos, Transactions American Geophysical Union 94, 321-323, doi:10.1002/2013EO370002.

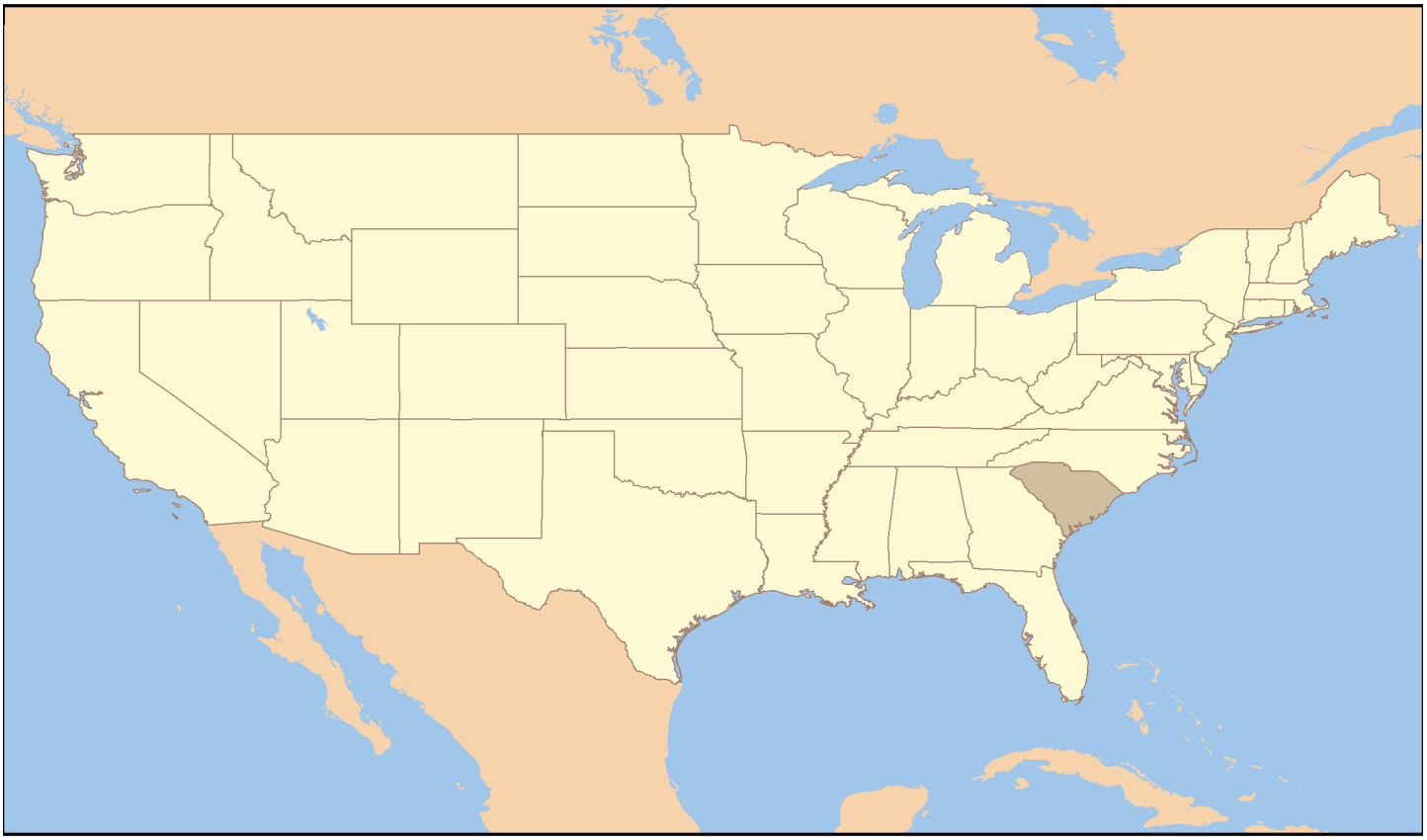
11 Disclaimer

These freely available, derived data sets were produced by J. Alder and S. Hostetler, US Geological Survey (USGS). The original climate data are from the NEX-DCP30 dataset, which was prepared by the Climate Analytics Group and NASA Ames Research Center using the NASA Earth Exchange, and is distributed by the NASA Center for Climate Simulation. No warranty expressed or implied is made by the USGS regarding the display or utility of the derived data on any other system, or for general or scientific purposes, nor shall the act of distribution constitute any such warranty. The USGS shall not be held liable for improper or incorrect use of the data described and/or contained herein.

Appendix 4b

U.S. Geological Survey - National Climate Change Viewer

Summary of South Carolina



December 1, 2016

1 Maximum 2-m Air Temperature

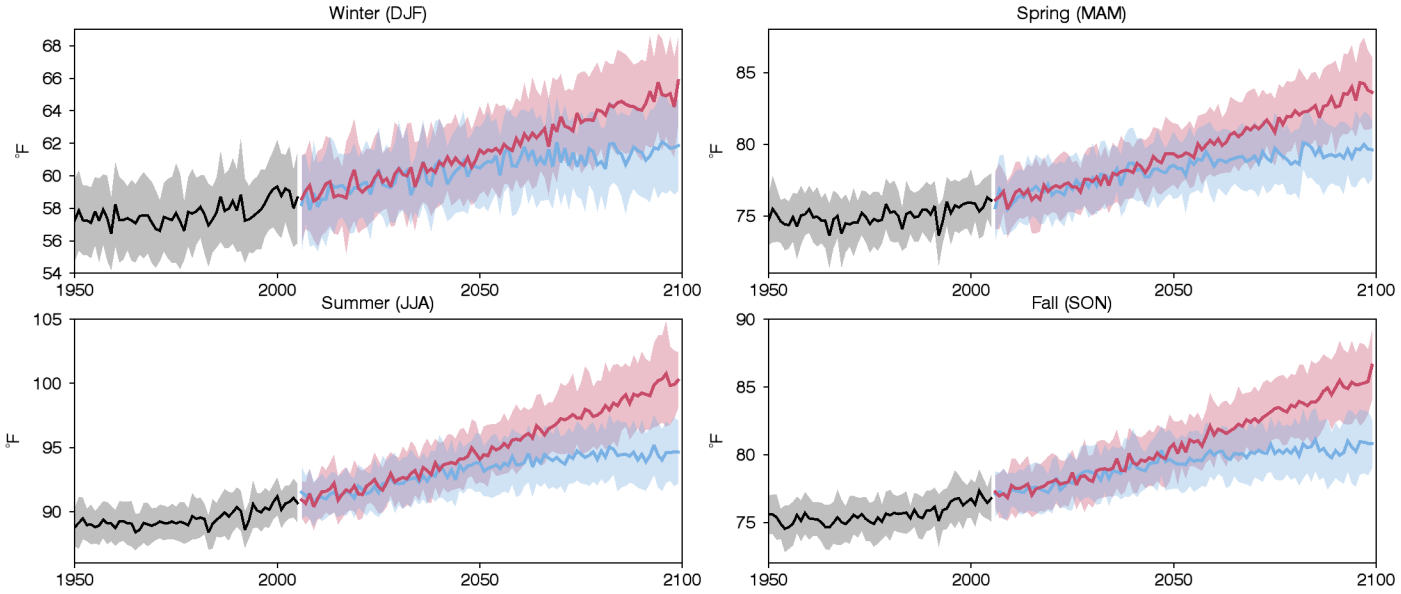


Figure 1: Seasonal average time series of maximum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

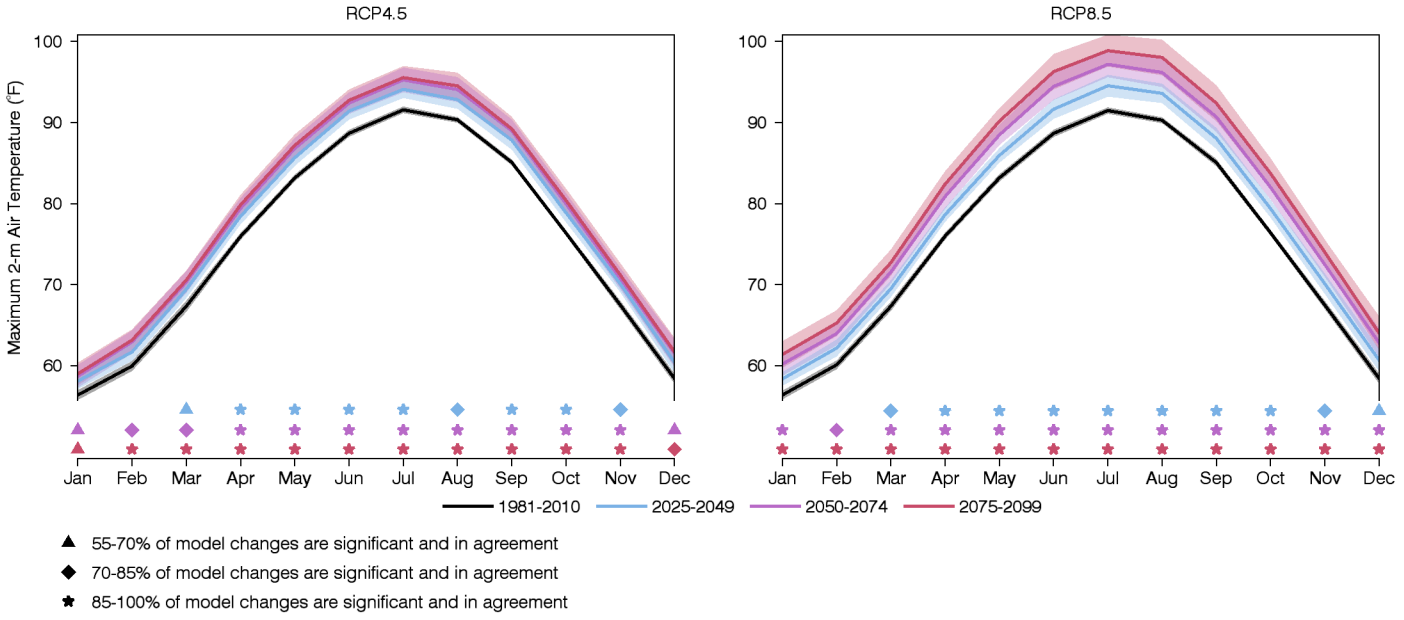


Figure 2: Monthly averages of maximum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

2 Minimum 2-m Air Temperature

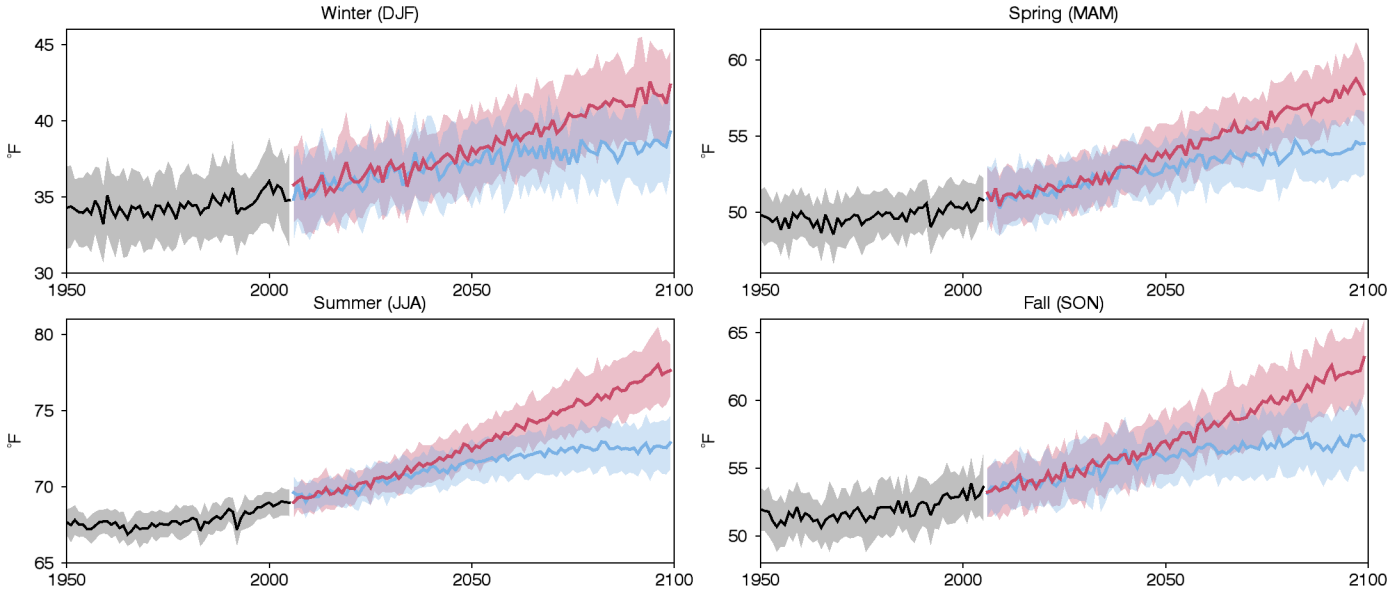


Figure 3: Seasonal average time series of minimum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

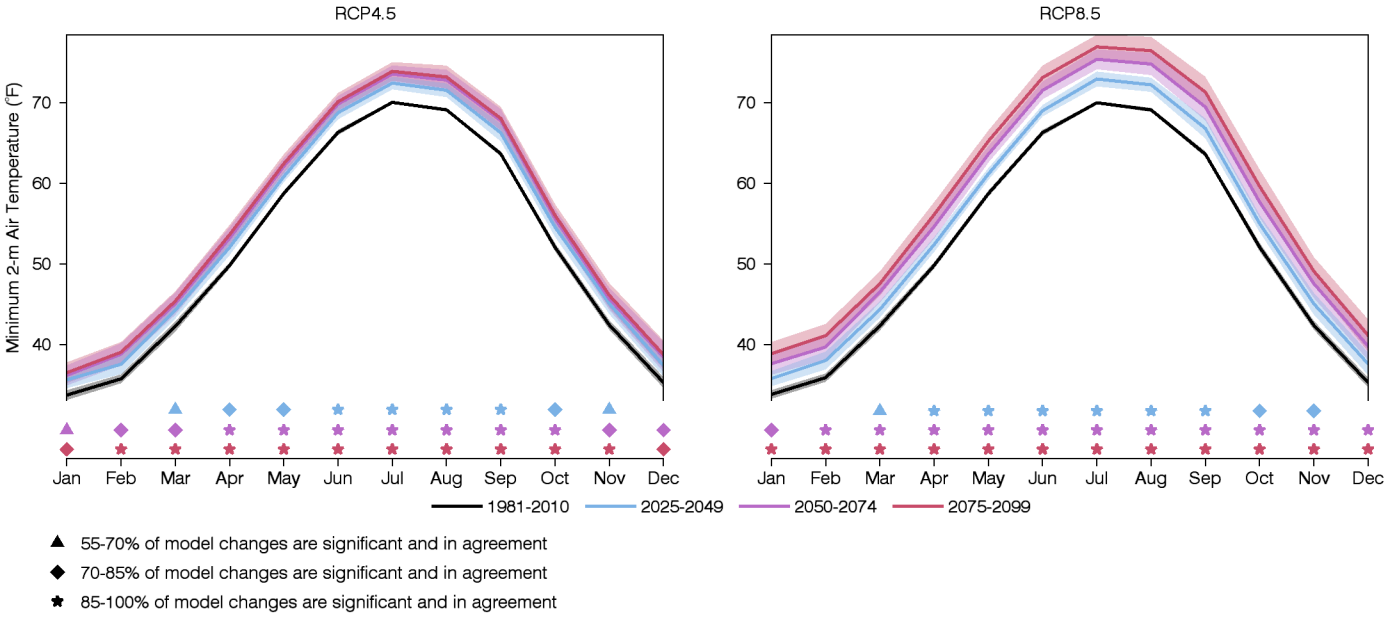


Figure 4: Monthly averages of minimum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

3 Precipitation

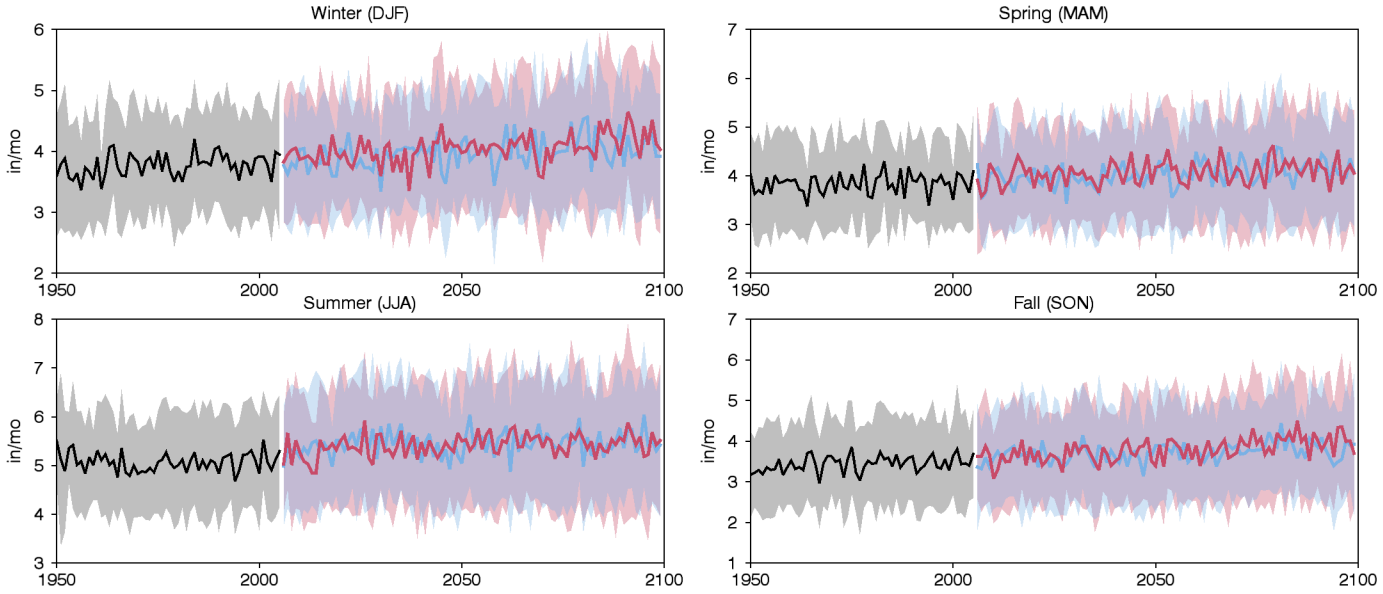


Figure 5: Seasonal average time series of precipitation for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

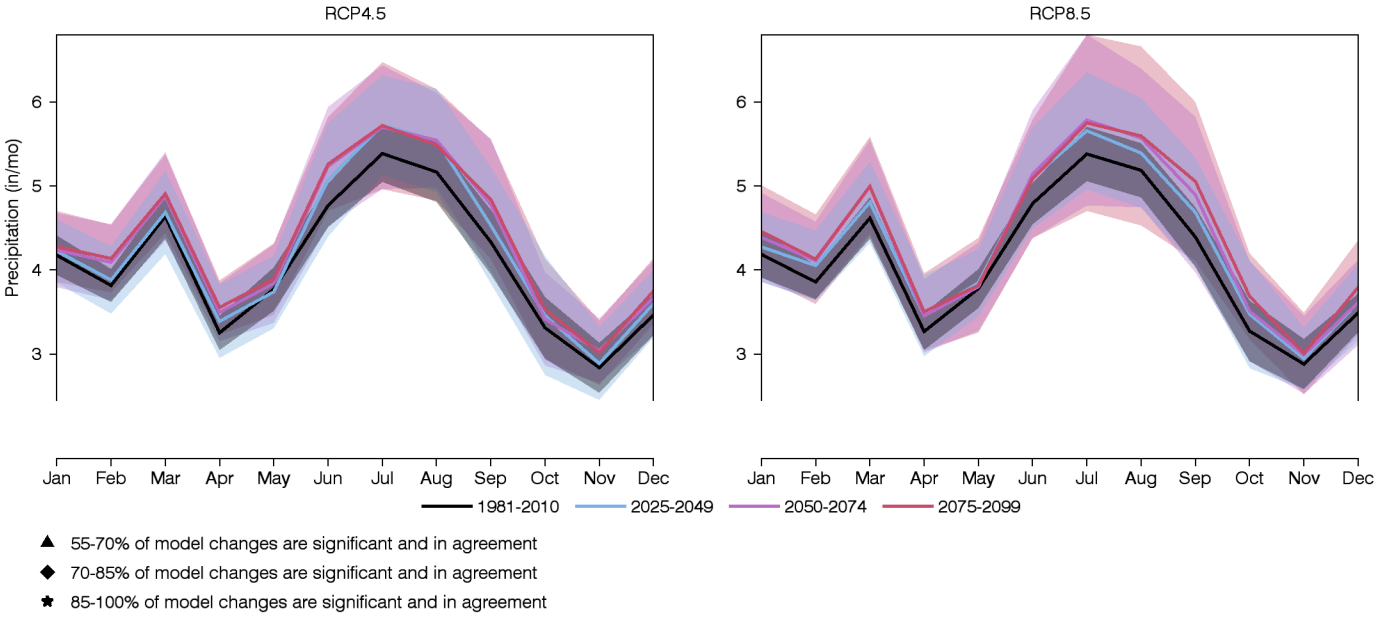


Figure 6: Monthly averages of precipitation for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

4 Snow Water Equivalent

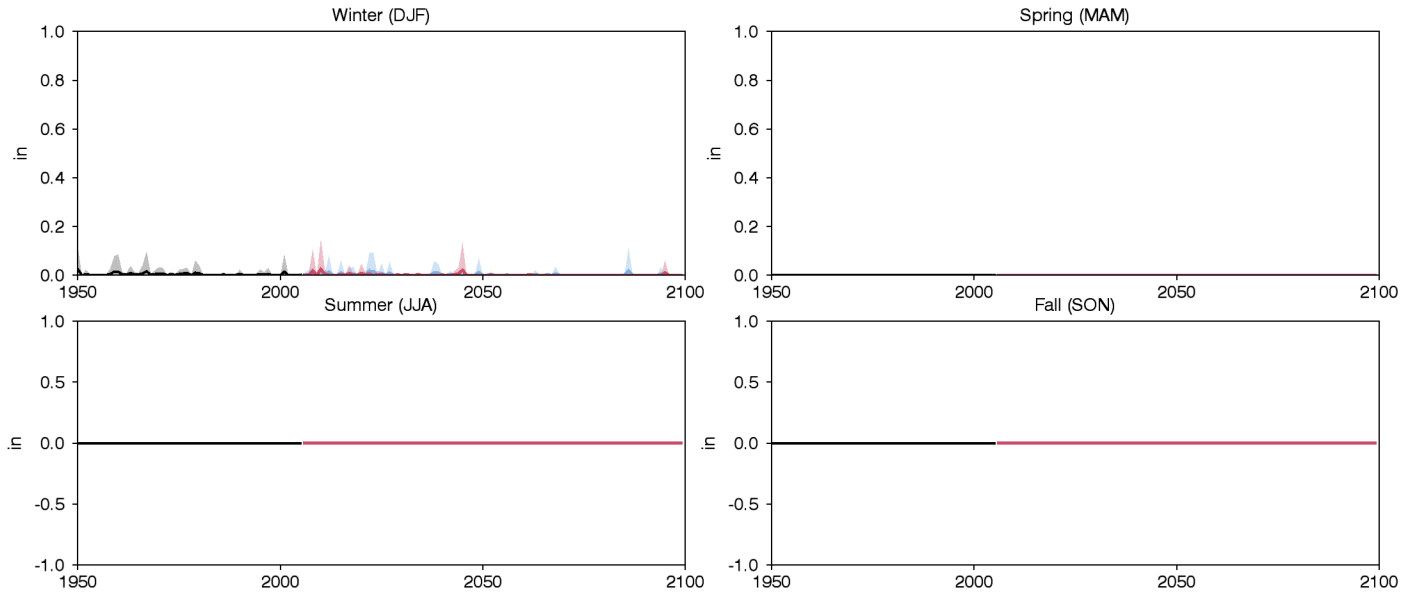


Figure 7: Seasonal average time series of snow water equivalent for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

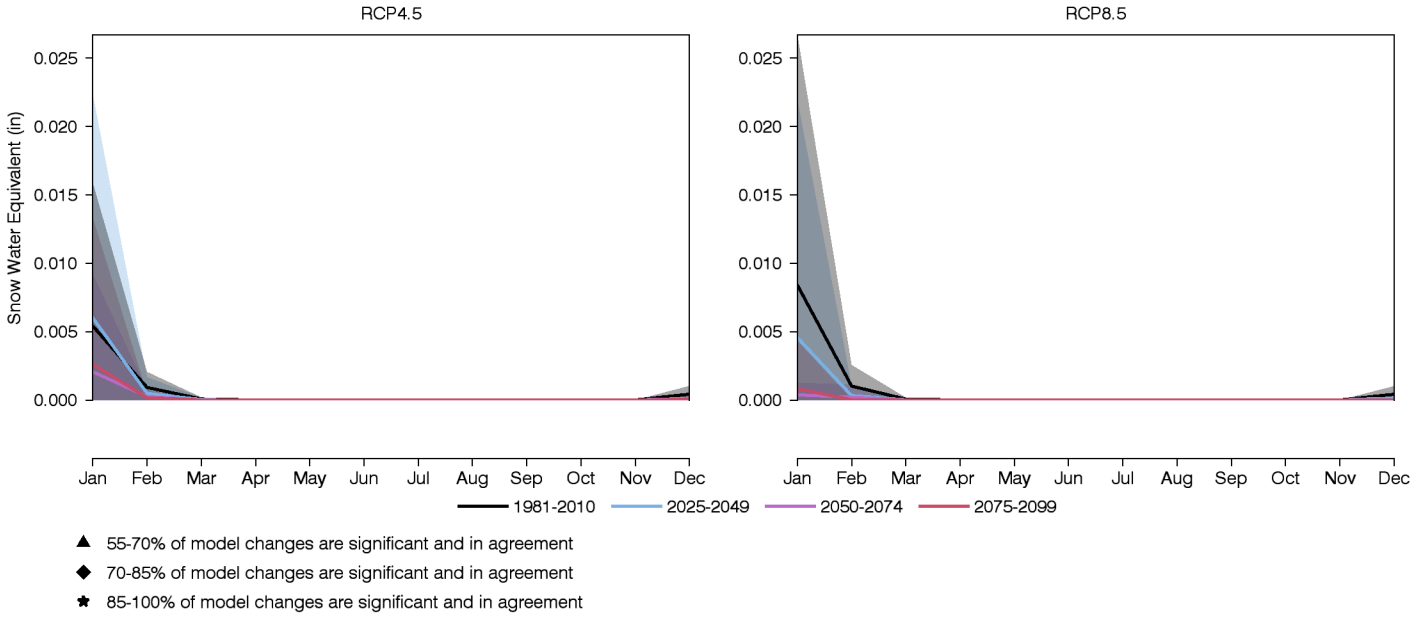


Figure 8: Monthly averages of snow water equivalent for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

5 Runoff

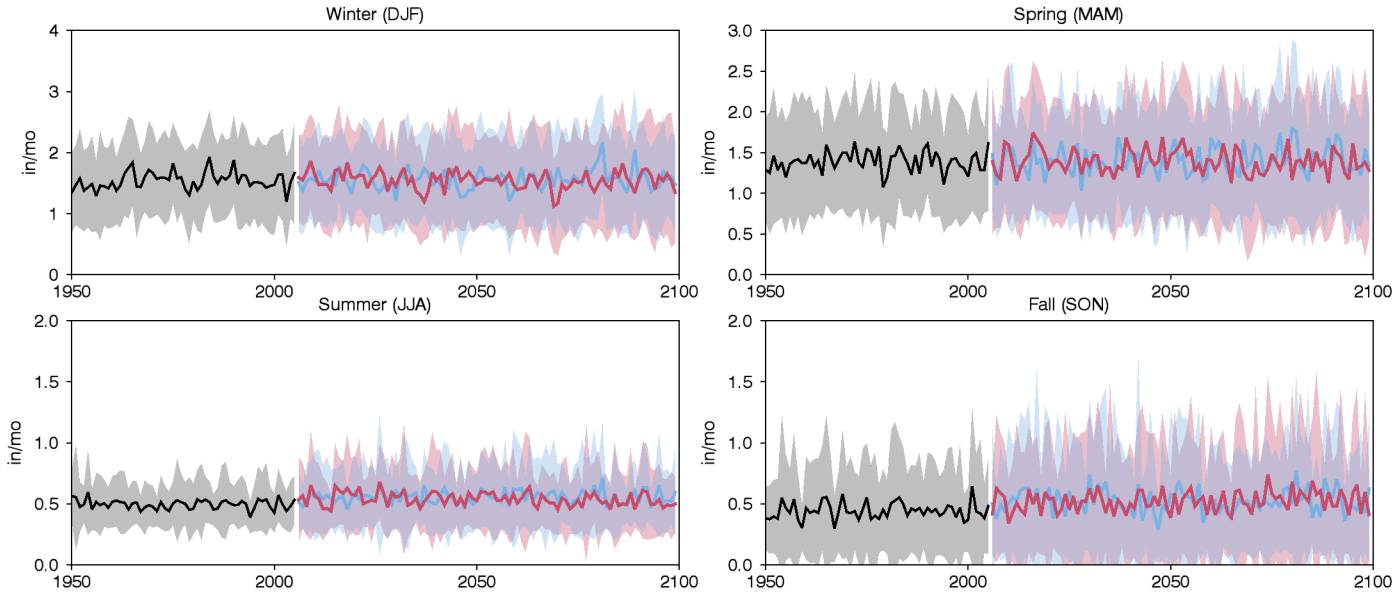


Figure 9: Seasonal average time series of runoff for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

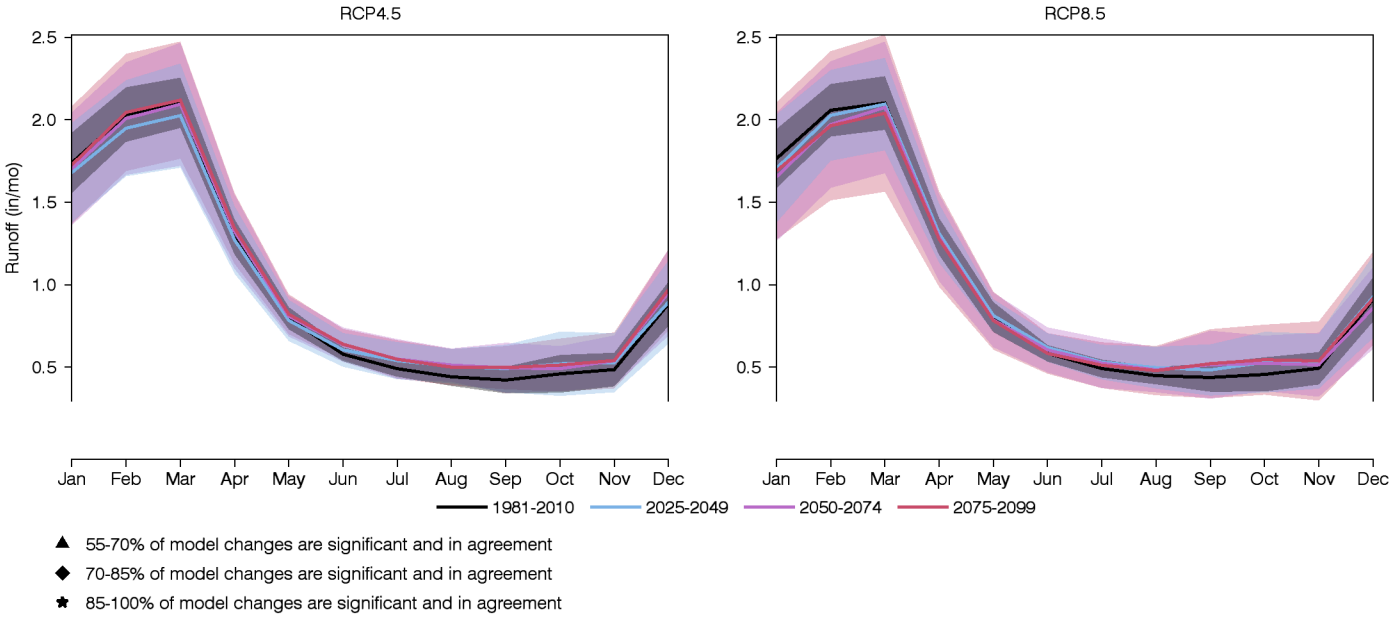


Figure 10: Monthly averages of runoff for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

6 Soil Water Storage

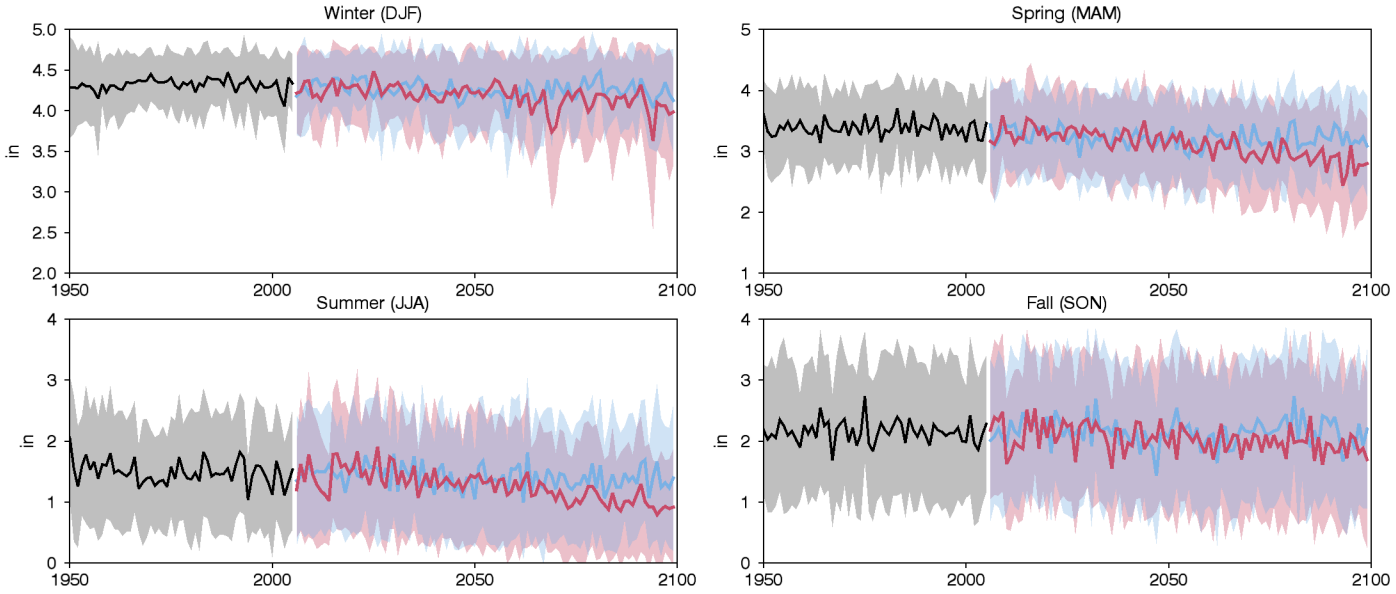


Figure 11: Seasonal average time series of soil water storage for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

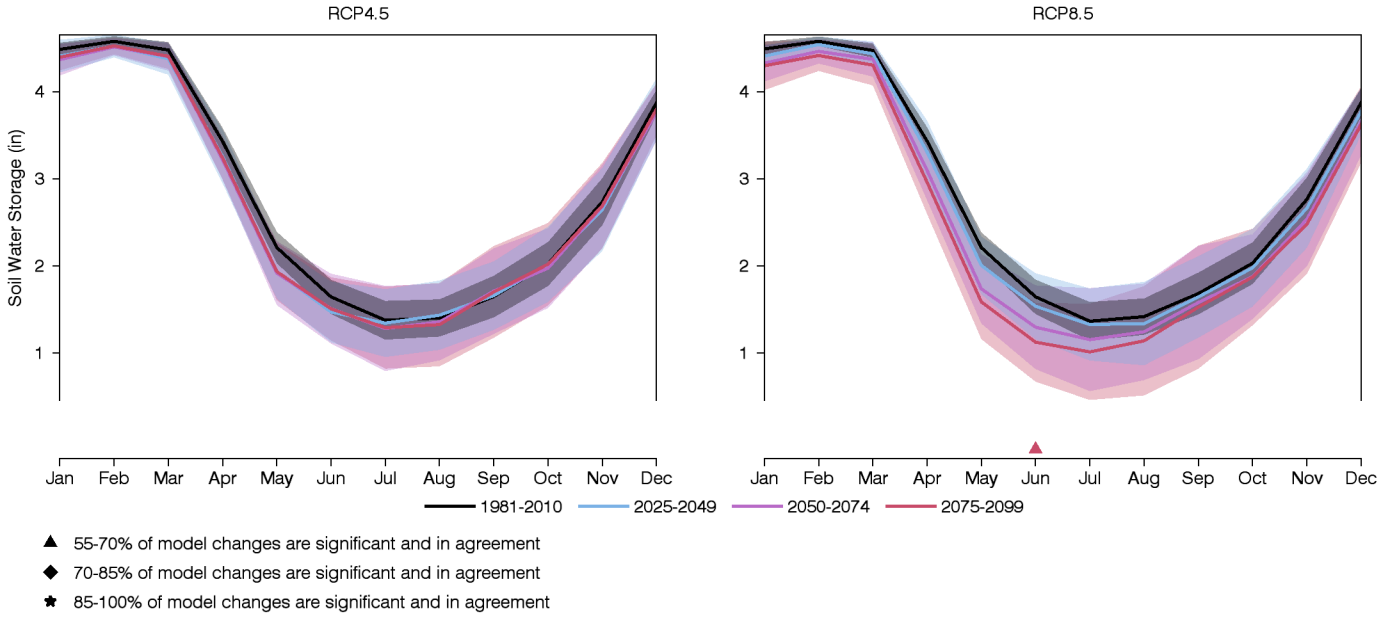


Figure 12: Monthly averages of soil water storage for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

7 Evaporative Deficit

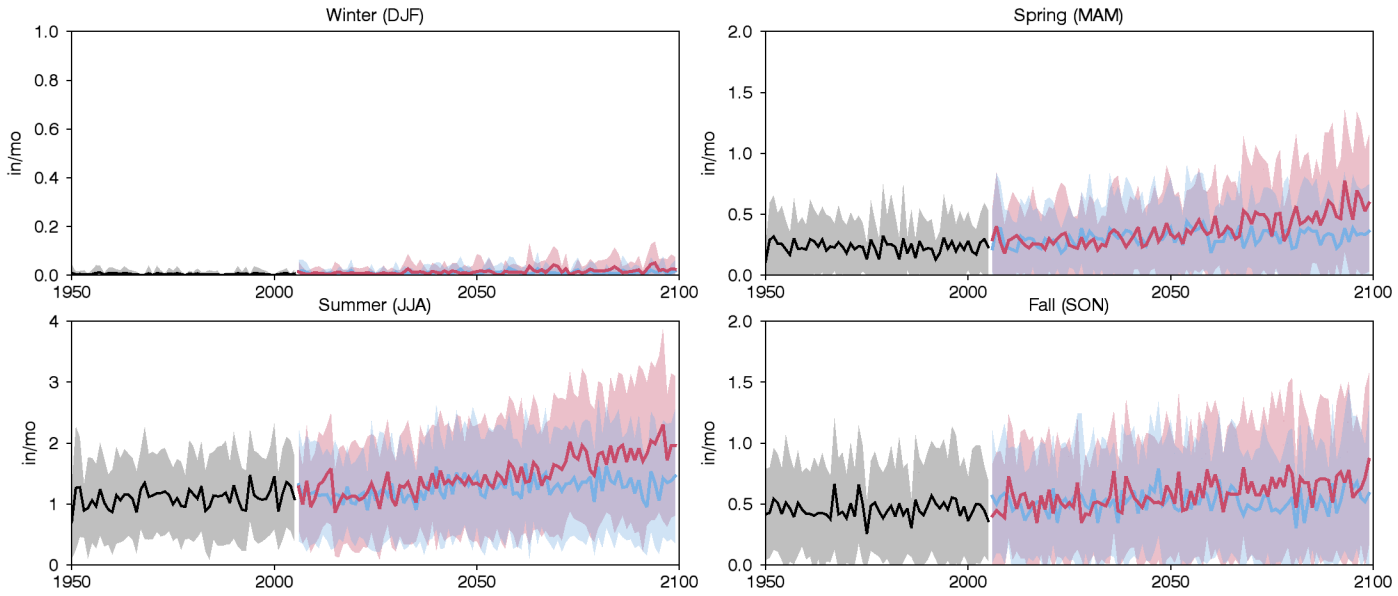


Figure 13: Seasonal average time series of evaporative deficit for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

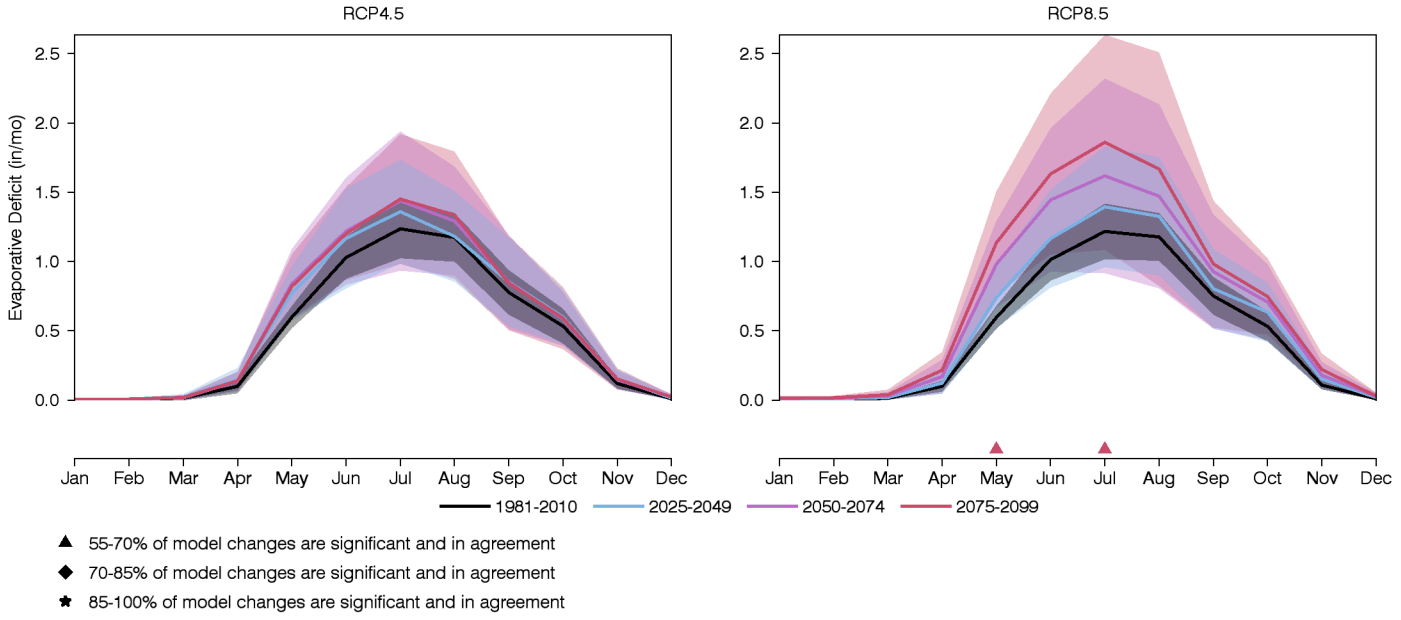


Figure 14: Monthly averages of evaporative deficit for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate the percent of models that simulate future minus present changes that are of the same sign and significant. A two-sided Students t-test is used to establish significance ($\rho \leq 0.05$).

8 Data

The temperature and precipitation summaries are created by spatially averaging the NASA NEX-DCP30 data set (Thrasher et al., 2013). The water-balance variables snow water equivalent, runoff, soil water storage and evaporative deficit are simulated by using the NEX-DCP30 temperature and precipitation as input to a simple model (McCabe and Wolock, 2007). The water-balance model accounts for the partitioning of water through the various components of the hydrologic system, but does not account for groundwater, diversions or regulation by impoundments.

9 Models

ACCESS1-0	bcc-csm1-1	bcc-csm1-1-m	BNU-ESM	CanESM2	CCSM4
CESM1-BGC	CMCC-CM	CNRM-CM5	CSIRO-Mk3-6-0	FGOALS-g2	FIO-ESM
GFDL-CM3	GFDL-ESM2G	GFDL-ESM2M	GISS-E2-R	HadGEM2-AO	HadGEM2-CC
HadGEM2-ES	inmcm4	IPSL-CM5A-LR	IPSL-CM5A-MR	IPSL-CM5B-LR	MIROC5
MIROC-ESM	MIROC-ESM-CHEM	MPI-ESM-LR	MPI-ESM-MR	MRI-CGCM3	NorESM1-M

10 Citation Information

Alder, J. R. and S. W. Hostetler, 2013. USGS National Climate Change Viewer. US Geological Survey `http://www.usgs.gov/climate_landuse/clu_rd/nccv.asp` doi:10.5066/F7W9575T.

Hostetler, S.W. and Alder, J.R., 2016. Implementation and evaluation of a monthly water balance model over the U.S. on an 800 m grid. Water Resources Research, 52, doi:10.1002/2016WR018665.

Thrasher, B., J. Xiong, W. Wang, F. Melton, A. Michaelis, and R. Nemani, 2013. New downscaled climate projections suitable for resource management in the U.S. Eos, Transactions American Geophysical Union 94, 321-323, doi:10.1002/2013EO370002.

11 Disclaimer

These freely available, derived data sets were produced by J. Alder and S. Hostetler, US Geological Survey (USGS). The original climate data are from the NEX-DCP30 dataset, which was prepared by the Climate Analytics Group and NASA Ames Research Center using the NASA Earth Exchange, and is distributed by the NASA Center for Climate Simulation. No warranty expressed or implied is made by the USGS regarding the display or utility of the derived data on any other system, or for general or scientific purposes, nor shall the act of distribution constitute any such warranty. The USGS shall not be held liable for improper or incorrect use of the data described and/or contained herein.

Appendix 5

Protected status of current populations throughout the range of the dwarf-flowered heartleaf. Protected status is as follows: 1-protected in perpetuity; 2-protected, but not in perpetuity; 3-not protected.

Population Number	Protection Status
1	1
2	1
3	1
4	1
5	3
2	2 (part)
23	3
29	3
31	2 (part)
44	1
59	2(part)
71	3
77	1
85	3
93	3
96	1 (part)
98	3
99	2 (part)
100	1 (part)
124	3
125	2
130	3
154	1
157	3
158	2/3
176	3
177	3
178	2
179	2(part)
183	1
195	3
206	3
208	2
214	2 (part)
216	2 (part)
217	1
219	3
226	1 (part)
227	1
229	1
232	3
243	1/2 (part)
245	2/3
247	1 (part)

248	3
252	?
261	3
271	1
272	3
274	3
275	3
276	2
279	3
287	1
291	2(part)
292	3
293	3
295	2 (part)
296	3
297	3
298	3
299	3
300	3
302	1 (part)
303	1/2
304	1
306	3
307	2(part)
308	2 (part)
309	3
311	1
312	1
316	?
317	3
318	2 (part)
320	3
321	3
Rock Barn Solar Farm	1

Dwarf Flowered Heartleaf Proposed Delisting Rule

Merritt, Timothy <timothy_merritt@fws.gov>

Mon 10/29/2018 4:46 PM

To: Stevens, Michael P <Mike.Stevens@sol.doi.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>

Mike,
See attached. You can take your full time if needed on this one. Thanks.
Tim

--

_____
Timothy Merritt
Chief, Division of Conservation and Classification
U S Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
615 574 8812 cell

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

The Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2018-XXXX; FXES11130900000-189-FF0932000]

RIN

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; availability of draft post-delisting monitoring plan.

SUMMARY: We, the U.S. Fish & Wildlife Service (Service), propose to remove the Dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicates that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened or endangered species under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the Dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan. If this proposal is finalized, the Dwarf-flowered heartleaf will be removed from the List.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for public hearings, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES**:** You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2018–XXXX, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rules link to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2018–XXXX; U.S. Fish and Wildlife Service, MS: BPHC, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see *Public Comments*, below, for more information).

Document availability: The proposed rule, draft PDM plan and supporting documents (including the Species Status Assessment (SSA), references cited, five year review) are available at *http://www.regulations.gov* under Docket No. FWS-R4-ES-2018-XXXX.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC

28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. This action proposes to remove the Dwarf-flowered heartleaf from the List of Endangered and Threatened Plants in title 50 of the Code of Federal Regulations (50 CFR 17.11(h)). Removing a species from the List ("delisting") can only be completed by issuing a rule.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposed; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The determination to delist a species must be based on an analysis of the same factors. In addition, the Act's implementing regulations at 50 CFR 424.11 provide that we may delist a species only if the best scientific and commercial data indicate the species is neither a threatened nor an endangered species for one or more of the following reasons: (1) The species is extinct; (2) the species has recovered and is no longer threatened or endangered; or (3) the original data used at the time the species was classified were in error. We have determined that the Dwarf-flowered heartleaf should be proposed for delisting under the Act because, based on an analysis of the five listing factors, it no longer meets the definition of an endangered or threatened species, and that it has recovered.

Peer review:

Deleted: Wildlife

Deleted: based on the species' recovery

Deleted: We

Deleted: based on recovery

(b)(5) DPP & ACP

In accordance with our joint policy on peer review published in the **Federal Register** July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we have sought the expert opinions of seven appropriate specialists regarding the Species Status Assessment Report (SSA Report), which informed this proposed rule. The purpose of peer review is to ensure that our determination is based on scientifically sound data, assumptions, and analyses.

Deleted: S

(b)(5) DPP & ACP

Deleted: classification

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from the public, other concerned governmental agencies (including but not limited to State and Federal agencies and city local governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information received during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

Deleted: ,

(1) Information concerning the biology and ecology of the Dwarf-flowered heartleaf;

(2) Relevant data concerning any threats (or lack thereof) to the Dwarf-flowered heartleaf particularly any data on the possible effects of climate change as it relates to habitat, the extent of State protection and management that would be provided to this aster as a delisted species;

(3) Current or planned activities within the geographic range of the Dwarf-flowered heartleaf that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment – including your personal identifying information – on *http://www.regulations.gov*. You may request at the top of your document that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee that we will be able to do so.

Comments and materials we receive, as well as supporting documentation we used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Service Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is a threatened or endangered species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the **Federal Register**. Such requests must be sent to the address shown in the **FOR FURTHER INFORMATION CONTACT** section. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings,

as well as how to obtain reasonable accommodations, in the **Federal Register** at least 15 days before the hearing.

Previous Federal Actions

On April 14, 1989, we published a final rule in the *Federal* Register (FR 54 14964) listing the Dwarf-flowered heartleaf as endangered due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing. A Recovery Plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to recover this species.

(b)(5) DPP & ACP

Background

(b)(5) DPP & ACP

The Dwarf-flowered heartleaf (Hexastylis naniflora) is a species of plant endemic to the upper 4 Piedmont region of western North Carolina and upstate South Carolina. Although Dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (USFWS 2010, p. 15; NCNHP 2016, p. 4). When Dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include four additional counties in North Carolina. As of 2016, the distribution of this species consisted of 113 populations distributed across 13 counties in these two states. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted: ¶

(b)(5) DPP & ACP

Dwarf-flowered heartleaf appears to have a restricted range due to its habitat requirements. The habitat where Dwarf-flowered heartleaf exists is limited in size and scope due

to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of Dwarf-flowered heartleaf, but also the size of any population.

Dwarf-flowered heartleaf occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186-196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, p. 114; Weakley 2015, p. 129; USFWS 2015, entire), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). Wagner (2013, pp. 30-32) conducted a habitat suitability study to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants.

A thorough review of the taxonomy, life history, ecology, and overall viability of the Dwarf-flowered Heartleaf is presented in the SSA (USFWS 2018, entire; available at https://www.fws.gov/southeast/ and at http://www.regulations.gov under Docket No. FWS-R4-ES-xxxx-xxxx).

Summary of Biological Status and Threats

The Act directs us to determine whether any species is an endangered or a threatened species because of any factors affecting its continued existence. The SSA report documents the results of our comprehensive biological status review for the Dwarf-flowered heartleaf, including an assessment of the potential stressors to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for listing as endangered or

Deleted: given

Deleted: on

Deleted: p

Formatted: Font: Italic

(b)(5) DPP & ACP

threatened species under the Act. It does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS-R4-ES-201X-XXXX.

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the three conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate individual life-history needs. In the next stage, we assessedthe historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We utilized this information to inform our decision in this proposed rule.

For the Dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect the Dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of Dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as elevation, slope, aspect, and soil type. Influencing those factors are elements of Dwarf-flowered heartleaf ecology that determine whether populations can grow to maximize habitat

Deleted: T

Deleted: involved an assessment of

Deleted: The

Deleted: of the SSA involved makin

Deleted: g

occupancy.

The species also needs to exhibit redundancy. We measured redundancy for the Dwarf-flowered heartleaf by the number and distribution of resilient populations across the range of the species. It is important to note that Dwarf-flowered heartleaf has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area.

The third characteristic, representation, can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. In the absence of species-specific genetic and ecological diversity information, we evaluated representation based on the extent and variability of habitat characteristics across the geographical range.

Current Condition

Resiliency

Based on recent reports using the methods described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple EOs and stand-alone EO records.

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. The EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, provided

(b)(5) DPP & ACP

(b)(5) DPP & ACP
(b)(5) DPP & ACP

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: some degree of

Deleted: in terms of

Deleted: R

Deleted: e

Deleted: also

Deleted: given

there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, again depending on habitat conditions; and poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat level information for every population we assessed, we synthesized all of the above population size information and created four resiliency categories as follows:

Deleted: e

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Redundancy

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Species-level redundancy reflects the ability of a species to withstand catastrophic events, and is best achieved by having multiple, widely distributed populations relative to the spatial occurrence of catastrophic events. Redundancy for dwarf-flowered heartleaf is the total number and resilience of population segments and their distribution across the species range.

An important question when investigating redundancy for dwarf-flowered heartleaf is, "what exactly is a catastrophe?" We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with devastating effects; however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010, pp. 7-10).

Deleted: , like hurricanes

Deleted: ,

Representation

(b)(5) DPP & ACP

We lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species.

(b)(5) DPP & ACP

Summary of Threats and Conservation Measures that Affect the Species

Section 4(a)(1) of the Act directs us to determine whether any species is an endangered species or a threatened species because of any factors affecting its continued existence due to one or more of the five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for a delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future following the delisting or downlisting and the removal of the Act's protections. In the SSA Report (Service, 2018, entire) we discuss the factors affecting the Dwarf-flowered heartleaf.

Threats were assessed for populations monitored by NCNHP during 2012-2016 (Robinson and Padgett 2016, pp. 7-8, 17-20), and EOs were reviewed for other documented threats to populations. Threats observed during these years included development, incompatible forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and road construction. Indirect or direct threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank for each threat factor determines the overall value for each threat observed at each population. No significant changes in threats within populations were noted from 2012-2016.

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Moved (insertion) [7]

Deleted: ¶

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Formatted: Indent: First line: 0

(b)(5) DPP & ACP

Deleted: ¶

(b)(5) DPP & ACP
(b)(5) DPP & ACP

We assess the specific observed threats, organized by listing factor, below.

Factor A. Present or threatened destruction, modification, or curtailment of habitat or range:

Dwarf-flowered heartleaf populations occur in rapidly growing urban areas with expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

The most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving dwarf-flowered heartleaf, is road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations between the USFWS and the North Carolina Department of Transportation (NCDOT). Collectively, these projects have adversely impacted or are currently expected to impact some 22,135 rosettes. In most cases the Section 7 process has resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection to those plants remaining (post-construction) within NCDOT right-of-way (ROW). Significant portions of other populations have been purchased by NCDOT as off-site conservation measures in association with these consultations. Over the many years of Section 7 consultations between the USFWS and NCDOT, NCDOT has pledged monitoring and/or management for most of the sites it has acquired, as well as some locations where the species is protected within NCDOT rights-of-way (ROW). In recent years USFWS and NCDOT have

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Deleted:

Deleted: *H. naniflora*

Deleted: NCDOT

(b)(5) DPP & ACP

Deleted: ¶

recognized a need to follow up on these commitments by verifying the number of plants remaining post-construction, the number and survival of transplanted individuals, the number of rosettes protected within ROWs, and/or the number of rosettes protected via off-site land purchases. In particular, there remains a need for monitoring data to be collected in a consistent manner from one year to the next for the purposes of meaningfully accounting for trends. In 2009, NCDOT pledged to provide this information to the USFWS as one of many conservation measures associated with another formal consultation involving adverse effects to the species (USFWS 2009, n.p.). This information, anticipated within the next calendar year, will substantially inform future assessments of the status, threats, and levels of protection afforded to the species.

Other forms of economic development have also resulted in the destruction or modification of habitats occupied by the dwarf-flowered heartleaf; in many cases, these activities have also required Section 7 consultations with the USFWS. Examples of these activities include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities (in compliance with Federal Aviation Administration standards) at a regional airport. Collectively, these activities have involved the loss or relocation of several thousand rosettes.

Factor B: Overutilization for commercial, sporting, scientific, or educational purposes:

Overutilization is not known to be a threat at this time.

Factor C: Disease or predation:

Deleted: -

Deleted: *H. naniflora*

(b)(5) DPP & ACP

Deleted:

Deleted: *H. naniflora*

When the species was listed in 1989, neither disease nor predation were known to be significant factors affecting the status of the species. We have no new information to suggest that this has changed.

Factor D: Inadequacy of existing regulatory mechanisms:

The North Carolina Plant Protection Act lists plants MORE, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. Outside of the Act, the species does not have legal protection from collection or destruction in the state of South Carolina.

The majority of sites that have the potential to afford long-term protection to the species have been protected (or have received additional protection) as a direct result of the regulatory protections afforded by the Endangered Species Act (ESA). In North Carolina, there are 14 sites with the potential to afford long-term protection to the species. Twelve of these have been associated with ESA section 7 consultations stemming from anticipated impacts to *H. naniflora*. Eight of these 12 sites have served as on-site mitigation for impacts to the species, in which the remaining portions of the population not impacted by the subject activity are expected to be protected in perpetuity (subject to the terms and conditions of a biological opinion authored by the Service). Three other sites were (or will be) acquired as off-site mitigation for projects also expected to adversely affect the species. One final site (the Rhyne Preserve) is already in protective ownership, but will serve as a recipient site for plants that would otherwise be destroyed in conjunction with a project located elsewhere in that same county (approximately 7 miles away) requiring ESA section 7 consultation.

Deleted: federally

Deleted: this was

Deleted: not

Deleted: a

Deleted: listed under that statute

Deleted: T

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

In South Carolina, ESA section 7 consultation afforded some protection to the species at the Lake Blalock population, which would have been reduced by 1/3 as a result of plans to raise lake levels. The remaining portions of this population (above the new high-water mark and on property owned by the Spartanburg Water System) are expected to be protected in perpetuity (subject to a Biological Opinion written by the Service), however this protection needs verification. The Peter's Creek SCDNR Heritage Preserve was also acquired as off-site mitigation for impacts stemming from this ESA Section 7 consultation.

Therefore, the protections afforded to the species as a result of its status under the ESA enabled protection (or additional protection) of 14 of the 20 sites currently capable of providing perpetual protection to the species. It is likely that many of these protection efforts would not have occurred without the protections of the ESA.

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Factor E: Other natural or manmade factors affecting its continued existence:

Invasive exotic plant species are rapidly spreading throughout riparian corridors and ravines across the range of this species. Invasive exotics such as English Ivy, Chinese privet, Japanese honeysuckle and Japanese Nepal grass are known to threaten several sites which contain the species; however, the scope and magnitude of this threat has not been comprehensively assessed. This is, however, considered the greatest threat to sites currently in protective ownership, and requires active management in order to be successfully abated. Therefore, sites receiving protection via conservation ownership which lack clearly assigned management responsibilities are not likely to provide perpetual protection to the species.

Deleted: rampantly

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Climate Change

There is a growing concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Because typical habitats for this

species include moist soils adjacent to creeks, streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams, specific effects of climate change to the dwarf-flowered heartleaf are likely related to changes in soil moisture associated with potential increases in drought.

Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.) which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p.7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p.7).

Despite the recognition of potential climate effects on ecosystem processes, there is uncertainty about what the exact climate future for the Southeastern US will be and how the ecosystems and species in this region will respond. Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. As a result, impacts from rapid urbanization in the region might be exacerbated under even a mild to moderate climate future.

Regardless of a pessimistic, optimistic, or status quo climate future, the following systematic changes are expected to be realized to varying degrees in the Southeastern US (IPCC 2013, p. 7):

- More frequent drought
- More extreme heat (resulting in increases in air and water temperatures, Figure 5-3)

- Increased heavy precipitation events (e.g., flooding)
- More intense storms (e.g., frequency of major hurricanes increases)
- Rising sea level and accompanying storm surge

(b)(5) DPP & ACP

Future Condition

Our analysis of the past, current, and future influences on what the Dwarf-flowered heartleaf needs for long term viability revealed that there are several influences that pose risks to future viability of the species. These risks are primarily related to habitat changes from development and long term climate change. We use projections of urban development to assess potential habitat loss and fragmentation. We also considered how climate change may exacerbate the impacts of development in a qualitative fashion using a narrative approach.

(b)(5) DPP & ACP

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. The projection to 2040 is based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape (see SSA Report for further explanation). Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

(b)(5) DPP & ACP

Deleted: B

(b)(5) DPP & ACP

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or

positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040. SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995, entire). The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations
- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There are no data available on the exact relationships between urbanization and the impacts to Dwarf-flowered heartleaf. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that

Deleted: is

very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative impacts; development increase of at least 50% was likely to have significant impacts to populations. We also assume that populations currently on protected lands are likely to see smaller impacts from urbanization compared to those that are not protected, but protection status (perpetuity vs non-perpetuity) matters. For example, Registered Heritage Areas are non-binding agreements with a land owner, and if the land changes ownership, or the owner decides not to continue with the agreement, then the Registry is no longer valid. Appendix 4 to the SSA Report shows the protection status of each delineated population which helped to inform our assessment of resilience under each scenario.

(b)(5) DPP & ACP

(b)(5) DPP & ACP

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. This is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider under Current Conditions include detections that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to persist. Dwarf-flowered heartleaf is a long-lived perennial, and several EOs have been revisited after more than 10 years and the species was present. For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

Deleted: for

(b)(5) DPP & ACP

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resilience of that population.

Deleted: ,

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000 foot buffer.

Deleted: e

Deleted: e

The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 foot buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 foot buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-flowered heartleaf is likely to persist.

Status Quo Scenario

Under the status quo scenario, we assume a few populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

(b)(5) DPP & ACP

Deleted: %

Deleted: e

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no negative impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold

- Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

High Development Scenario

Under the high development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

Deleted: e

- No additional populations are identified as persisting
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
  - Protected areas
    - Protected in perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Voluntary protection/non-perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold
  - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold; extirpation of populations if % increase in urbanization exceeds >90% threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we assume it is likely several additional populations (i.e. more than status quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resiliency under the following assumptions:

Deleted: e

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

Future Resiliency

Deleted: *e*

Our focus on future resiliency of dwarf-flowered heartleaf is on the potential impacts from urbanization. Table 1.5 shows a summary of currently delineated populations and the predicted urban development to occur within each of the populations. The table only includes those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Populations not included in this

Deleted: e

table are not predicted to be urbanized at all, so for the purposes of future analysis, will be assumed to retain the same resilience category as current. For those populations included in the table, we focus on those populations that are anticipated to increase in urbanization beyond a threshold value, depending on the scenario, but thresholds include >25% >50%, and >90% increases. Also taken into account is whether or not a population is on protected lands, and if so, whether the population is protected in perpetuity or not. Below is a summary of projected future resiliency under each of the three scenarios.

(b)(5) DPP & ACP

Deleted: e

Status Quo Scenario

In the Status Quo scenario, 75 populations of Dwarf-flowered heartleaf are predicted in 2040. The predicted resiliency of the extant populations is as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be highly resilient. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the seven additional populations predicted to persist under this scenario, four are in South Carolina, and three in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), and moderate (4).

Deleted: there are predicted to be
Deleted: on the landscape
Deleted: e
Deleted: are
Deleted: e
Deleted: e
Deleted: of very high
Deleted: ce

High Development Scenario

In the High Development scenario, 72 populations of Dwarf-flowered heartleaf are predicted in 2040. The predicted resilience of the extant populations is as follows: very high (27); high (4); moderate (25); and low (16). No new future populations are predicted to be discovered. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resilience is predicted to drop to moderate resilience; one high resilience population is predicted to drop to moderate; two moderate populations are predicted to drop to low resilience; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the Targeted Conservation scenario, 79 populations of Dwarf-flowered heartleaf are predicted in 2040. The predicted resilience of the extant populations is as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations discovered to persist, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development. Of the sixteen additional populations predicted to persist under this scenario, ten are in South Carolina, and six in North Carolina. We did not assess resilience for these additional populations, but it is worth mentioning that the last time these populations were detected, resilience was very high (2), high (1), moderate (11), and low (2).

Deleted: there are predicted to be

Deleted: on the landscape

Deleted: are

Deleted: e

(b)(5) DPP & ACP

Deleted: there are predicted to be

Deleted: on the landscape

Deleted: are

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resilience and extirpation of a few populations is offset in the Status Quo and Targeted Conservation scenarios by the persistence of several additional populations. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resiliency in several additional populations. However, in all three scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of Dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances; however the species range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

Based on the assumption that Dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. As discussed below, there are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Table 1 Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

(b)(5) DPP & ACP

Deleted: e

Deleted: Regardless of the scenario

Deleted: expected

Deleted: on the landscape

Deleted: are of at

Deleted: e

Deleted: ,

(b)(5) DPP & ACP

Deleted: Given

Deleted: for this species

Deleted: we have

	Current	Status Quo	High Development	Targeted Conservation
Very High	28	27	27	27
High	5	6	4	6
Moderate	26	23	25	23
Low	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total	**78**	**75**	**72**	**79**

Determination

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the Dwarf-flowered heartleaf. Currently, there are a total of 78 known populations in 12 counties with occurrences documented since 2005, 75 percent of which are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend. At the end of the projection period (2040), under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (5-6) of currently low resilient populations are projected to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Approximately 30 percent of the 78 currently known populations are permanently protected, and another 25 or so percent are somewhat protected (voluntary agreements or provided some level of protection) reducing the likelihood of development impacting those populations. We therefore propose to remove the Dwarf-flowered

heartleaf from the Federal List of Endangered and Threatened Wildlife at 50 CFR 17.11(h) due to recovery.

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect Dwarf-flowered heartleaf. There is no critical habitat designated for this species.

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as a threatened or endangered species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

(b)(5) DPP & ACP

Deleted: due to recovery

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all

phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2018-XXXX. Copies can also be obtained from the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT** section). We seek information, data, and comments from the public regarding the Dwarf-flowered heartleaf and the PDM plan. We are also seeking peer review of this draft plan concurrently with this comment period. We anticipate finalizing this plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Deleted: , Asheville, North Carolina 28801

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(a) Be logically organized;

(b) Use the active voice to address readers directly;

(c) Use clear language rather than jargon;

(d) Be divided into short sections and sentences; and

(e) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs

that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc. Send a copy of any comments on how we can make this rule easier to understand to: Office of Regulatory Affairs, Department of the Interior, room 7229, 1849 C Street NW., Washington, DC 20240. You may also email the comments to this address: Exsec@ios.doi.gov.

National Environmental Policy Act

We have determined that we do not need to prepare an Environmental Assessment or Environmental Impact Statement, as defined in the National Environmental Policy Act (42 USC 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act. We published a notice outlining our reasons for this determination in the Federal Register October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribal lands associated with this proposed regulation.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket Number FWS-R4-ES-2018-XXXX and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the South Carolina/ Ecological Services Field Office.

Deleted: is

(b)(5) DPP & ACP

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

2. Amend § 17.11(h), by removing the entries for "Heartleaf, Dwarf-flowered" under "PLANTS" from the List of Endangered and Threatened Wildlife.

§ 17.11 Endangered and threatened wildlife.

Dated: _____

_____

Deputy Director, U.S. Fish and Wildlife Service, Exercising the Authority of the Director, U.S. Fish and Wildlife Service.

Re: Dwarf Flowered Heartleaf Proposed Delisting Rule

Stevens, Michael P <Mike.Stevens@sol.doi.gov>

Wed 4/17/2019 3:35 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Merritt, Timothy <timothy_merritt@fws.gov>

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Please let me know if you want to discuss.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Tue, Apr 2, 2019 at 7:37 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good morning Mike,
>
> Please see attachment for the proposed delisting rule for dwarf-flowered heartleaf. If you have any further comments, please let me know. Thanks.
>
> On Tue, Nov 13, 2018 at 9:29 AM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:
>
> (b)(5) DPP & ACP

(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP Please let me know if you have any questions.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Oct 29, 2018 at 4:47 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Mike,
> See attached. You can take your full time if needed on this one. Thanks.
> Tim
>
> --
>
> _____
> Timothy Merritt
> Chief, Division of Conservation and Classification
> U S Fish and Wildlife Service

> 1875 Century Blvd NE Suite 200
> Atlanta, GA 30345
> 404-679-7082 office
> 615-574-8812 cell
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

Re: Heartleaf rule

Peeples, Gary <gary_peeples@fws.gov>
Thu 6/6/2019 12:43 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Reid, Rebekah N <rebekah_reid@fws.gov>

Hey Byron,

We're seeing the edits when we open on our end. When you look at the document, in the upper right corner is it set for "viewing" or "editing"?

-Gary

On Thu, Jun 6, 2019 at 12:33 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Hello Rebekah
>
> Can you send me the version of the rule with the tracked changes? The google docs version that I have looks clean with no edits. Thanks.
>
> On Fri, May 31, 2019 at 3:35 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
>
> > Byron,
> >
> > Gary and I have added our suggested changes in the following Google Doc: https://docs.google.com/document/d/1BLY2KusGjbPIPIRkFE-e3prAW2ttpL_HpMpO4EStFNg/edit?usp=sharing If additional information is needed, I suggest we have a conference call to work out the final details.
> >
> > Some of the language in the proposed rule was cut-and-paste from an older version of the SSA. I changed it where I noticed but you should go back through and make sure all info is updated as well. I sent you an updated version of the SSA on Aug 1, 2018. Since August, we did find on error on one map and in reviewing the solicitor comments, we realized there was (b)(5) DPP (b)(5) DPP In the attached version of the SSA the map has been corrected and the discussion of invasives has been added.
> >
> > I realize you will also need the PDM. I have that finished, I'm just waiting on one minor bit of info and then I'll send that to you.
> >
> > Thanks.
> >
> > Rebekah Reid
> >
> > US Fish and Wildlife Service
> > Asheville Ecological Services Field Office
> > 160 Zillicoa St.
> > Asheville NC 28801
> > phone: 828-258-3939 x238
> > cell: 828-782-0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Wed, May 15, 2019 at 6:30 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Good morning Rebekah

This is the opportunity. You can address the comments when you get back to the FO.

On Tue, May 14, 2019 at 8:45 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

Also, will we (Asheville FO) be given the opportunity to provide official comments on the proposed rule? Or, is this our opportunity?

Thanks.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St
Asheville, NC 28801
phone: 828-258-3939 x238
cell: 828-782-0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Mon, May 13, 2019 at 5:28 PM Reid, Rebekah rebekah_reid@fws.gov wrote:

Hey Byron,

There are quite a few comments. Can you narrow it down? Which comments are you having trouble with?

I'm at NCTC this week without all of my files. I'll be back ne t week and can take a more thorough look at it then.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville, NC 28801
phone: 828-258-3939 x238
cell 828 782 0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Fri, May 10, 2019 at 8:22 AM Hamilton, Byron byron_hamilton@fws.gov wrote:

> Hi Rebekah,
>
> Can you take a look at Mike Stevens comments and give me some feedback? I have to get this to HQ by June. Thanks!
>
> **Byron Hamilton, Sr.**
> **Fish & Wildlife Biologist (Ecological Services Division of Conservation & Classification)**
> **U.S. Fish & Wildlife Service**
> **1875 Century Blvd.**
> **Atlanta, GA 30345**
> **Work (404) 679 4119**
> **Cell (803) 707 9518**

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work (404) 679 4119
Cell (803) 707 9518

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work (404) 679 4119
Cell (803) 707 9518

Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov

office 828/258-3939, ext. 234
fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

Re: Dwarf Flowered Heartleaf Proposed Delisting Rule

Stevens, Michael P <Mike.Stevens@sol.doi.gov>

Mon 6/10/2019 12:05 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Merritt, Timothy <timothy_merritt@fws.gov>

Thanks. I will get to this as soon as I can. I have numerous packages with deadlines within the next three weeks that will have to come first.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Jun 10, 2019 at 11:52 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good afternoon
>
> I've attached the dwarf-flowered heartleaf rule with your comments addressed. Portions of the previous versions of the rule contains outdated information. The new version of the rule includes the info from the updated version of the SSA. Please see attachments for the rule and SSA. Thanks.
>
> On Wed, Apr 17, 2019 at 3:35 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

> > Please let me know if you want to discuss.
> >
> > Michael Stevens
> > Attorney-Advisor
> > Office of the Regional Solicitor
> > Southeast Region

404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Tue, Apr 2, 2019 at 7:37 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Good morning Mike,

Please see attachment for the proposed delisting rule for dwarf-flowered heartleaf. If you have any further comments, please let me know. Thanks.

On Tue, Nov 13, 2018 at 9:29 AM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP
(b)(5) DPP & ACP lease let me know if you have any questions.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Oct 29, 2018 at 4:47 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Mike,
> See attached. You can take your full time if needed on this one. Thanks.
> Tim
>
> --
>
> _____
> Timothy Merritt
> Chief, Division of Conservation and Classification
> U S Fish and Wildlife Service
> 1875 Century Blvd., NE, Suite 200
> Atlanta, GA 30345
> 404-679-7082 office
> 615 574 8812 cell
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.

Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

Re: Heartleaf rule

Peeples, Gary <gary_peeples@fws.gov>
Thu 6/20/2019 8:07 AM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Reid, Rebekah N <rebekah_reid@fws.gov>

Hey Byron,

Here's our stakeholder list for the heartleaf:
https://docs.google.com/spreadsheets/d/1JYzoXLeDthEgnTXbw8i0z5P-aiWdWSRIYIgHU7l46M4/edit#gid=1710077126

We'd say those on the "federal" tab are affected, those on all the other tabs are interested.

-Gary

On Wed, Jun 19, 2019 at 9:21 AM Hamilton, Byron byron_hamilton@fws.gov wrote:

> Good morning
>
> I'm filling out the RIN application for the dwarf flowered heartleaf. I need to know:
>
> **B. What populations, groups, Indian tribes, States/regions, or organizations may be affected by this rule, and how?**
>
> **B. What populations, groups, Indian tribes, States/regions, or organizations may be interested in this rule, and why?**
>
> Thanks in advance!
>
> On Thu, Jun 6, 2019 at 12:53 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
>
> > Thanks!!!!
> >
> > On Thu, Jun 6, 2019 at 12:46 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> >
> > > Yes, I see "view only". I requested access to edit. Maybe that's the issue.
> > >
> > > On Thu, Jun 6, 2019 at 12:44 PM Peeples, Gary <gary_peeples@fws.gov> wrote:
> > >
> > > > Hey Byron,
> > > >
> > > > We're seeing the edits when we open on our end. When you look at the document, in the upper right corner is it set for "viewing" or "editing"?
> > > >
> > > > -Gary
> > > >
> > > > On Thu, Jun 6, 2019 at 12:33 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> > > >
> > > > > Hello Rebekah
> > > > >
> > > > > Can you send me the version of the rule with the tracked changes? The google docs version that I have looks clean with no edits. Thanks.

On Fri, May 31, 2019 at 3:35 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

Byron,

Gary and I have added our suggested changes in the following Google Doc: https://docs.google.com/document/d/1BLY2KusGjbPIPIRkFE-e3prAW2ttpL_HpMpO4EStFNg/edit?usp=sharing If additional information is needed, I suggest we have a conference call to work out the final details.

Some of the language in the proposed rule was cut-and-paste from an older version of the SSA. I changed it where I noticed but you should go back through and make sure all info is updated as well. I sent you an updated version of the SSA on Aug 1, 2018. Since August, we did find on error on one map and in reviewing the solicitor comments, we realized there was (b)(5) DPP(b)(5) DPP(b)(5) DPP In the attached version of the SSA the map has been corrected and the discussion of invasives has been added.

I realize you will also need the PDM. I have that finished, I'm just waiting on one minor bit of info and then I'll send that to you.

Thanks.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville NC 28801
phone: 828-258-3939 x238
cell: 828-782-0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Wed, May 15, 2019 at 6:30 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Good morning Rebekah

This is the opportunity. You can address the comments when you get back to the FO.

On Tue, May 14, 2019 at 8:45 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

Also, will we (Asheville FO) be given the opportunity to provide official comments on the proposed rule? Or, is this our opportunity?

Thanks.

Rebekah Reid

US Fish and Wildlife Service

Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville, NC 28801
phone: 828-258-3939 x238
cell 828 782 0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Mon, May 13, 2019 at 5:28 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Hey Byron,
>
> There are quite a few comments. Can you narrow it down? Which comments are you having trouble with?
>
> I'm at NCTC this week without all of my files. I'll be back next week and can take a more thorough look at it then.
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
> 160 Zillicoa St.
> Asheville, NC 28801
> phone 828 258 3939 238
> cell: 828-782-0090
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***

On Fri, May 10, 2019 at 8:22 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Hi Rebekah,
>
> Can you take a look at Mike Stevens comments and give me some feedback? I have to get this to HQ by June. Thanks!
> --
> **Byron Hamilton, Sr.**
> **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> **U.S. Fish & Wildlife Service**
> **1875 Century Blvd.**
> **Atlanta, GA 30345**
> **Work - (404) 679-4119**
> **Cell - (803) 707-9518**

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
office 828/258-3939, ext. 234
fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

> --
> **Byron Hamilton, Sr.**
> **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> **U.S. Fish & Wildlife Service**
> **1875 Century Blvd.**
> **Atlanta, GA 30345**
> **Work - (404) 679-4119**
> **Cell - (803) 707-9518**

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
office 828/258-3939, ext. 42234
fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

Re: Heartleaf rule

Peeples, Gary <gary_peeples@fws.gov>
Mon 6/24/2019 3:21 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Reid, Rebekah N <rebekah_reid@fws.gov>

Hey Byron,

I'm on AL right now, but I can tell you external affairs has the outreach package and I think they may have completed their surname.

Sent from my iPhone

On Jun 24, 2019, at 1:46 PM, Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good afternoon
>
> Could you send me a copy of the press release for the heartleaf?
>
> On Thu, Jun 20, 2019 at 8:10 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> > Awesome, thanks!
> >
> > On Thu, Jun 20, 2019 at 8:08 AM Peeples, Gary <gary_peeples@fws.gov> wrote:
> > > Hey Byron,
> > >
> > > Here's our stakeholder list for the heartleaf:
> > > https://docs.google.com/spreadsheets/d/1JYzoXLeDthEgnTXbw8i0z5P-aiWdWSRIYIgHU7l46M4/edit#gid=1710077126
> > >
> > > We'd say those on the "federal" tab are affected, those on all the other tabs are interested.
> > >
> > > -Gary
> > >
> > > On Wed, Jun 19, 2019 at 9:21 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> > > > Good morning
> > > >
> > > > I'm filling out the RIN application for the dwarf-flowered heartleaf. I need to know:
> > > >
> > > > **B. What populations, groups, Indian tribes, States/regions, or organizations may be affected by this rule, and how?**
> > > >
> > > > **B. What populations, groups, Indian tribes, States/regions, or organizations may be interested in this rule, and why?**
> > > >
> > > > Thanks in advance!
> > > >
> > > > On Thu, Jun 6, 2019 at 12:53 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Thanks!!!!

On Thu, Jun 6, 2019 at 12:46 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Yes, I see "view only". I requested access to edit. Maybe that's the issue.
>
> On Thu, Jun 6, 2019 at 12:44 PM Peeples, Gary <gary_peeples@fws.gov> wrote:
>
> > Hey Byron,
> >
> > We're seeing the edits when we open on our end. When you look at the document, in the upper right corner is it set for "viewing" or "editing"?
> >
> > -Gary
> >
> > On Thu, Jun 6, 2019 at 12:33 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> >
> > > Hello Rebekah
> > >
> > > Can you send me the version of the rule with the tracked changes? The google docs version that I have looks clean with no edits. Thanks.
> > >
> > > On Fri, May 31, 2019 at 3:35 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
> > >
> > > > Byron,
> > > >
> > > > Gary and I have added our suggested changes in the following Google Doc: https://docs.google.com/document/d/1BLY2KusGjbPIPIRkFE-e3prAW2ttpL_HpMpO4EStFNg/edit?usp=sharing If additional information is needed, I suggest we have a conference call to work out the final details.
> > > >
> > > > Some of the language in the proposed rule was cut-and-paste from an older version of the SSA. I changed it where I noticed but you should go back through and make sure all info is updated as well. I sent you an updated version of the SSA on Aug 1, 2018. Since August, we did find on error on one map and in reviewing the solicitor comments, we realized there was (b)(5) DPP(b)(5) DPP(b)(5) DPP In the attached version of the SSA the map has been corrected and the discussion of invasives has been added.
> > > >
> > > > I realize you will also need the PDM. I have that finished, I'm just waiting on one minor bit of info and then I'll send that to you.
> > > >
> > > > Thanks.
> > > >
> > > > Rebekah Reid
> > > >
> > > > US Fish and Wildlife Service

Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville, NC 28801
phone: 828-258-3939 x238
cell 828 782 0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Wed, May 15, 2019 at 6:30 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good morning Rebekah
>
> This is the opportunity. You can address the comments when you get back to the FO.
>
> On Tue, May 14, 2019 at 8:45 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
>
> > Also, will we (Asheville FO) be given the opportunity to provide official comments on the proposed rule? Or, is this our opportunity?
> >
> > Thanks.
> >
> > Rebekah Reid
> >
> > US Fish and Wildlife Service
> > Asheville Ecological Services Field Office
> > 160 Zillicoa St.
> > Asheville NC 28801
> > phone: 828-258-3939 x238
> > cell: 828-782-0090
> >
> > ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***
> >
> > On Mon, May 13, 2019 at 5:28 PM Reid, Rebekah rebekah_reid@fws.gov wrote:
> >
> > > Hey Byron,
> > >
> > > There are quite a few comments. Can you narrow it down? Which comments are you having trouble with?

I'm at NCTC this week without all of my files. I'll be back next week and can take a more thorough look at it then.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville, NC 28801
phone: 828-258-3939 x238
cell: 828-782-0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Fri, May 10, 2019 at 8:22 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Hi Rebekah,
>
> Can you take a look at Mike Stevens comments and give me some feedback? I have to get this to HQ by June. Thanks!
> --
> **Byron Hamilton, Sr.**
> **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> **U.S. Fish & Wildlife Service**
> **1875 Century Blvd.**
> **Atlanta, GA 30345**
> **Work - (404) 679-4119**
> **Cell - (803) 707-9518**

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.

Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
office 828/258-3939, ext. 234
fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.

> **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> **U.S. Fish & Wildlife Service**
> **1875 Century Blvd.**
> **Atlanta, GA 30345**
> **Work - (404) 679-4119**
> **Cell - (803) 707-9518**

--
Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
office 828/258-3939, ext. 42234
fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

Re: Dwarf Flowered Heartleaf Proposed Delisting Rule

Stevens, Michael P <Mike.Stevens@sol.doi.gov>

Tue 6/25/2019 1:05 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Merritt, Timothy <timothy_merritt@fws.gov>

Byron:

Thanks for checking up. The problem with heartleaf is that it does not appear on any lists with deadlines, court-ordered or management ordered. Right now, this is what's ahead of heartleaf in the queue (Tim, this will serve as an update to you as well):

2 FL orchids 12MF: working on them right now. Due yesterday, but we've been going back and forth.
Berry cave salamander rule: Due yesterday, waiting on latest edit from FWS.
Red-cockaded woodpecker delisting rule: Due 6/30, still reviewing conservation agreements.
Black pine snake final critical habitat: Due 6/30.

The other two packages left are heartleaf and Eastern black rail. I intend to review both of these (at least initially) by 7/3, mainly because I am going to be out of the office from then until 7/14. So the answer to your question: no later than 7/3/2019.

BTW: two other delisting rules, *Lepanthes* and FL golden aster, are being reviewed by Linus Chen in DC. Another 12-month finding, Southern hognose snake, is being reviewed by Amanda Koehler (aka Susan Bossie) in our NE Regional Office. Contact them for the status of those packages.

If you want me to rearrange the order of review, particularly of the packages that I haven't gotten to yet, please let me know. I am trying very hard to meet all deadlines, to the extent that they are within my control.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Tue, Jun 25, 2019 at 12:19 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Greetings Mike
>
> I know you are going through these packages as fast as you can... But could you give us an update on the dwarf-flowered heartleaf? Thanks!

On Mon, Jun 10, 2019 at 12:05 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

Thanks. I will get to this as soon as I can. I have numerous packages with deadlines within the next three weeks that will have to come first.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Jun 10, 2019 at 11:52 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Good afternoon

I've attached the dwarf-flowered heartleaf rule with your comments addressed. Portions of the previous versions of the rule contains outdated information. The new version of the rule includes the info from the updated version of the SSA. Please see attachments for the rule and SSA. Thanks.

On Wed, Apr 17, 2019 at 3:35 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Please let me know if you want to discuss.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Tue, Apr 2, 2019 at 7:37 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good morning Mike,
>
> Please see attachment for the proposed delisting rule for dwarf-flowered heartleaf. If you have any further comments, please let me know. Thanks.
>
> On Tue, Nov 13, 2018 at 9:29 AM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP

(b)(5) DPP & ACP Please let me know if you have any questions.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Oct 29, 2018 at 4:47 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Mike,
> See attached. You can take your full time if needed on this one. Thanks.
> Tim
>
> --
> _____
> Timothy Merritt
> Chief, Division of Conservation and Classification
> U.S. Fish and Wildlife Service
> 1875 Century Blvd., NE, Suite 200
> Atlanta, GA 30345
> 404-679-7082 office
> 615-574-8812 cell
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)

U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

Re: Dwarf Flowered Heartleaf Proposed Delisting Rule

Young, Kristi <kristi_young@fws.gov>

Wed 7/3/2019 8:35 AM

To: Hamilton, Byron <byron_hamilton@fws.gov>

OK! Let me know if you need help with anything.

>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<

Kristi Young
Deputy Chief Divi ion of Con ervation and Cla ification
U.S. Fish and Wildlife Service
Southeast Region
(919) 856-4520 x30
Kri ti Young@FWS gov

: : : : : : : : : : : : : :

On Wed, Jul 3, 2019 at 8:35 AM Hamilton, Byron byron_hamilton@fws.gov wrote:

> Kristi,
>
> Got a few more comments from Mike. I'm addressing them now.
>
> Forwarded message
> From: **Stevens, Michael** mike.stevens@sol.doi.gov
> Date: Wed, Jul 3, 2019 at 8:18 AM
> Subject: Re: Dwarf Flowered Heartleaf Proposed Delisting Rule
> To: Hamilton, Byron byron_hamilton@fws.gov
> Cc: Merritt, Timothy timothy_merritt@fws.gov

> Thanks let me know if you want to discuss.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Jun 10, 2019 at 12:05 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

> Thanks. I will get to this as soon as I can. I have numerous packages with deadlines within the next three weeks that will have to come first.
>
> Michael Stevens
> Attorney-Advisor
> Office of the Regional Solicitor
> Southeast Region
> 404-331-5617
>
> This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.
>
> On Mon, Jun 10, 2019 at 11:52 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
>
> > Good afternoon
> >
> > I've attached the dwarf-flowered heartleaf rule with your comments addressed. Portions of the previous versions of the rule contains outdated information. The new version of the rule includes the info from the updated version of the SSA. Please see attachments for the rule and SSA. Thanks.
> >
> > On Wed, Apr 17, 2019 at 3:35 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Please let me know if you want to discuss.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Tue, Apr 2, 2019 at 7:37 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good morning Mike,
>
> Please see attachment for the proposed delisting rule for dwarf-flowered heartleaf. If you have any further comments, please let me know. Thanks.
>
> On Tue, Nov 13, 2018 at 9:29 AM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

(b)(5) DPP & ACP
(b)(5) DPP & ACP

(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP
(b)(5) DPP & ACP Please let me know if you have any questions.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Oct 29, 2018 at 4:47 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Mike,
> See attached. You can take your full time if needed on this one. Thanks.
> Tim
>
> --
>
> _____
> Timothy Merritt
> Chief, Division of Conservation and Classification
> U.S. Fish and Wildlife Service
> 1875 Century Blvd., NE, Suite 200
> Atlanta, GA 30345
> 404-679-7082 office
> 615-574-8812 cell
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***

--

> > > **Byron Hamilton, Sr.**
> > > **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> > > **U.S. Fish & Wildlife Service**
> > > **1875 Century Blvd.**
> > > **Atlanta, GA 30345**
> > > **Work - (404) 679-4119**
> > > **Cell - (803) 707-9518**

> > --
> > **Byron Hamilton, Sr.**
> > **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> > **U.S. Fish & Wildlife Service**
> > **1875 Century Blvd.**
> > **Atlanta, GA 30345**
> > **Work - (404) 679-4119**
> > **Cell - (803) 707-9518**

> --
> **Byron Hamilton, Sr.**
> **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> **U.S. Fish & Wildlife Service**
> **1875 Century Blvd.**
> **Atlanta, GA 30345**
> **Work - (404) 679-4119**
> **Cell - (803) 707-9518**

Fwd: Dwarf Flowered Heartleaf Proposed Delisting Rule

Young, Kristi <kristi_young@fws.gov>
Wed 7/3/2019 10:35 AM

To: Stevens, Michael P <Mike.Stevens@sol.doi.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>; Merritt, Timothy <timothy_merritt@fws.gov>

Aloha Mike,

We are working hard to address your comments, but after my initial review of the remaining issues, I don't believe we can address them before noon today. We need to discuss with the field and that's going to take time.

Just wanted to let you know, so you're not expecting the rule back today. Should we send it to Shannon when we are finished?

Enjoy your time off!

- Kristi
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<
Kristi Young
Deputy Chief Divi ion of Con ervation and Cla ification
U.S. Fish and Wildlife Service
Southeast Region
(919) 856-4520 x30
Kri ti Young@FWS gov
: : : : : : : : : : : : : :

Forwarded message
From: **Hamilton, Byron** byron_hamilton@fws.gov
Date: Wed, Jul 3, 2019 at 8:35 AM
Subject: Fwd: Dwarf Flowered Heartleaf Proposed Delisting Rule
To: Kristi Young kristi_young@fws.gov

Kristi,

Got a few more comments from Mike. I'm addressing them now.

Forwarded message
From: **Stevens, Michael** mike.stevens@sol.doi.gov
Date: Wed, Jul 3, 2019 at 8:18 AM
Subject: Re: Dwarf Flowered Heartleaf Proposed Delisting Rule
To: Hamilton, Byron byron_hamilton@fws.gov
Cc: Merritt, Timothy timothy_merritt@fws.gov

(b)(5) DPP & ACP(b)(5) DPP & ACP

Thanks--let me know if you want to discuss.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Jun 10, 2019 at 12:05 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

> Thanks. I will get to this as soon as I can. I have numerous packages with deadlines within the next three weeks that will have to come first.
>
> Michael Stevens
> Attorney-Advisor
> Office of the Regional Solicitor
> Southeast Region
> 404-331-5617
>
> This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.
>
> On Mon, Jun 10, 2019 at 11:52 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Good afternoon

I've attached the dwarf-flowered heartleaf rule with your comments addressed. Portions of the previous versions of the rule contains outdated information. The new version of the rule includes the info from the updated version of the SSA. Please see attachments for the rule and SSA. Thanks.

On Wed, Apr 17, 2019 at 3:35 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Please let me know if you want to discuss.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Tue, Apr 2, 2019 at 7:37 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good morning Mike,
>
> Please see attachment for the proposed delisting rule for dwarf-flowered heartleaf. If you have any further comments, please let me know. Thanks.
>
> On Tue, Nov 13, 2018 at 9:29 AM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP Please let me know if you have any questions.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Oct 29, 2018 at 4:47 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Mike,
> See attached. You can take your full time if needed on this one. Thanks.
> Tim
>
> --
> _____

Timothy Merritt
Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
615-574-8812 cell

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

Re: Heartleaf rule

Reid, Rebekah N <rebekah_reid@fws.gov>

Wed 7/10/2019 3:10 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Peeples, Gary <gary_peeples@fws.gov>

Hi Byron,

I sent you a note and a share directly from Google docs for this round of comments. Let me know if it doesn't come through.

Thanks.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville NC 28801
phone: 828-258-3939 x42238
cell: 828-782-0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Wed, Jul 3, 2019 at 10:03 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> Sounds good, thanks!
>
> On Wed, Jul 3, 2019 at 10:02 AM Peeples, Gary <gary_peeples@fws.gov> wrote:
> > Thanks Byron,
> >
> > We'll start tackling what we can. Probably early next week before we can get something back.
> >
> > -G
> >
> > On Wed, Jul 3, 2019 at 9:18 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> > > I've attached the updated document.
> > >
> > > On Wed, Jul 3, 2019 at 8:46 AM Peeples, Gary <gary_peeples@fws.gov> wrote:
> > > > Greetings Byron,
> > > >
> > > > This week is a little tight for us between the holiday and some other deadlines. Does the solicitor have new comments? I didn't see any in the document.
> > > >
> > > > -Gary
> > > >
> > > > On Wed, Jul 3, 2019 at 8:27 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Good morning,

Are you available to answer some solicitor comments for the heartleaf today?

On Tue, Jun 25, 2019 at 6:53 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Awesome, thanks!
>
> On Mon, Jun 24, 2019 at 3:21 PM Gary Peeples <gary_peeples@fws.gov> wrote:
>
> > Hey Byron,
> >
> > I'm on AL right now, but I can tell you external affairs has the outreach package and I think they may have completed their surname.
> >
> > Sent from my iPhone
> >
> > On Jun 24, 2019, at 1:46 PM, Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> >
> > > Good afternoon
> > >
> > > Could you send me a copy of the press release for the heartleaf?
> > >
> > > On Thu, Jun 20, 2019 at 8:10 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> > >
> > > > Awesome, thanks!
> > > >
> > > > On Thu, Jun 20, 2019 at 8:08 AM Peeples, Gary <gary_peeples@fws.gov> wrote:
> > > >
> > > > > Hey Byron,
> > > > >
> > > > > Here's our stakeholder list for the heartleaf: https://docs.google.com/spreadsheets/d/1JYzoXLeDthEgnTXbw8i0z5P_aiWdWSRIYIgHU7l46M4/edit#gid_1710077126
> > > > >
> > > > > We'd say those on the "federal" tab are affected, those on all the other tabs are interested.
> > > > >
> > > > > -Gary
> > > > >
> > > > > On Wed, Jun 19, 2019 at 9:21 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> > > > >
> > > > > > Good morning
> > > > > >
> > > > > > I'm filling out the RIN application for the dwarf-flowered heartleaf. I need to know:
> > > > > >
> > > > > > **B. What populations, groups, Indian tribes, States/regions, or organizations may be affected by this rule, and how?**

B. What populations, groups, Indian tribes, States/regions, or organizations may be interested in this rule, and why?

Thanks in advance!

On Thu, Jun 6, 2019 at 12:53 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Thanks!!!!
>
> On Thu, Jun 6, 2019 at 12:46 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
>
> > Yes, I see "view only". I requested access to edit. Maybe that's the issue.
> >
> > On Thu, Jun 6, 2019 at 12:44 PM Peeples, Gary <gary_peeples@fws.gov> wrote:
> >
> > > Hey Byron,
> > >
> > > We're seeing the edits when we open on our end. When you look at the document, in the upper right corner is it set for "viewing" or "editing"?
> > >
> > > -Gary
> > >
> > > On Thu, Jun 6, 2019 at 12:33 PM Hamilton, Byron byron_hamilton@fws.gov wrote:
> > >
> > > > Hello Rebekah
> > > >
> > > > Can you send me the version of the rule with the tracked changes? The google docs version that I have looks clean with no edits. Thanks.
> > > >
> > > > On Fri, May 31, 2019 at 3:35 PM Reid, Rebekah rebekah_reid@fws.gov wrote:
> > > >
> > > > > Byron,
> > > > >
> > > > > Gary and I have added our suggested changes in the following Google Doc: https://docs.google.com/document/d/1BLY2KusGjbPIPIRkFE_e3prAW2ttpL_HpMpO4EStFNg/edit?usp=sharing If additional information is needed, I suggest we have a conference call to work out the final details.
> > > > >
> > > > > Some of the language in the proposed rule was cut and paste from an older version of the SSA. I changed it where I noticed but you should go back through and make sure all info is updated as well. I sent you an

updated version of the SSA on Aug 1, 2018. Since August, we did find on error on one map and in reviewing the solicitor comments, we realized there was (b)(5) DPP(b)(5) DPP(b)(5) DPP In the attached version of the SSA the map has been corrected and the discussion of invasives has been added.

I realize you will also need the PDM. I have that finished, I'm just waiting on one minor bit of info and then I'll send that to you.

Thanks.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville, NC 28801
phone: 828-258-3939 x238
cell: 828-782-0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Wed, May 15, 2019 at 6:30 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good morning Rebekah
>
> This is the opportunity. You can address the comments when you get back to the FO.
>
> On Tue, May 14, 2019 at 8:45 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
>
> > Also, will we (Asheville FO) be given the opportunity to provide official comments on the proposed rule? Or, is this our opportunity?
> >
> > Thanks.
> >
> > Rebekah Reid
> >
> > US Fish and Wildlife Service
> > Asheville Ecological Services Field Office
> > 160 Zillicoa St.
> > Asheville, NC 28801
> > phone: 828-258-3939 x238

cell: 828-782-0090

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

On Mon, May 13, 2019 at 5:28 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Hey Byron,
>
> There are quite a few comments. Can you narrow it down? Which comments are you having trouble with?
>
> I'm at NCTC this week without all of my files. I'll be back next week and can take a more thorough look at it then.
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
> 160 Zillicoa St.
> Asheville, NC 28801
> phone: 828-258-3939 x238
> cell: 828-782-0090
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***

On Fri, May 10, 2019 at 8:22 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Hi Rebekah,
>
> Can you take a look at Mike Stevens comments and give me some feedback? I have to get this to HQ by June. Thanks!
> --
> **Byron Hamilton, Sr.**
> **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> **U.S. Fish & Wildlife Service**

1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
office 828/258-3939, ext. 234
fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service

> **1875 Century Blvd.**
> **Atlanta, GA 30345**
> **Work - (404) 679-4119**
> **Cell - (803) 707-9518**

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
office 828/258-3939, ext. 42234
fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service

1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
office 828/258-3939, ext. 42234

fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--

Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
office 828/258-3939, ext. 42234
fax 828/258-5330

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

Re: Dwarf Flowered Heartleaf Proposed Delisting Rule

Young, Kristi <kristi_young@fws.gov>
Thu 7/11/2019 10:40 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>

Byron,

A few comments on heartleaf.

Pg 12, under redundancy. The added text, I think we mean to say 24 populations across 8 counties? Not states. The species only exists in North and South Carolina, I believe.

New climate change section, starting pg 20, we will need to add in metric or English measurements (e.g., 2 degrees F; X degrees C) for distance, temperature, area, etc. Otherwise, while a bit long and rambling, (b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP

Check for references where the name of the researchers is in the sentence, and not as a parenthetical. For example, bottom of pg 22, the sentence:

In their analyses of life-history traits in relation to potential vulnerability to variability in demographic vital rates caused by increased variability in climatic patterns, Morris et al. (2008, p. 22) and Dalgleish et al. (2010, p. 216) concluded that longer-lived species should be less influenced by climate-driven increases in demographic variability.

needs to be rewritten so the citations are all in parentheses. Suggested rewrite:

In an analysis of life-history traits .... researchers concluded that longer-lived ... (Morris et al. 2008, p. 22; Dalgleish et al 2010, p. 2016).

Pg 35 (maybe earlier). Have we incorporated the latest SPR template language in this rule?

: : : : : : : : : : : : : :
Kristi Young
Deputy Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
Southea t Region
(919) 856-4520 x30
Kristi_Young@FWS.gov
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<

On Thu, Jul 11, 2019 at 10:01 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Hello Mike,

Please see attachment for the updated Dwarf-flowered heartleaf rule with comments addressed.
Hope you have a great vacation!

On Wed, Jul 3, 2019 at 10:36 AM Young, Kristi <kristi_young@fws.gov> wrote:

Aloha Mike,

(b)(5) DPP & ACP

Enjoy your time off!

- Kristi

>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<

Kristi Young
Deputy Chief Divi ion of Con ervation and Cla ification
U.S. Fish and Wildlife Service
Southeast Region
(919) 856-4520 x30
Kri ti Young@FWS gov

: : : : : : : : : : : : : :

Forwarded message
From: **Hamilton, Byron** byron_hamilton@fws.gov
Date: Wed, Jul 3, 2019 at 8:35 AM
Subject: Fwd: Dwarf Flowered Heartleaf Proposed Delisting Rule
To: Kristi Young kristi_young@fws.gov

Kristi,

Got a few more comments from Mike. I'm addressing them now.

Forwarded message
From: **Stevens, Michael** mike.stevens@sol.doi.gov
Date: Wed, Jul 3, 2019 at 8:18 AM
Subject: Re: Dwarf Flowered Heartleaf Proposed Delisting Rule
To: Hamilton, Byron byron_hamilton@fws.gov
Cc: Merritt, Timothy timothy_merritt@fws.gov

(b)(5) DPP & ACP

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Thanks--let me know if you want to discuss.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Jun 10, 2019 at 12:05 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

> Thanks. I will get to this as soon as I can. I have numerous packages with deadlines within the next three weeks that will have to come first.
>
> Michael Stevens
> Attorney-Advisor
> Office of the Regional Solicitor
> Southeast Region
> 404-331-5617
>
> This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.
>
> On Mon, Jun 10, 2019 at 11:52 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Good afternoon

I've attached the dwarf-flowered heartleaf rule with your comments addressed. Portions of the previous versions of the rule contains outdated information. The new version of the rule includes the info from the updated version of the SSA. Please see attachments for the rule and SSA. Thanks.

On Wed, Apr 17, 2019 at 3:35 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Please let me know if you want to discuss.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Tue, Apr 2, 2019 at 7:37 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good morning Mike,
>
> Please see attachment for the proposed delisting rule for dwarf-flowered heartleaf. If you have any further comments, please let me know. Thanks.
>
> On Tue, Nov 13, 2018 at 9:29 AM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP

(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP (b)(5) DPP & ACP Please let me know if you have any questions.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Oct 29, 2018 at 4:47 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Mike,
> See attached. You can take your full time if needed on this one. Thanks.
> Tim

--

_____

Timothy Merritt
Chief, Division of Conservation and Classification
U S Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
615 574 8812 cell

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service

1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

Fwd: Dwarf Flowered Heartleaf Proposed Delisting Rule

Young, Kristi <kristi_young@fws.gov>
Mon 7/15/2019 2:34 PM

To: McRae, Sarah <sarah_mcrae@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>

Sarah,

As Byron is out sick, can you please get this rule cleaned up and ready to go to PRB today? I'll also send you the form and a sample email so you know what to say when you send the email.

Mahalo!

- Kristi

Kristi Young
Deputy Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
Southea t Region
(919) 856-4520 x30
Kristi_Young@FWS.gov
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<

---------- Forwarded message ---------
From: **Stevens, Michael** <mike.stevens@sol.doi.gov>
Date: Mon, Jul 15, 2019 at 1:55 PM
Subject: Re: Dwarf Flowered Heartleaf Proposed Delisting Rule
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>, Timothy Merritt <timothy_merritt@fws.gov>

(b)(5) DPP & ACP

Let me know if you have any questions.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Thu, Jul 11, 2019 at 10:01 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Hello Mike,
>
> Please see attachment for the updated Dwarf-flowered heartleaf rule with comments addressed.
> Hope you have a great vacation!
>
> On Wed, Jul 3, 2019 at 10:36 AM Young, Kristi <kristi_young@fws.gov> wrote:
>
> > Aloha Mike,
> >
> > We are working hard to address your comments, but after my initial review of the remaining issues, I don't believe we can address them before noon today. We need to discuss with the field and that's going to take time.
> >
> > Just wanted to let you know, so you're not expecting the rule back today. Should we send it to Shannon when we are finished?
> >
> > Enjoy your time off!
> >
> > - Kristi
> > >:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<
> > Kristi Young
> > Deputy Chief Divi ion of Con ervation and Cla ification
> > U.S. Fish and Wildlife Service
> > Southeast Region
> > (919) 856-4520 x30
> > Kri ti Young@FWS gov
> > : : : : : : : : : : : : : :
> >
> > Forwarded message
> > From: **Hamilton, Byron** byron_hamilton@fws.gov
> > Date: Wed, Jul 3, 2019 at 8:35 AM
> > Subject: Fwd: Dwarf Flowered Heartleaf Proposed Delisting Rule
> > To: Kristi Young kristi_young@fws.gov
> >
> > Kristi,
> >
> > Got a few more comments from Mike. I'm addressing them now.

---------- Forwarded message ---------
From: **Stevens, Michael** <mike.stevens@sol.doi.gov>
Date: Wed, Jul 3, 2019 at 8:18 AM
Subject: Re: Dwarf Flowered Heartleaf Proposed Delisting Rule
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Merritt, Timothy <timothy_merritt@fws.gov>

Thanks--let me know if you want to discuss.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Jun 10, 2019 at 12:05 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

> Thanks. I will get to this as soon as I can. I have numerous packages with deadlines within the next three weeks that will have to come first.
>
> Michael Stevens
> Attorney-Advisor
> Office of the Regional Solicitor
> Southeast Region

404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Jun 10, 2019 at 11:52 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Good afternoon

I've attached the dwarf-flowered heartleaf rule with your comments addressed. Portions of the previous versions of the rule contains outdated information. The new version of the rule includes the info from the updated version of the SSA. Please see attachments for the rule and SSA. Thanks.

On Wed, Apr 17, 2019 at 3:35 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP

(b)(5) DPP & ACP

Please let me know if you want to discuss.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Tue, Apr 2, 2019 at 7:37 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Good morning Mike,

Please see attachment for the proposed delisting rule for dwarf-flowered heartleaf. If you have any further comments, please let me know. Thanks.

On Tue, Nov 13, 2018 at 9:29 AM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP

(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP Please let me know if you have any questions.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Oct 29, 2018 at 4:47 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Mike,
> See attached. You can take your full time if needed on this one. Thanks.
> Tim
>
> --
>
> _____
> Timothy Merritt
> Chief, Division of Conservation and Classification
> U.S. Fish and Wildlife Service
> 1875 Century Blvd., NE, Suite 200
> Atlanta, GA 30345
> 404-679-7082 office
> 615-574-8812 cell
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--

Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

Dwarf flowered heartleaf proposed delisting rule

Stevens, Michael P <Mike.Stevens@sol.doi.gov>

Tue 7/16/2019 10:31 AM

To: Miranda, Leopoldo <Leopoldo_Miranda@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>; Merritt, Timothy <timothy_merritt@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>; Arnold, Jack <jack_arnold@fws.gov>; Young, Kristi <kristi_young@fws.gov>
Cc: Speights, Helen H <helen.speights@sol.doi.gov>; Jesup, Benjamin C <BENJAMIN.JESUP@sol.doi.gov>; Romanik, Peg A <PEG.ROMANIK@sol.doi.gov>; Goessling, Shannon L <shannon.goessling@sol.doi.gov>

The Regional Solicitor has signed the review memorandum and surnamed the rule. The signature and surname pages, along with a TrackChanges version of the rule showing revisions recommended by the Solicitor's Office, are attached.

Please let me know if you have any questions.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

United States Department of the Interior
OFFICE OF THE SOLICITOR
Southeast Regional Office
Richard B. Russell Federal Building
75 Ted Turner Drive, S.W., Room 304
Atlanta, Georgia 30303

FWS.SE.0442.MPS

July 16, 2019

BY E-MAIL

TO: Leopoldo Miranda, Regional Director

FROM: Shannon Goessling, Regional Solicitor SHANNON GOESSLING Digitally signed by SHANNON GOESSLING Date: 2019.07.16 10:19:39 -04'00'

SUBJECT: Review of Federal Register listing document: proposed rule to delist dwarf-flowered heartleaf

You have asked us to review the referenced rule, which was prepared pursuant to Section 4(a)(1) of the Endangered Species Act. Based on our review, we are surnaming the rule (surname pages enclosed).

If you have any questions, please contact Michael Stevens at (404) 331-5617.

cc: Kristi Young, Ecological Services
Nicole Rankin, Ecological Services
Timothy Merritt, Ecological Services
Jack Arnold, Ecological Services

Enclosures

[ATTORNEY-CLIENT PRIVILEGED COMMUNICATION]
SUMMARY RESULTS OF LEGAL REVIEW OF
DRAFT SECTION 4 (ESA) DOCUMENTS

DESCRIPTION OF DRAFT DOCUMENT: Proposed rule to delist dwarf-flowered heartleaf

REVIEWING OFFICE: Regional Solicitor, Southeast Region

DATE OF RECEIPT: June 10, 2019

RESULTS OF LEGAL REVIEW:

This summary is issued by:

SHANNON GOESSLING Digitally signed by SHANNON GOESSLING Date: 2019.07.16 10:20:16 -04'00'

Date: July 16, 2019

Regional Solicitor

Note: Any Solicitor's Office "surname" attaches only to the draft that was submitted for review, unless subsequent amendments are specifically referred for follow-up review.

SHANNON GOESSLING
Digitally signed by SHANNON GOESSLING
Date: 2019.07.16 10:20:59 -04'00'

The Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2018-XXXX; FXES11130900000-189-FF0932000]

RIN

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; availability of draft post-delisting monitoring plan.

SUMMARY: We, the U.S. Fish & Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicates that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened or endangered species under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan. If this proposal is finalized, *Hexastylis naniflora* will be removed from the List.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

The Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2018-XXXX; FXES11130900000-189-FF0932000]

RIN

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; availability of draft post-delisting monitoring plan.

SUMMARY: We, the U.S. Fish & Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicates that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened or endangered species under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan. If this proposal is finalized, *Hexastylis naniflora* will be removed from the List.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for public hearings, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES**:** You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2018–XXXX, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rules link to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2018–XXXX; U.S. Fish and Wildlife Service, MS: BPHC, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see *Public Comments*, below, for more information).

Document availability: The proposed rule, draft PDM plan and supporting documents (including the Species Status Assessment (SSA), references cited, five year review) are available at *http://www.regulations.gov* under Docket No. FWS-R4-ES-2018-XXXX.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC

28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. This action proposes to remove the dwarf-flowered heartleaf from the List of Endangered and Threatened Plants in title 50 of the Code of Federal Regulations (50 CFR 17.11(h)). Removing a species from the List ("delisting") can only be completed by issuing a rule.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The determination to delist a species must be based on an analysis of the same factors. In addition, the Act's implementing regulations at 50 CFR 424.11 provide that we may delist a species only if the best scientific and commercial data indicate the species is neither a threatened nor an endangered species for one or more of the following reasons: (1) The species is extinct; (2) the species has recovered and is no longer threatened or endangered; or (3) the original data used at the time the species was classified were in error. We have determined that the dwarf-flowered heartleaf should be proposed for delisting under the Act because, based on an analysis of the five listing factors, it no longer meets the definition of an endangered or threatened species, and that it has recovered.

Deleted: d

(b)(5) DPP & ACP

Peer review:

In accordance with our joint policy on peer review published in the **Federal Register** July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we have sought the expert opinions of seven appropriate specialists regarding the Species Status Assessment Report (SSA), which informed this proposed rule. The purpose of peer review is to ensure our determination is based on scientifically sound data, assumptions, and analyses.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from the public, other concerned governmental agencies (including but not limited to State and Federal agencies and city or county governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information received during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

(1) Information concerning the biology and ecology of the *Hexastylis naniflora* ;

(2) Relevant data concerning any threats (or lack thereof) to the *Hexastylis naniflora* particularly any data on the possible effects of climate change as it relates to habitat, the extent of State protection and management that would be provided to this plant as a delisted species;

(3) Current or planned activities within the geographic range of the *Hexastylis naniflora* that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment – including your personal identifying information – on *http://www.regulations.gov*. You may request, at the top of your document, that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee we will be able to do so.

Comments and materials we receive, as well as supporting documentation used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Service Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is a threatened or endangered species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the **Federal Register**. Such requests must be sent to the address shown in the **FOR FURTHER INFORMATION CONTACT** section. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings,

as well as how to obtain reasonable accommodations, in the **Federal Register** at least 15 days before the hearing.

Previous Federal Actions

On April 14, 1989, we published a final rule in the *Federal* Register (FR 54 14964) listing the *Hexastylis naniflora* as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing. A recovery plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf SSA to aid in determining the appropriateness of reclassifying the species.

Background

Hexastylis naniflora is a species of plant endemic to the Upper Piedmont region of western North Carolina and upstate South Carolina. It is a rare, low-growing herbaceous plant in the birthwort family (Aristolochiaceae). Although *Hexastylis naniflora* is restricted in range, it is not as rare as once thought (Service 2010, p. 15; NCNHP 2016, p. 4). When *Hexastylis naniflora* was federally listed in 1989, the listing rule described 24 extant populations (and one extirpated population) distributed across eight counties in the Upper Piedmont of North and South Carolina.. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two states. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Hexastylis naniflora appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This

unique combination of factors limits not only the range of *Hexastylis naniflora* , but also the size of any population.

Hexastylis naniflora occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186-196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, p. 114; Weakley 2015, p. 129; Service 2015, entire), or in moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). Wagner (2013, pp. 30-32) conducted a habitat suitability study to quantify the habitat requirements for *Hexastylis naniflora* , which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants. The unit of measurement for population size in this species is a "clump" (rosette).

(b)(5) DPP & ACP

A thorough review of the taxonomy, life history, ecology, and overall viability of the *Hexastylis naniflora* is presented in the SSA (Service 2018, entire; available at https://www fws.gov/southeast/ and at http://www regulations.gov under Docket No. FWS-R4-ES-xxxx-xxxx).

Summary of Biological Status and Threats

The Act directs us to determine whether any species is endangered or threatened by factors affecting its continued existence. The SSA documents the results of our comprehensive biological status review for the *Hexastylis naniflora* , including an assessment of the potential stressors to the species. The SSA does not represent a decision by the Service on whether the species should be proposed for delisting as an endangered or threatened species under the Act. It

does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA; the full SSA can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.*gov under Docket No. FWS-R4-ES-201X-XXXX.

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the the conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate individual life-history needs. In the next stage, we assessed the historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We utilized this information to inform our decision in this proposed rule.

Current Condition

Resiliency

For *Hexastylis naniflora* to maintain viability, its populations, or some portion thereof, must be resilient. Resiliency is assessed at the level of populations and reflects a species' ability to withstand stochastic events (events arising from random factors). Resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates and fecundity (demographic stochasticity), variations in rainfall (environmental stochasticity), and

the effects of anthropogenic activities. Stochastic factors that have the potential to affect the *Hexastylis naniflora* include habitat impacts, particularly human development pressures, but also climate change, and exotic, invasive species. Factors influencing the resiliency of *Hexastylis naniflora* populations include population size, available habitat, and elements of *Hexastylis naniflora* ecology that determine whether populations can maximize habitat occupancy.

The Natural Heritage Program (NHP) collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member NHPs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2004, n.p.). Since the Service does not maintain its own database of known locations of *Hexastylis naniflora* , it regards the NHP databases as the best repository for this information (Service 2010, p.41). Based on recent reports using the methods described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple sub-EOs and stand-alone EO records. For the purpose of assessing resiliency, only the 78 populations observed since 2005 were assessed due to the high confidence in their persistence.

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The

primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Of the 78 populations assessed, 28 had very high resiliency, five had high, 26 had moderate, while 19 had low resiliency.

Deleted: resilience

Redundancy

Redundancy is also assessed at the species level and reflects a species' ability to withstand catastrophic events (such as a rare destructive natural event or episode involving many populations) by spreading the risk of such an event across multiple, resilient populations. We

measured redundancy for the *Hexastylis naniflora* by the number and distribution of resilient populations across the range of the species. It is important to note that *Hexastylis naniflora* has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area.. Redundancy for *Hexastylis naniflora* is the total number and resiliency of population segments and their distribution across the species range.

We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with devastating effects; however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of *Hexastylis naniflora* ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010, pp. 7-10). There are 119 populations of *Hexastylis naniflora* , spread across 13 counties. This is an increase from 24 populations across eight states at the time of listing. There appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press disturbances.

Representation

We lack genetic and ecological diversity data to characterize representation for *Hexastylis naniflora* . In the absence of species-specific genetic and ecological diversity

information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. Instead, we used the EO Data Standard, which provides a Default Separation Distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several *Hexastylis naniflora* populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Summary of Threats and Conservation Measures that Affect the Species

Section 4(a)(1) of the Act directs us to determine whether any species is an endangered species or a threatened species because of any factors affecting its continued existence due to one or more of the five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable

future. In the SSA (Service 2018, entire) we discuss the threats affecting the *Hexastylis naniflora* .

The NC Natural Heritage Program assessed threats in populations they monitored from 2012-2016 (Robinson and Padgett 2016, pp. 7-8, 17-20). Threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank (A-G) for each threat factor determined an overall value for each threat observed at each population. Threats observed during these years included development, incompatible forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and road construction. Despite threats observed in many of the populations surveyed, several of the populations appear to be stable during the five-year survey and no significant changes in threats within populations were noted between 2012 and 2016.

Development

Hexastylis naniflora populations occur in rapidly-growing urban areas within expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

The most recent 5 year review for the species identified the most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving *Hexastylis naniflora* , *a*s road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations. Collectively, these projects have adversely impacted or were expected to impact approximately 22,135 rosettes. In most cases, the Section 7 process resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection. Significant portions of other populations have been purchased by the NC Department of Transportation (NCDOT) as off-site conservation measures in association with these consultations. Other forms of economic development have also resulted in the destruction or modification of habitats occupied by the *Hexastylis naniflora* ; in many cases, these activities have also required Section 7 consultations with the Service. Examples include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities at a regional airport. Collectively, these activities involved the loss or relocation of several thousand rosettes.

The North Carolina Plant Protection and Conservation Act, N.C. Gen. Stat. § 106-202.12 et seq., lists native plants as threatened, endangered, or species of concern, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. In South Carolina, plants are protected only from disturbance where they occur on those properties owned by the State and specifically managed as South Carolina Heritage Preserves (SC State Code of Regulations Part 123 § 200-204).

The overwhelming majority of *Hexastylis naniflora* populations have been discovered as a direct result of surveys conducted to ensure compliance with the Endangered Species Act. Even more significantly, the majority of sites that have the potential to afford long-term protection to the species have been protected as a direct result of the provisions of Section 7 of the ESA, which directs consulting agencies to minimize adverse effects to federally listed species through conservation measures pledged as a part of the project description.

Invasive, Exotic Species

Deleted: *Invasice*

Formatted: Font: Not Bold

Invasive exotic plant species occur across the range of this species. Plants such as English ivy, Chinese privet, Japanese honeysuckle and Japanese stiltgrass are known at several sites which contain *Hexastylis naniflora*, (Service 2011, p. 15). Invasive, exotic species were identified as a threat at eight of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17-19). The eight populations include four stand-alone EOs and four parent EOs with 19 sub-EOs. Of the four stand-alone EOs, one has an invasive threat rank of B (moderate to severe, imminent threat for a significant portion (20-60%) of the population, occurrences, or area), two have a rank of F (low severity threat for most or significant proportion of population, occurrences, or area), and one has a rank of G (low severity threat for a small proportion of population, occurrences, or area). Of the 19 sub-EOs, nine have invasive, exotic species identified as a threat. Of the nine sub-EOs, one has an invasive threat rank of A (moderate to severe, imminent threat for most (>60%) of population, occurrences, or area), four have a rank of B (moderate to severe, imminent threat for a significant portion (20-60%) of the population, occurrences, or area), two have a rank of E (moderate to severe threat for small proportion of population, occurrences, or area), and two have a rank of G (low severity threat for a small proportion of population, occurrences, or area). The one stand-alone and five sub-EOs

Deleted: I

Deleted: dwarf-flowered heartleaf

with the highest threat ranks (A and B) are located in three populations. Based on the most recent monitoring data, one is increasing, one is stable, and one is decreasing (Robinson and Padgett 2016, p.11).

Invasive exotic species were identified as a threat at all (three) South Carolina populations monitored by NCNHP and all sites had an invasive threat rank of F (low severity threat for most or significant proportion of population, occurrences, or area) (Robinson and Padgett 2016, pp. 20). Based on the most recent monitoring data, all populations are stable (Robinson and Padgett 2016, p.11).

In short, the data indicate that *Hexastylis naniflora* populations can persist and increase in the presence of exotic invasive species. Despite the long-term presence of invasive, exotic plants, from 2012 to 2016 there were no changes in the severity of threats observed in the field from these species significant enough to elevate the threat ranks of populations evaluated (NCNHP 2016, p. 8).

(b)(5) DPP & ACP

Climate Change

Formatted: Font: Not Bold

There is concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Because typical habitats for this species include moist soils adjacent to creeks, streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams, specific effects of climate change to the *Hexastylis naniflora* are likely related to changes in soil moisture associated with potential increases in drought. Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.) which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly,

leading to increased flooding events (IPCC 2013, p.7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p.7). Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats.. In recent years, the southeast has experienced moderate to severe droughts, which many observers have implicated in population declines and poor transplant survivorship (NC NHP, 2010; and references throughout this review). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). Although climate change is likely to affect terrestrial habitats in the Southeast, there is uncertainty about the specific effects of climate change on *Hexastylis naniflora* . Currently, we have no evidence that climate change effects observed to date have had any adverse impact on the species or its habitats; however, *Hexastylis naniflora* is found in 13 counties, up from eight at listing, and is up to 119 known populations, up from 24 at listing.

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Future Condition

Our analysis of the past, current, and future influences on what the *Hexastylis naniflora* needs for long term viability revealed that there are several influences that may pose risks to future viability of the species. These risks are primarily related to invasive species, climate change, and habitat changes from development.

Invasive, Exotic Species

As discussed above, invasive, exotic plants were identified as a threat at the time of listing; however, the threat may not be as significant as once thought. The NCNHP monitored 13 populations of *Hexastylis naniflora* and assessed threats at each population. Their results show that, of monitored sites, only 9% of populations (one of 11) where invasive, exotic species are present are also in decline, indicating the species has at least some capacity to withstand the presence of invasive, exotic species. The number of populations has increased dramatically since listing; the invasive, exotic plant threat posed at many of the largest populations is low (NCNHP, pp. 8, 17-20); and the number of populations under conservation ownership with management has increased.

Therefore, we do not believe that competition from invasive, exotic species will be a significant threat r in the foreseeable future (2040).

Climate Change

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time,

Formatted: Font: Not Bold

Deleted: I

Deleted: impactful

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: This data

Deleted: s

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

Deleted: is

(b)(5) DPP & ACP

Deleted: to the species now o

Deleted: ¶

depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

According to IPCC, ‘‘most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change on most landscapes’’ (IPCC 2014, p. 13). Plant species with restricted ranges may experience population declines as a result of the effects of climate change. The concept of changing climate can be meaningfully assessed both by looking into the future and reviewing past changes.

As part of the current, worldwide collaboration in climate modelling under the IPCC, climate assessments of the full dataset of 30 climate models for historical and 21st century comparisons provide predictions at scales ranging from global to county level in the U.S. (USGS National Climate Change Viewer (NCCV) 2019; https://www2.usgs.gov/landresources/lcs/nccv.asp). This global climate information has been recently downscaled by NASA to scales relevant to our region of interest, and projected into the future under two different scenarios of possible emissions of greenhouse gases (Alder and Hostetler 2017, p. 3). Using the NCCV and assuming the more extreme Representative Concentration Pathways (RCP) greenhouse gas emission scenario (RCP 8.5), in which greenhouse gas emissions continue to rise unchecked through the end of the century leading to an equivalent radiative forcing of 8.5 Watts m^2, we calculated projected annual mean changes comparing 1981-2010 to 2025-2049 for maximum temperature (+2.9-3.1°F in NC and +2.9 °F in SC), precipitation (+0.02 inches per month for NC and SC), soil storage (-0.1 inch for NC and SC), and evaporative deficit (no change for NC or SC) in all counties where *Hexastylis naniflora*

occurs (Adler and Hostetler 2017, entire). Based on these results, all 13 counties within the range of *Hexastylis naniflora* will be subjected to higher temperatures (annual mean increase of 2.9 °F) and slightly higher precipitation (annual mean increase of 0.2 inches per month) relative to the period of 1981-2010. Because the average annual increase in precipitation is predicted to be only slight, the loss in soil storage is likely primarily the result of higher predicted temperatures. While the predictions of a changing climate could negatively impact *Hexastylis naniflora*, the species possesses other biological traits to provide resiliency to this threat. *Hexastylis naniflora* is a long-lived perennial species. Several populations have been revisited after decades and the species was still present. For example, one population (WHERE?) was first observed in 1957 and was next observed in 2001 (NCNHP 2018, n.p.). In their analyses of life-history traits in relation to potential vulnerability to variability in demographic vital rates caused by increased variability in climatic patterns, Morris et al. (2008, p. 22) and Dalgleish et al. (2010, p. 216) concluded that longer-lived species should be less influenced by climate-driven increases in demographic variability.

Deleted: ly higher

Deleted: resilience

Deleted: such

Within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal by ants) (Lengyel et al. 2010, p. 49). This supports Gaddy's work (1986, entire), which found three species of *Hexastylis,* including *Hexastylis naniflora,* employ myrmecochory as a method for seed dispersal. While species with ant dispersed seeds have been shown to have slower migration rates than species with seeds that are adhesive or ingested (Brunet and Von Oheimb 1998, p. 429), the multiple benefits myrmecochory provides for plants is evidence for the adaptive advantages of this strategy. Ants can disperse seeds to sites that might be nutrient-enhanced or where plant fitness will be higher. Additionally, ants are

known to bury seeds and some studies show burying seeds may protect them from fire and drought (Boyd 2001, p. 235) - two conditions exacerbated by climate change.

Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl et al. 2009, p. 111). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations of *Hexastylis naniflora* in 2009 (Golder and Associates 2009). However, anecdotal observation suggests that the species was not appreciably harmed by this fire (Service 2011, p.14). Additionally, the National Park Service (NPS) uses prescribed fire as a vegetation management tool at Cowpens National Battlefield. The scope of NPS's prescribed burning activity includes the majority of the *Hexastylis naniflora* population on site. Monitoring data suggest that burning has had no adverse effects upon growth or flowering (Walker et al. 2009, p. 14).

Deleted: A

Deleted: s

Formatted: Indent: First line: 0.5

Populations are located within various ecological settings within the species' range. *Hexastylis naniflora* occurs on piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186-196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, p. 114; Weakley 2015, p. 129), or moist soils adjacent to creeks, streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats demonstrating the species' ability to adapt to different environmental conditions that could be brought on by climate change.

Although climate change is almost certain to affect *Hexastylis naniflora* habitats in North and South Carolina (USGS NCCV 2019; https://www2.usgs.gov/landresources/lcs/nccv.asp), there is uncertainty about the specific effects of climate change on the plant. As discussed

Deleted: Currently,

above, we have no direct evidence that climate change has had any adverse impact on *Hexastylis naniflora* or its habitat, and we are uncertain of how projected changes in temperature, precipitation, and soil moisture will influence the species in the future. However, based on the biological traits discussed above, we do not believe that climate change is a threat to the plant now or within the foreseeable future (2040; see below).

Development

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. We have identified 2040 as our foreseeable future based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape (see SSA for further explanation). Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040, a time period for which

Deleted: effects

Deleted: observed to date have

Deleted: future

Formatted: Font: Not Bold

the models would provide reliable data. SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995, entire). The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations
- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There are no data available on the exact relationships between urbanization and the impacts to *Hexastylis naniflora* . We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative

impacts; development increase of at least 50% was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. This is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider under Current Conditions include detections that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years and the species was present. For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where *Hexastylis naniflora* is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where *Hexastylis naniflora* is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-

current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resiliency of that population.

Once these older EOs were identified, we created a 1,000 meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000 meterbuffer. The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000 meterbuffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000 meterbuffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where *Hexastylis naniflora* is likely to persist.

Deleted:

Status Quo Scenario

Under the status quo scenario, we assume a few populations (75) will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that

are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no negative impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold

High Development Scenario

Under the high development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

- No additional populations are identified as persisting
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:

- Protected areas
    - Protected in perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Voluntary protection/non-perpetuity— population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold
- Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold; extirpation of populations if % increase in urbanization exceeds >90% threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we assume it is likely several additional populations (i.e. more than status quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resiliency under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no impacts from urbanization

        - Voluntary protection/non-perpetuity—population drops 1 resiliency rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resiliency rank if % increase in urbanization exceeds >25% threshold; population drops 2 resiliency ranks if % increase in urbanization exceeds >50% threshold

Future Resiliency

Status Quo Scenario

In the Status Quo scenario, there are predicted to be 75 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and two additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

High Development Scenario

In the High Development scenario, there are predicted to be 72 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition a few

populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate; two moderate populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the Targeted Conservation scenario, there are predicted to be 79 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and six additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few populations is offset in the Status Quo and Targeted Conservation scenarios by the persistence of several additional populations. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resiliency in several additional populations. However, in all three

scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press catastrophic disturbances; however the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events over the next 20-30 years, such as climate change.

Based on the assumption that *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. Here are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Table 1 Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	Current	Status Quo	High Development	Targeted Conservation
Very High	28	27	27	27
High	5	6	4	6
Moderate	26	23	25	23
Low	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total	**78**	**75**	**72**	**79**

Determination

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the *Hexastylis naniflora*. Currently, there are a total of 119 known populations in 13 counties, 78 of which have been documented since 2005. This is a significant increase from 24 known populations in eight counties at the time of listing. Of the 78 populations, 75 percent are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend.

When the *Hexastylis naniflora* was placed on the threatened and endangered species list, the two prominent threats identified were invasive, exotic plants and habitat loss or destruction. As discussed above, invasive, exotic species are not as significant a threat to *Hexastylis naniflora* as originally thought. Only one of the 11 monitored populations where invasive, exotic species occur was identified is declining. Additionally, analysis in the SSA indicates *Hexastylis naniflora* has the capacity to withstand habitat loss and destruction due to development. The species currently has significant redundancy (119 populations), resilient populations (33 of 78 evaluated populations with high or very high viability), and representation in two different ecological settings. Even under our High Development scenario, only two high or very high viability populations are lost to a lower viability rank. Therefore, we do not believe that competition from invasive, exotic species or habitat loss and destruction are significant threats to the species. Additionally, since listing, there has been a nearly four-fold increase in the number of known populations and several populations have entered into conservation ownership by organizations with management staff (e.g. Broad River Greenway) or commitments of management (e.g. N.C. Department of Transportation). We conclude that the species is currently not in danger of extinction throughout its range.

Deleted: dwarf-flowered heartleaf

Deleted: now or in the foreseeable future (2040)

In order to more closely examine the future threat posed by habitat loss or destruction, the Service analyzed three different development scenarios into the future until 2040. Under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (5-6) of currently low resilient populations are projected to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Approximately 31 percent of the 78 currently known populations are permanently protected, and another 23 or so percent are somewhat protected (voluntary agreements or provided some level of protection), reducing the likelihood of development impacting those populations. Recent examination of the species also identified climate change and invasive species as potential future threats. The broadened range (eight counties to thirteen) and significantly increased population numbers (24 to 119) since initial listing indicate the species benefits from sufficient redundancy and resiliency to withstand perturbations from climate change as well as from invasive species. Based on this analysis, we conclude that the species is not likely to become in danger of extinction in the foreseeable future.

(b)(5) DPP & ACP

Deleted: a potential

Deleted: ¶

Determination of Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range (SPR). Where the best available information allows the Services to determine a status for the species rangewide, that determination should be given conclusive weight because a rangewide determination of status more accurately reflects the species' degree of imperilment and better promotes the purposes of the Act. Under this reading, we should first

consider whether the species warrants listing "throughout all" of its range and proceed to conduct a "significant portion of its range" analysis if, and only if, a species does not qualify for listing as either an endangered or a threatened species according to the "throughout all" language.

Having determined that the *Hexastylis naniflora* is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in an SPR. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do the "screening" analysis, we ask whether there are portions of the species' range for which there is substantial information indicating that: (1) the portion may be significant; and, (2) the species may be, in that portion, either in danger of extinction or likely to become so in the foreseeable future. For a particular portion, if we cannot answer both questions in the affirmative, then that portion does not warrant further consideration and the species does not warrant listing because of its status in that portion of its range. We emphasize that answering these questions in the affirmative is not a determination that the species is in danger of extinction or likely to become so in the foreseeable future throughout a significant portion of its range—rather, it is a step in determining whether a more detailed analysis of the issue is required.

If we answer these questions in the affirmative, we then conduct a more thorough analysis to determine whether the portion does indeed meet both of the SPR prongs: (1) the portion is significant and (2) the species is, in that portion, either in danger of extinction or likely to become so in the foreseeable future. Confirmation that a portion does indeed meet one of these prongs does not create a presumption, prejudgment, or other determination as to whether

the species is an endangered species or threatened species. Rather, we must then undertake a more detailed analysis of the other prong to make that determination. Only if the portion does indeed meet both SPR prongs would the species warrant listing because of its status in a significant portion of its range.

At both stages in this process—the stage of screening potential portions to identify any portions that warrant further consideration and the stage of undertaking the more detailed analysis of any portions that do warrant further consideration—it might be more efficient for us to address the "significance" question or the "status" question first. Our selection of which question to address first for a particular portion depends on the biology of the species, its range, and the threats it faces. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range.

For *Hexastylis naniflora*, we first chose to evaluate the status question (i.e., identifying portions where the *Hexastylis naniflora* may be in danger of extinction or likely to become so in the foreseeable future). To conduct this screening, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. If a species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range and the threats to the species are essentially uniform throughout its range, then the species would not have a greater level of imperilment in any portion of its range than it does throughout all of its range and therefore no portions would qualify as an SPR.

Deleted:

Deleted: first

Analysis

Formatted: Indent: First line: 0

Applying the process described above, we first determine if any portion of the range of *Hexastylis naniflora* warrants further consideration. As discussed above, a portion of a species'

Formatted: Font: Italic

range is significant if it is part of the current range of the species and is important to the conservation of the species because it contributes meaningfully to the representation, resiliency or redundancy of the species. The contribution must be at a level such that its loss would result in a decrease in the ability to conserve the species. While there is some variability in the habitats occupied by *Hexastylis naniflora* across its range, the basic ecological components required for the species to complete its life cycle are present throughout the habitats occupied by the 119 populations of the species. No specific location within the current range of the species provides a unique or biologically significant function that is not found in other portions of the range, and no specific locations are likely to be of greater biological or conservation importance than any other locations.

We next examined whether any threats are geographically concentrated in some way that could indicate the species could be in danger of extinction, or likely to become so, in a specific area. The NCNHP monitored 13 populations of *Hexastylis naniflora* throughout the species range. Eleven of the 13 populations had invasive, exotic species identified as a threat, indicating that invasive, exotic species are found throughout the range and not concentrated in any specific location. Climate change effects, as discussed previously, are very uniform throughout the range. The opportunity for habitat loss and destruction due to development is higher on privately owned lands that could be sold for future development. Of the 78 populations evaluated, we determined that 31 percent are permanently protected and another approximately 23 percent are partially protected (i.e. voluntary landowner agreements). The unprotected populations are spread throughout the species' range and not geographically "clumped" together.

Since we found no portions of the species' range where threats are significantly concentrated or substantially greater than in other portions of its range, we did not identify any

Formatted: Font: Italic

(b)(5) DPP & ACP

Formatted: Font: Italic

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

portions where the species may be in danger of extinction or likely to become so in the foreseeable future. Therefore, no portions warrant further consideration through a more detailed analysis.

Our review of the best available scientific and commercial information indicates that the *Hexastylis naniflora* is not in danger of extinction or likely to become so in the foreseeable future in any significant portion of its range. Our approach to analyzing SPR in this determination is consistent with the court's holding in *Desert Survivors v. Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018).

On the basis of this evaluation, we believe *Hexastylis naniflora* no longer requires the protection of the Act, and we propose to remove *Hexastylis naniflora* throughout its range from the Federal List of Endangered and Threatened Plants (50 CFR 17.12(h)).

Effects of this Proposed Rule

Deleted: ¶

This proposal, if made final, would revise 50 CFR 17.12(h) to remove *Hexastylis naniflora* from the Federal List of Endangered and Threatened Wildlife. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under Section 7 of the Act in the event that activities they authorize, fund, or carry out may affect *Hexastylis naniflora*.

Deleted:

Deleted:

(b)(5) DPP & ACP

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than five years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to

verify that a species delisted remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as a threatened or endangered species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2018-XXXX. Copies can also be obtained from the Service's Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT** section). We seek information, data, and comments from the public regarding *Hexastylis naniflora* and the PDM plan. We are also seeking peer review of this draft plan concurrently with this comment period. We anticipate finalizing this plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Deleted: U S Fish and Wildlife

Deleted: ,

Deleted: the dwarf-flowered heartleaf

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(a) Be logically organized;

(b) Use the active voice to address readers directly;

(c) Use clear language rather than jargon;

(d) Be divided into short sections and sentences; and

(e) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc. Send a copy of any comments on how we can make this rule easier to understand to: Office of Regulatory Affairs, Department of the Interior, room 7229, 1849 C Street NW., Washington, DC 20240. You may also email the comments to this address: Exsec@ios.doi.gov.

National Environmental Policy Act

We have determined that we do not need to prepare an Environmental Assessment or Environmental Impact Statement, as defined in the National Environmental Policy Act (42 USC 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act. We published a notice outlining our reasons for this determination in the Federal Register October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands associated with this proposed regulation.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket Number FWS-R4-ES-2018-XXXX and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

2. Amend § 17.11(h), by removing the entries for "Heartleaf, Dwarf-flowered" under "FLOWERING PLANTS" from the List of Endangered and Threatened Plants.

Deleted: Wildlife

§ 17.11 Endangered and threatened wildlife.

Dated: _____

_____

Margret E. Everson
Principal Deputy Director
U.S. Fish and Wildlife Service,
Exercising the Authority of the Director,
U.S. Fish and Wildlife Service.

Deleted: f

~~**Endangered and Threatened Wildlife and Plants; Removal of the Nashville Crayfish from the Federal List of Endangered and Threatened Wildlife**~~

Fwd: Dwarf flowered heartleaf info for HQ

Merritt, Timothy <timothy_merritt@fws.gov>
Wed 7/31/2019 2:33 PM

To: Morgan, Don <don_morgan@fws.gov>
Cc: Fahey, Bridget <bridget_fahey@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>; Young, Kristi <kristi_young@fws.gov>

Dwarf-flowered heartleaf for your reading pleasure.
Tim

---------- Forwarded message ---------
From: **Hamilton, Byron** <byron_hamilton@fws.gov>
Date: Wed, Jul 31, 2019 at 2:25 PM
Subject: Dwarf-flowered heartleaf info for HQ
To: Timothy Merritt <timothy_merritt@fws.gov>

Tim,

See attachments.

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
_____
Timothy Merritt
Chief, Division of Conservation and Classification
U S Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
615 574 8812 cell

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2019–0081; FXES11130900000-189-FF0932000]

RIN 1018-BD95

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; availability of draft post-delisting monitoring plan.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicate that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened species, and does not meet the definition of an endangered species, under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: *Written comments:* You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2019–0081, which is the docket number for this rulemaking. Then, click on the Search button. On the resulting page, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rule box to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2019–0081, U.S. Fish and Wildlife Service, MS: JAO/1N, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see **Information Requested**, below, for more information).

Document availability: The proposed rule, draft PDM plan, and supporting documents (including the species status assessment (SSA) report, references cited, and 5-year review) are available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and

Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC 28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from other concerned governmental agencies (including, but not limited to, State and Federal agencies and city or county governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information we receive during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

(1) Information concerning the biology and ecology of *Hexastylis naniflora*;

(2) Relevant data concerning any threats (or lack thereof) to *Hexastylis naniflora*, particularly any data on the possible effects of climate change as it relates to habitat, as well as the extent of State protection and management that would be provided to this plant as a delisted species;

(3) Current or planned activities within the geographic range of *Hexastylis naniflora* that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All

comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment—including your personal identifying information—on *http://www.regulations.gov*. You may request, at the top of your document, that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee we will be able to do so.

Comments and materials we receive, as well as supporting documentation used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act (16 U.S.C. 1531 et seq.) directs that determinations as to whether any species is an endangered or threatened species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for a public hearing on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the *Federal Register* (see **DATES**, above). Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the *Federal Register* at least 15 days before the hearing.

Peer Review

In accordance with our joint policy on peer review published in the *Federal Register* on July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we have sought the expert opinions of seven appropriate specialists regarding the species status assessment (SSA) report, which informed this proposed rule. The purpose of peer review is to ensure our determination is based on scientifically sound data, assumptions, and analyses.

Previous Federal Actions

On April 14, 1989, we published a final rule in the *Federal Register* (54 FR 14964) listing *Hexastylis naniflora* as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting, and cattle grazing. A recovery plan for the species was never completed. However, over the last 30 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf species status assessment (SSA) to aid in determining the appropriateness of reclassifying the species.

Background

Hexastylis naniflora is a species of plant endemic to the Upper Piedmont region of western North Carolina and upstate South Carolina. It is a rare, low-growing herbaceous plant in the birthwort family (Aristolochiaceae). Although *Hexastylis naniflora* is restricted in range, it is not as rare as once thought (Service 2010, p. 15; NCNHP 2016, p. 4). When *Hexastylis naniflora* was federally listed in 1989, the listing rule described 24 extant populations (and one extirpated population) distributed across eight counties in the Upper Piedmont of North and South Carolina. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two States. In North Carolina, it is found in Alexander, Burke, Caldwell,

Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Hexastylis naniflora appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of *Hexastylis naniflora*, but also the size of any population.

Hexastylis naniflora occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, p. 114; Weakley 2015, p. 129; Service 2015, entire), or in moist soils adjacent to creeks or streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). Wagner (2013, pp. 30–32) conducted a habitat suitability study to quantify the habitat requirements for *Hexastylis naniflora*, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species' habitat preferences), finding new populations, or identifying suitable sites for transplants. The unit of measurement for population size in this species is a "clump" (rosette).

A thorough review of the taxonomy, life history, ecology, and overall viability of the *Hexastylis naniflora* is presented in the SSA report (Service 2018, entire; available at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081).

Summary of Biological Status and Threats

Section 4(a)(1) of the Act directs us to determine whether any species is an endangered or a threatened species because of any of the following factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The SSA report documents the results of our comprehensive biological status review for *Hexastylis naniflora*, including an assessment of the potential stressors to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for removal from the List of Endangered and Threatened Plants (i.e., "delisting"). It does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate the species' individual life-history needs. In the next stage, we assessed the historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize the

species' viability (i.e., its ability to sustain populations in the wild over time). We utilized this information to inform this proposed rule.

Current Condition

Resiliency

For *Hexastylis naniflora* to maintain viability, its populations, or some portion thereof, must be resilient. Resiliency is assessed at the level of populations and reflects a species' ability to withstand stochastic events (events arising from random factors). Resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates and fecundity (demographic stochasticity), variations in rainfall (environmental stochasticity), and the effects of anthropogenic activities. Stochastic factors that have the potential to affect *Hexastylis naniflora* include habitat impacts, particularly human development pressures, but also climate change, and exotic, invasive species. Factors influencing the resiliency of *Hexastylis naniflora* populations include population size, available habitat, and elements of *Hexastylis naniflora* ecology that determine whether populations can maximize habitat occupancy.

The Natural Heritage Program (NHP) collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member NHPs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2004, n.p.). Since the Service does not maintain its own database of known locations of *Hexastylis naniflora*, it regards the NHP databases as the best repository for this

information (Service 2010, p. 41). Based on recent reports using the data sources described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple sub-EOs and stand-alone EO records. For the purpose of assessing resiliency, only the 78 populations observed since 2005 were assessed due to the high confidence in their persistence.

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

- Very high—populations with more than 1,000 individuals; very high probability of persistence for 20–30 years at or above the current population size.
- High—populations with 500 to 1,000 individuals; moderately high probability of persistence for 20–30 years at or above the current population size.
- Moderate—populations with 100 to 500 individuals; low probability of persistence for 20–30 years at or above the current population size.

- Low—populations with fewer than 100 individuals; low probability of persistence for 20–30 years at or above the current population size, and moderately high probability of extirpation.

Of the 78 populations assessed, 28 have very high resiliency, 5 have high resiliency, 26 have moderate resiliency, and 19 have low resiliency.

Redundancy

Redundancy is also assessed at the species level and reflects a species' ability to withstand catastrophic events (such as a rare destructive natural event or episode involving many populations) by spreading the risk of such an event across multiple, resilient populations. We measured redundancy for *Hexastylis naniflora* by the number and distribution of resilient populations across the range of the species. It is important to note that *Hexastylis naniflora* has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area. Redundancy for *Hexastylis naniflora* is the total number and resiliency of population segments and their distribution across the species' range.

We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with devastating effects; however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of *Hexastylis naniflora* ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way

construction), the primary potential catastrophic disturbances are press disturbances from long-term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010, pp. 7–10). There are 119 populations of *Hexastylis naniflora*, spread across 13 counties. This is an increase from 24 populations across eight counties at the time of listing. There appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press disturbances.

Representation

We lack genetic and ecological diversity data to characterize representation for *Hexastylis naniflora*. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. Instead, we used the EO data standard, which provides a default separation distance of 1 kilometer (km) (0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several *Hexastylis naniflora* populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Summary of Threats and Conservation Measures that Affect the Species

As stated earlier in this document, section 4(a)(1) of the Act directs us to determine whether any species is an endangered species or a threatened species because of any factors

affecting its continued existence due to one or more of the five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future. In the SSA report (Service 2018, entire), we discuss the threats affecting *Hexastylis naniflora*.

The North Carolina (NC) NHP assessed threats in populations they monitored from 2012 through 2016 (Robinson and Padgett 2016, pp. 7–8, 17–20). Threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank (A through G) for each threat factor determined an overall value for each threat observed at each population. Threats observed during these years included development; incompatible forestry practices; agriculture; trampling; invasive, exotic species; sedimentation; erosion; and road construction. In this rule, we only discuss development, climate change and invasive, exotic species. Despite threats observed in many of the populations surveyed, several of the populations appear to be stable during the 5-year survey, and no significant changes in threats within populations were noted between 2012 and 2016.

Development

Hexastylis naniflora populations occur in rapidly growing urban areas within expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, South Carolina (SC), to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

The most recent 5-year review for the species identified the most recurrent source of habitat destruction, and certainly the most common trigger for consultations under section 7 of the Act involving *Hexastylis naniflora*, *a*s road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of section 7 consultations. Collectively, these projects have adversely impacted or were expected to impact approximately 22,135 rosettes. In most cases, the section 7 process resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection. Significant portions of other populations have been purchased by the NC Department of Transportation (NCDOT) as off-site conservation measures in association with these consultations. Other forms of economic development have also resulted in the destruction or modification of habitats occupied by *Hexastylis naniflora*; in many cases, these activities have also required section 7 consultations with the Service. Examples include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities at a regional airport. Collectively, these activities involved the loss or relocation of several thousand rosettes.

The North Carolina Plant Protection and Conservation Act (North Carolina General Statutes, sections 106-202.12 et seq.) lists native plants as threatened, endangered, or species of concern, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. In South Carolina, plants are protected only from disturbance where they occur on those properties owned by the State and specifically managed as South Carolina Heritage Preserves (South Carolina Code of State Regulations, chapter 123, sections 123-200 through 123-204).

The overwhelming majority of *Hexastylis naniflora* populations have been discovered as a direct result of surveys conducted to ensure compliance with the Act. Even more significantly, the majority of sites that have the potential to afford long-term protection to the species have been protected as a direct result of the provisions of section 7 of the Act, which directs consulting agencies to minimize adverse effects to federally listed species through conservation measures pledged as a part of the project description.

Invasive, Exotic Species

Invasive, exotic plant species occur across the range of this species. Plants such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and Japanese stiltgrass (*Microstegium vimineum*)are known at several sites that contain *Hexastylis naniflora* (Service 2011, p. 15). Invasive, exotic species were identified as a threat at 8 of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17–19). The eight populations include four stand-alone EOs and four parent EOs with 19 sub-EOs. Of the four stand-alone EOs, one has an invasive threat rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area),

two have a rank of F (low severity threat for most or a significant proportion of population, occurrences, or area), and one has a rank of G (low severity threat for a small proportion of population, occurrences, or area). Of the 19 sub-EOs, 9 have invasive, exotic species identified as a threat. Of the nine sub-EOs, one has an invasive threat rank of A (moderate to severe, imminent threat for most (more than 60 percent) of population, occurrences, or area), four have a rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area), two have a rank of E (moderate to severe threat for a small proportion of population, occurrences, or area), and two have a rank of G (low severity threat for a small proportion of population, occurrences, or area). The one stand-alone EO and five sub-EOs with the highest threat ranks (A and B) are located in three populations. Based on the most recent monitoring data, one is increasing, one is stable, and one is decreasing (Robinson and Padgett 2016, p. 11).

Invasive, exotic species were identified as a threat at all (three) South Carolina populations monitored by NCNHP, and all sites had an invasive threat rank of F (low severity threat for most or a significant proportion of population, occurrences, or area) (Robinson and Padgett 2016, p. 20). Based on the most recent monitoring data, all populations are stable (Robinson and Padgett 2016, p. 11).

In short, the data indicate that *Hexastylis naniflora* populations can persist and increase in the presence of invasive, exotic species. Despite the long-term presence of invasive, exotic plants, from 2012 to 2016, there were no changes in the severity of threats observed in the field from these species significant enough to elevate the threat ranks of *Hexastylis naniflora* populations evaluated (NCNHP 2016, p. 8).

Climate Change

There is concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Because typical habitats for this species include moist soils adjacent to creeks or streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams, specific effects of climate change to *Hexastylis naniflora* are likely related to changes in soil moisture associated with potential increases in drought. Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.), which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p. 7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages, resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p. 7). Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. In recent years, the Southeast has experienced moderate to severe droughts, which many observers have implicated in population declines and poor transplant survivorship (NCNHP 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County, NC; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, entire). Although climate change is likely to affect terrestrial habitats in the Southeast, there is uncertainty about the specific effects of climate change on *Hexastylis naniflora*. Currently, we have no evidence that climate change

effects observed to date have had any adverse impact on the species or its habitats; however *Hexastylis naniflora* is found in 13 counties, up from 8 at listing, and is known from 119 populations, up from 24 at listing.

Future Condition

Our analysis of the past, current, and future influences on what *Hexastylis naniflora* needs for long-term viability revealed that there are several influences that may pose risks to the future viability of the species. These risks are primarily related to invasive species, climate change, and habitat changes from development. We discuss how we define "foreseeable future" for this species below, under ***Determination.***

Invasive, Exotic Species

As discussed above, invasive, exotic plants were identified as a threat at the time of listing; however, the threat may not be as significant as once thought. The NCNHP monitored 13 populations of *Hexastylis naniflora* and assessed threats at each population. Their results show that, of monitored sites, only 9 percent of populations (one of 11) where invasive, exotic species are present are also in decline, indicating the species has at least some capacity to withstand the presence of invasive, exotic species. The number of populations has increased dramatically since listing; the invasive, exotic plant threat posed at many of the largest populations is low (NCNHP 2016, pp. 8, 17–20); and the number of populations under conservation ownership with management has increased.

Therefore, we do not believe that competition from invasive, exotic species will be a significant threat in the foreseeable future (about 20 years from now: 2040).

Climate Change

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

According to IPCC, "most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change on most landscapes" (IPCC 2014, p. 13). Plant species with restricted ranges may experience population declines as a result of the effects of climate change. The concept of changing climate can be meaningfully assessed both by looking into the future and reviewing past changes.

As part of the current, worldwide collaboration in climate modelling under the IPCC, climate assessments of the full dataset of 30 climate models for historical and 21st century comparisons provide predictions at scales ranging from global to county level in the United States (U.S. Geological Survey (USGS) National Climate Change Viewer (NCCV) 2019;

https://www2.usgs.gov/landresources/lcs/nccv.asp). This global climate information has been recently downscaled by the National Aeronautics and Space Administration to scales relevant to our region of interest, and projected into the future under two different scenarios of possible emissions of greenhouse gases (Alder and Hostetler 2017, p. 3). Using the NCCV and assuming the more extreme "representative concentration pathways" (RCP) greenhouse gas emission scenario (RCP 8.5), in which greenhouse gas emissions continue to rise unchecked through the end of the century leading to an equivalent radiative forcing of 8.5 watts per square meter (m^2), we calculated projected annual mean changes comparing 1981–2010 to 2025–2049 for maximum temperature (+2.9–3.1 degrees Fahrenheit (°F) in NC and +2.9 °F in SC), precipitation (+0.02 inches per month for NC and SC), soil storage (-0.1 inch for NC and SC), and evaporative deficit (no change for NC or SC) in all counties where *Hexastylis naniflora* occurs (Adler and Hostetler 2017, entire). Based on these results, all 13 counties within the range of *Hexastylis naniflora* will be subjected to higher temperatures (annual mean increase of 2.9 °F) and slightly higher precipitation (annual mean increase of 0.2 inches per month) relative to the period of 1981–2010. Because the average annual increase in precipitation is predicted to be only slight, the loss in soil storage is likely primarily the result of higher predicted temperatures. While the predictions of a changing climate could negatively impact *Hexastylis naniflora*, the species possesses other biological traits to provide resiliency to this threat.

Hexastylis naniflora is a long-lived perennial species. Several populations have been revisited after decades and the species was still present. For example, one population in Rutherford County was first observed in 1957, and was next observed in 2001 (NCNHP 2018, n.p.). In their analyses of life-history traits in relation to potential vulnerability to variability in demographic vital rates caused by increased variability in climatic patterns, Morris et al. (2008,

p. 22) and Dalgleish et al. (2010, p. 216) concluded that longer-lived species should be less influenced by climate-driven increases in demographic variability.

Within the family Aristolochiaeae, more than 50 percent of the plant lineage is myrmecochorous (seed dispersal by ants) (Lengyel et al. 2010, p. 49). This supports Gaddy's work (1986, entire), which found three species of *Hexastylis,* including *Hexastylis naniflora,* employ myrmecochory as a method for seed dispersal. While species with ant-dispersed seeds have been shown to have slower migration rates than species with seeds that are adhesive or ingested (Brunet and Von Oheimb 1998, p. 429), the multiple benefits myrmecochory provides for plants is evidence for the adaptive advantages of this strategy. Ants can disperse seeds to sites that might be nutrient-enhanced or where plant fitness will be higher. Additionally, ants are known to bury seeds, and some studies show burying seeds may protect them from fire and drought (Boyd 2001, p. 235), two conditions exacerbated by climate change.

Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, p. 111). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations of *Hexastylis naniflora* in 2009 (Golder and Associates 2009). However, anecdotal observation suggests that the species was not appreciably harmed by this fire (Service 2011, p. 14). Additionally, the National Park Service (NPS) uses prescribed fire as a vegetation management tool at Cowpens National Battlefield. The scope of NPS's prescribed burning activity includes the majority of the *Hexastylis naniflora* population on site. Monitoring data suggest that burning has had no adverse effects upon growth or flowering (Walker et al. 2009, p. 14).

Populations are located within various ecological settings within the species' range. *Hexastylis naniflora* occurs on Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (Padgett 2004, p. 114; Weakley 2015, p. 129), or moist soils adjacent to creeks or streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats, demonstrating the species' ability to adapt to different environmental conditions that could be brought on by climate change.

Although climate change is almost certain to affect *Hexastylis naniflora* habitats in North and South Carolina (USGS NCCV 2019; *https://www2.usgs.gov/landresources/lcs/nccv.asp*), there is uncertainty about the specific effects of climate change on the plant. As discussed above, we have no direct evidence that climate change has had any adverse impact on *Hexastylis naniflora* or its habitat, and we are uncertain of how projected changes in temperature, precipitation, and soil moisture will influence the species in the future. However, based on the biological traits discussed above, we do not believe that climate change is a threat to the plant now or within the foreseeable future (about 20 years from now: 2040).

Development

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status quo, targeted conservation, and high development. We have identified 2040 as our foreseeable future based on the lifespan of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape (see SSA report,

available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081, for further explanation). Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040, a time period for which the models would provide reliable data. SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995, entire). The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0 to 100 percent. We chose 80 percent probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- Percent increase in projected development (SLEUTH probability of urbanization less than 80 percent) within current populations; and

- Percent increase in projected development (SLEUTH probability of urbanization less than 80 percent) within areas delineated as potential habitat by the Maxent habitat model.

There are no data available on the exact relationships between urbanization and the impacts to *Hexastylis naniflora*. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for percent increase in urban development to capture potential deleterious effects: 25 percent and 50 percent. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25 percent of the area of current populations was likely to have some negative impacts; and development increase of at least 50 percent was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios (targeted conservation and status quo). This is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider under **Current Conditions**, above, include detections that have occurred within the last few years. Second, we did not include many older detections (i.e., we only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years, and the species was present. For example, one such EO was first observed in 1957, and next observed in 2001. It seems as long as suitable habitat is still present, it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the

Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where *Hexastylis naniflora* is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e., we define current populations as those observed between 2005 and present day). Although our focus is on older EOs, where *Hexastylis naniflora* is likely to persist into the future, we also included current EOs (2005–current day) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005 to today. If these older EOs within current populations that were not included in our **Current Conditions** discussion, above, are found to be likely to persist, then it is possible we underestimated the resiliency of that population.

Once these older EOs were identified, we created a 1,000-meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20–25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed under **Current Conditions**, above (i.e., low = fewer than 100 individuals; moderate = 100–500 individuals; high = 500–1,000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and percent Maxent classified as 0.8–1.0 score. Average Maxent

score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000-meter buffer. The percent Maxent classified as 0.8–1.0 represents the percentage of all potential habitat within the 1,000-meter buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000-meter buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where *Hexastylis naniflora* is likely to persist.

Status Quo Scenario

Under the status quo scenario, we assume 75 populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—no negative impacts from urbanization; and
        - Voluntary protection/non-perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold.

- Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

High Development Scenario

Under the high development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

- No additional populations are identified as persisting.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
  - Protected areas:
    - Protected in perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold; and
    - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.
  - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold; extirpation of populations if percent increase in urbanization exceeds 90 percent threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we assume it is likely several additional populations (i.e., more than in the status quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as in the status quo scenario. We assessed population resiliency under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—no impacts from urbanization; and
        - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 50 percent threshold.
    - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

Future Resiliency

Status Quo Scenario

In the status quo scenario, there are predicted to be 75 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under

Current Conditions, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

High Development Scenario

In the high development scenario, there are predicted to be 72 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the targeted conservation scenario, there are predicted to be 79 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but

resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few populations is offset in the status quo and targeted conservation scenarios by the persistence of several additional populations. In the high development scenario, there is a predicted loss of six populations, with loss of resiliency in several additional populations. However, in all three scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press catastrophic disturbances; however, the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change, over the next 20 to 30 years.

Based on the assumption that *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (status quo and targeted conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current

populations. Here are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Table of viability summary for *Hexastylis naniflora* under three future scenarios (projected to year 2040) and compared to current condition.

	Current Condition	Status Quo Scenario	High Development Scenario	Targeted Conservation Scenario
Very High Resiliency	28	27	27	27
High Resiliency	5	6	4	6
Moderate Resiliency	26	23	25	23
Low Resiliency	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total Populations	**78**	**75**	**72**	**79**

Determination

Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to *Hexastylis naniflora*. Currently, there are a total of 119 known populations in 13 counties, 78 of which have been documented since 2005. This is a

significant increase from 24 known populations in eight counties at the time of listing. Of the 78 populations, 75 percent are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend.

When *Hexastylis naniflora* was placed on the Federal List of Endangered and Threatened Plants (54 FR 14964; April 14, 1989), the two prominent threats identified were invasive, exotic plants and habitat loss or destruction. As discussed above, invasive, exotic species are not as significant a threat to *Hexastylis naniflora* as originally thought. Only one of the 11 monitored populations where invasive, exotic species occur was identified is declining. Additionally, analysis in the SSA report indicates *Hexastylis naniflora* has the capacity to withstand habitat loss and destruction due to development. The species currently has significant redundancy (119 populations), resilient populations (33 of 78 evaluated populations with high or very high viability), and representation in two different ecological settings. Even under our high development scenario, only two high or very high viability populations are lost to a lower viability rank. Therefore, we do not believe that competition from invasive, exotic species or habitat loss and destruction are significant threats to the species. Additionally, since listing, there has been a nearly four-fold increase in the number of known populations, and several populations have entered into conservation ownership by organizations with management staff (e.g., Broad River Greenway) or have commitments of management (e.g., N.C. Department of Transportation). We conclude that the species is currently not in danger of extinction throughout its range.

In order to more closely examine the future threat posed by habitat loss or destruction, the Service analyzed three different development scenarios into the future to 2040. Under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very

highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (five or six) of currently low resilient populations are projected to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Approximately 31 percent of the 78 currently known populations are permanently protected, and another 23 or so percent are somewhat protected (through voluntary agreements or another type of protection), reducing the likelihood of development impacting those populations. Recent examination of the species also identified climate change and invasive species as potential future threats. The broadened range (8 counties to 13) and significantly increased population numbers (24 to 119) since listing in 1989 indicate that the species benefits from sufficient redundancy and resiliency to withstand perturbations from climate change as well as from invasive species. Based on this analysis, we conclude that the species is neither currently in danger of extinction, nor likely to become so within the foreseeable future.

Determination of Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range (SPR). Where the best available information allows the Services to determine a status for the species rangewide, that determination should be given conclusive weight because a rangewide determination of status more accurately reflects the species' degree of imperilment and better promotes the purposes of the Act. Under this reading, we should first consider whether the species warrants listing "throughout all" of its range and proceed to conduct

a "significant portion of its range" analysis if, and only if, a species does not qualify for listing as either an endangered or a threatened species according to the "throughout all" language.

Having determined that *Hexastylis naniflora* is not in danger of extinction nor likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in an SPR. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do the "screening" analysis, we ask whether there are portions of the species' range for which there is substantial information indicating that: (1) The portion may be significant; and (2) the species may be, in that portion, either in danger of extinction or likely to become so in the foreseeable future. For a particular portion, if we cannot answer both questions in the affirmative, then that portion does not warrant further consideration and the species does not warrant listing because of its status in that portion of its range. We emphasize that answering these questions in the affirmative is not a determination that the species is in danger of extinction or likely to become so in the foreseeable future throughout a significant portion of its range—rather, it is a step in determining whether a more detailed analysis of the issue is required.

If we answer these questions in the affirmative, we then conduct a more thorough analysis to determine whether the portion does indeed meet both of the SPR prongs: (1) The portion is significant; and (2) the species is, in that portion, either in danger of extinction or likely to become so in the foreseeable future. Confirmation that a portion does indeed meet one of these prongs does not create a presumption, prejudgment, or other determination as to whether the species is an endangered species or threatened species. Rather, we must then undertake a

more detailed analysis of the other prong to make that determination. Only if the portion does indeed meet both SPR prongs would the species warrant listing because of its status in a significant portion of its range.

At both stages in this process—the stage of screening potential portions to identify any portions that warrant further consideration and the stage of undertaking the more detailed analysis of any portions that do warrant further consideration—it might be more efficient for us to address the "significance" question or the "status" question first. Our selection of which question to address first for a particular portion depends on the biology of the species, its range, and the threats it faces. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range.

For *Hexastylis naniflora*, we chose to evaluate the status question (i.e., identifying portions where *Hexastylis naniflora* may be in danger of extinction or likely to become so in the foreseeable future) first. To conduct this screening, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. If a species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range and the threats to the species are essentially uniform throughout its range, then the species would not have a greater level of imperilment in any portion of its range than it does throughout all of its range, and, therefore, no portions would qualify as an SPR.

Analysis

Applying the process described above, we first determine if any portion of the range of *Hexastylis naniflora* warrants further consideration. As discussed above, a portion of a species' range is significant if it is part of the current range of the species and is important to the

conservation of the species because it contributes meaningfully to the representation, resiliency, or redundancy of the species. The contribution must be at a level such that its loss would result in a decrease in the ability to conserve the species. While there is some variability in the habitats occupied by *Hexastylis naniflora* across its range, the basic ecological components required for the species to complete its life cycle are present throughout the habitats occupied by the 119 populations of the species. No specific location within the current range of the species provides a unique or biologically significant function that is not found in other portions of the range, and no specific locations are likely to be of greater biological or conservation importance than any other locations.

We next examined whether any threats are geographically concentrated in some way that could indicate the species could be in danger of extinction, or likely to become so, in a specific area. The NCNHP monitored 13 populations of *Hexastylis naniflora* throughout the species' range. Eleven of the 13 populations had invasive, exotic species identified as a threat, indicating that invasive, exotic species are found throughout the range and not concentrated in any specific location. Climate change effects, as discussed previously, are very uniform throughout the range. The opportunity for habitat loss and destruction due to development is higher on privately owned lands that could be sold for future development. Of the 78 populations evaluated, we determined that 31 percent are permanently protected and another 23 percent are partially protected (i.e., voluntary landowner agreements). The unprotected populations are spread throughout the species' range and not geographically clustered together.

As we found no portions of the species' range where threats are significantly concentrated or substantially greater than in other portions of its range, we did not identify any portions where the species may be in danger of extinction or likely to become so in the

foreseeable future. Therefore, no portions warrant further consideration through a more detailed analysis.

Our review of the best available scientific and commercial information indicates that *Hexastylis naniflora* is not in danger of extinction or likely to become so in the foreseeable future in any significant portion of its range. Our approach to analyzing SPR in this determination is consistent with the court's holding in *Desert Survivors* v. *Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018).

On the basis of this evaluation, we believe *Hexastylis naniflora* no longer requires the protection of the Act, and we propose to remove *Hexastylis naniflora* throughout its range from the Federal List of Endangered and Threatened Plants (50 CFR 17.12(h)).

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove *Hexastylis naniflora* from the Federal List of Endangered and Threatened Plants. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect *Hexastylis naniflora*.

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that

proposing it as an endangered or threatened species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2019–0081. Copies can also be obtained from the Service's Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**). We seek information, data, and comments from the public regarding *Hexastylis naniflora* and the PDM plan. We are also seeking peer review of the draft PDM plan concurrently with this comment period. We anticipate finalizing the PDM plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are not clearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act

We have determined that we do not need to prepare an environmental assessment or environmental impact statement, as defined in the National Environmental Policy Act (42 U.S.C. 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act. We published a notice outlining our reasons for this determination in the *Federal Register* on October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered

Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands affected by this proposed rule.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081 and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

§ 17.12 [Amended]

2. Amend § 17.12(h) by removing the entry for "*Hexastylis naniflora*" under "FLOWERING PLANTS" from the List of Endangered and Threatened Plants.

Dated: _____

_____

Margaret E. Everson,
Principal Deputy Director,
U.S. Fish and Wildlife Service,
Exercising the Authority of the Director,
U.S. Fish and Wildlife Service.

~~**[Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants]**~~

Briefing Paper for Departmental Clearance of *Federal Register* Documents

I. Subject: Proposed Delisting Rule for Dwarf-flowered heartleaf

II. RIN (for rulemaking documents): 1018-BD95

III. Docket or tracking number: FWS-R4-ES-2019-0081

IV. DCN (from DTS):

V. Summary: We are proposing to delist the dwarf-flowered heartleaf (*Hexastylis naniflora*). This recommendation is based on a thorough review of the best available scientific and commercial information, which indicates that this species does not meet the definition on an endangered species or threatened species.

VI. Is the action controversial? ☐ Yes. ☒ No.

If yes, please answer the following:

a. What are the controversial issues? (b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP

b. Who will care about these issues? (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP

c. How strongly will they care? (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP

VII. Communications:

a. Has the bureau communications office coordinated with DOI communications staff?

☒ Yes. ☐ No.

If yes, please note whom you contacted and how (e.g., email, voicemail):

Brian Hires via email.

b. Does this document require a press release?

☒ Yes. ☐ No.

Press release title: Conservation Success Story: Threatened Plant Proposed for Removal from Endangered species List

Press release first paragraph: Tens of thousands of threatened dwarf-flowered heartleaf plants are conserved by Duke Energy along the Broad River. Another population is conserved at Cowpens National Battlefield, in upstate South Carolina. A third is part of the Broad River Greenway, a local park in North Carolina's Cleveland County. These are three of many conservation efforts for the heartleaf, leading the U.S. Fish and Wildlife Service (Service) to propose removing it from the federal threatened and endangered species list.

VIII. Is timing critical? ☒ Yes. ☐ No.

(b)(5) DPP(b)(5) DPP

If you provided an NLT date, please answer the following:

a. What is the main driver of the timing? (b)(5) DPP(b)(5) DPP .

b. What happens if the deadline is missed? (b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP

IX. Background (use this space to provide additional helpful information): (b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP

X. Is there an information collection associated with this document?

☐ Yes. ☒ No.

If yes, please answer the following:

a. Does the document have any approved OMB control number(s)? ☐ Yes. ☐ No.

If yes, provide the OMB control number(s) and expiration date(s):

b. Does the document require ☐ a new OMB control number or ☐ a renewal of an existing approval?

If a new number or a renewal is required, what is the current status?

XI. Approval is requested to send the document to:

☒ The Office of the Federal Register for publication, or

☐ OIRA for review.

XII. Primary contact:

Name: Gary Frazier, Assistant Director, Ecological Services

Phone: 202-208-4646

Email: gary_frazier@fws.gov

Information Memorandum for the Secretary/Director

Date: July 16, 2018

From: Gary Frazier, Assistant Director, Ecological Services

Telephone: 202-208-4646

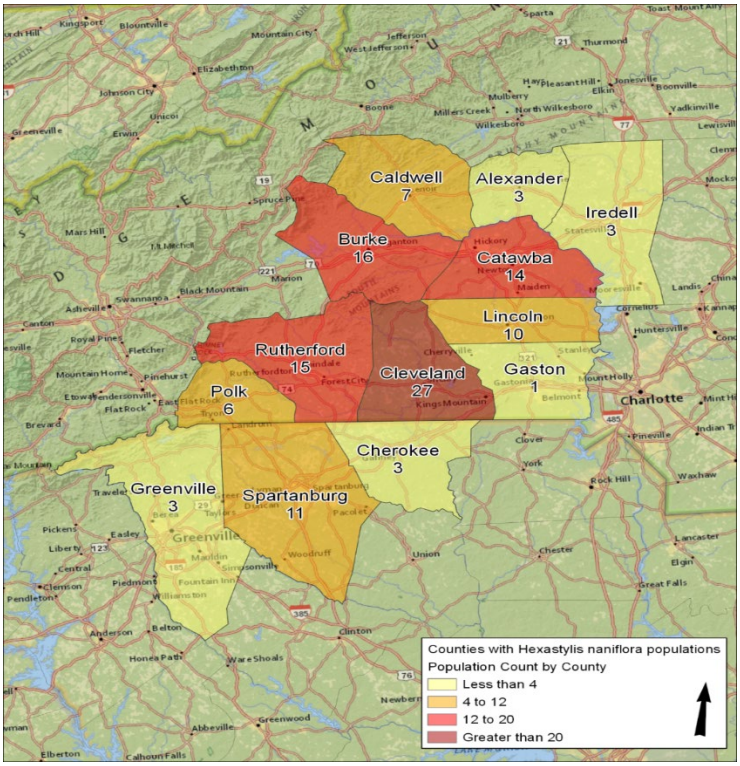
Subject: Dwarf-flowered Heartleaf Proposed Delisting

I. Introduction

We are proposing to delist the dwarf-flowered heartleaf (*Hexastylis naniflora*). This recommendation is based on a thorough review of the best available scientific and commercial information, which indicates that this species does not meet the definition of an endangered species or threatened species.

II. Background

On April 14, 1989, we published a final rule in the Federal Register (FR 54 14964) listing the dwarf-flowered heartleaf as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing. A recovery plan for the species was never completed. However, over the last 29 years, the Service has worked closely with partners to recover this species. The Service initiated a Species Status Assessment (SSA) to aid in determining the appropriateness of reclassifying the species in 2018.



Key Drivers of Species Status

CURRENT AND FUTURE CONDITIONS - The dwarf-flowered heartleaf is a low growing herbaceous plant in the birthwort family. When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include five additional counties in North Carolina. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is in Cherokee, Greenville, and Spartanburg Counties. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two states.

At the time of listing, the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. In addition, other documented threats include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of ponds, impacts from grazing cattle, ORV damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or siltation. In the SSA, we assessed these same factors as well as climate change to determine the viability of the dwarf-flowered heartleaf currently and in the future. Climate change through changes in temperature and precipitation may exacerbate these risk factors to the species.

To determine current resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the

species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focused monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Of the 78 populations assessed, 28 had very high resiliency, five had high, 26 had moderate, while 19 had low resiliency.

We assessed the future condition of the dwarf-flowered heartleaf under three scenarios projected out to the year 2040. We have identified 2040 as our foreseeable future based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape. In the Status Quo scenario, there are predicted to be 75 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and two additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. In the High Development scenario, there are predicted to be 72 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate; two moderate populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development. In the Targeted Conservation scenario, there are predicted to be 79 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and six additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our

Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. Thus, after considering the best available scientific and commercial information, we determine the dwarf-flowered heartleaf is not likely to become in danger of extinction in the foreseeable future.

Data Sources

The data set available for determining species abundance, distribution, and factors influencing the species viability predominantly relies on existing information from unpublished field survey results, research project reports, peer reviewed scientific publications, unpublished field observations by experienced biologists, personal communications, latest 5-year review, and the species status assessment report.

Section 4(d) Rule

Because we are proposing to delist this species, there will be no 4(d) rule for the dwarf-flowered heartleaf.

Recovery Criteria

There was no Recovery Plan completed for this species.

Conservation Efforts

The North Carolina Plant Conservation and Protection Act (NC State Code Article 19B, § 106-202.12) provides limited protection from unauthorized collection and trade of plants listed under that statute. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. Plant species are afforded even less protection in South Carolina, where they are protected only from disturbance where they occur on those properties owned by the state and specifically managed as South Carolina Heritage Preserves (SC State Code of Regulations Part 123 § 200-204). There are no other federal or state statutes that afford significant protections to *Hexastylis naniflora*.

The overwhelming majority of *Hexastylis naniflora* populations have been discovered as a direct result of surveys conducted to ensure compliance with the Endangered Species Act. Even more significantly, the majority of sites that have the potential to afford long-term protection to the species have been protected as a direct result of the provisions of Section 7 of the ESA, which directs consulting agencies to minimize adverse effects to federally listed species through conservation measures pledged as a part of the project description.

The section 7 consultation process has resulted in avoidance or minimization of adverse impacts, the protection of unaffected portions of *Hexastylis naniflora* populations, and/or monitoring of the species within protected areas. However, while conducting this review the USFWS discovered numerous examples in which conservation measures pledged during prior section 7 consultations had yet to be satisfactorily completed, or for which satisfactory evidence of completion was lacking. We actively working to follow-up on commitments previously pledged on behalf of *Hexastylis naniflora*. It is unlikely that any of these sites would have been afforded protection without this statutory protection.

Tens of thousands of threatened dwarf-flowered heartleaf plants are conserved by Duke Energy along the Broad River. Another population is conserved at Cowpens National Battlefield, in upstate South Carolina. A third is part of the Broad River Greenway, a local park in North Carolina's Cleveland County. These are three of many conservation efforts for the heartleaf, leading the USFWS to propose removing it from the federal threatened and endangered species list. Key to that conservation effort has been organizations acquiring and permanently protecting sites where the plant grows. Foothills Conservancy, Catawba Lands Conservancy, and The Nature Conservancy all protect sites. The North Carolina Department of Transportation is one of the greatest contributors to conservation, acquiring land and conserving multiple populations over the years, including land that became part of Cleveland County's Broad River Greenway.

Post-Delisting Monitoring

The purpose of post-delisting monitoring is to verify that the dwarf-flowered heartleaf (*Hexastylis naniflora*) remains secure from the risk of extinction after it has been removed from the protections of the Act. The Service prepared this draft post-delisting monitoring (PDM) plan (Plan), in coordination with different partners. This draft plan is designed to detect substantial declines in the dwarf-flowered heartleaf population with reasonable certainty and precision. It meets the minimum requirement set forth by the Act by effectively monitoring the status of dwarf-flowered heartleaf using annual sampling events.

****

The information below this line is for informational and outreach purposes only and has not been used as the basis for any potential Agency decision.

III. Positions of Interested Parties

The dwarf-flowered heartleaf occurs on public and private land, based on a long history of outreach and conservation projects, landowners would likely be neutral or favorable regarding a proposed delisting.

IV. Potential Issues/Conflicts

Potential issues and conflicts with this proposed delisting are not anticipated.

V. Communications and Outreach

Outreach Lead:	Phil Kloer
Affected States:	North/South Carolina
Media POC:	Phil Kloer 404-679-7299
Congressional:	Kristen Peters (EA) will send advance notification emails to Congressionals via email two days before rule publication.

State Contacts:	Raleigh Ecological Services Office Field Supervisor (Pete Benjamin) will ensure email notification sent to the following offices: North/South Carolina Governor's Office, Deputy Chief of Staff; NC Botanical Garden, Director of Conservation Programs; NC Forest Service, Regional Forester; NC Division of Parks and Recreation – State Parks, Director; NC Natural Heritage Program, Director; NC Plant Conservation Program, Administrator; NC Clean Water Management Trust Fund, Acquisition Program Manager.
Other Outreach:	Region 4 Facebook and Twitter Accounts – Katherine Taylor.

Draft Species Status Assessment for Dwarf-flowered Heartleaf (*Hexastylis naniflora*)

Prepared by:

Michael E. Marshall
U.S. Fish and Wildlife Service
Ecological Services
Atlanta, Georgia

Version 2.0
May 2019

EXECUTIVE SUMMARY

The dwarf-flowered heartleaf (*Hexastylis naniflora*), a perennial member of the birthwort family, is known from 119 populations in North and South Carolina. It is threatened by habitat loss due to the conversion of land to residential, commercial, industrial, and agricultural use, timber harvest, hydrological alterations from damming of ponds, cattle grazing, ORV damage, trampling, invasive species, highway and road improvements, and erosion or siltation. To evaluate the biological status of dwarf-flowered heartleaf currently and into the future, we consider the species' viability as characterized by resiliency, redundancy, and representation (i.e., 3Rs). Dwarf-flowered heartleaf needs multiple resilient populations across its range to maintain its persistence into the future and to avoid extinction. Given the relatively high number of populations across each scenario analyzed, redundancy remains similar to current conditions. Redundancy within the range of dwarf-flowered heartleaf appears to be adequate which would allow the species to withstand the impacts of localized short-term catastrophic disturbances; however, the species range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change. Dwarf-flowered heartleaf has a limited range and representative units were not defined for the species; however, the scenarios analyzed do not predict declines in species representation.

DRAFT

Table of Contents

EXECUTIVE SUMMARY ii
Chapter 1: INTRODUCTION 1
Chapter 2: SPECIES BIOLOGY 3
Taxonomy and Species Description 3
Distribution 5
Life History 6
Demographics 6
Pollination and Dispersal 6
Habitat 7
Soils 7
Fire 8
Genetics 8
Chapter 3: SPECIES NEEDS 10
Delineating Populations 10
Population Resiliency 11
Habitat Factors: Slope, Aspect, Elevation, Soil, and Forest Type 11
Reproduction and Presence of Pollinators 17
Abundance 17
Chapter 4: CURRENT CONDITIONS 20
Current Population Resilience 21
Categorizing Resilience 21
Occupancy and Abundance 22
Population Trends 26
Current Species Representation 27
Current Species Redundancy 27
Chapter 5: INFLUENCES ON VIABILITY 28
Human Population Change 28
Development 30
Invasive Species and Woody Encroachment 31
Climate Change 32

DRAFT

Chapter 6: FUTURE CONDITION 34
Future Considerations 34
Status Quo Scenario 60
High Development Scenario 60
Targeted Conservation Scenario 61
Future Resilience 61
Status Quo Scenario 63
High Development Scenario 65
Targeted Conservation Scenario 67
Viability Summary 70
Opportunities for Additional Conservation 71
Literature Cited 74

DRAFT

Chapter 1: INTRODUCTION

The dwarf-flowered heartleaf (*Hexastylis naniflora*) is a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It has been listed as threatened under the Endangered Species Act of 1973, as amended (Act), since 1989 (FR 54 14964-14967). The Species Status Assessment (SSA) framework (USFWS 2016, entire) summarizes the information compiled and reviewed by the US Fish and Wildlife Service (Service), incorporating the best available scientific and commercial data, to conduct an in-depth review of the species' biology and threats, evaluate its biological status, and assess the resources and conditions needed to maintain long-term viability. The SSA supports all functions of the Endangered Species Program from listing to consultations to recovery. The SSA is intended to inform regulatory and policy decision, but has been developed independently from any such decision.

A recovery plan for the species was never completed; however, over the last 29 years, the Service has worked closely with partners to make significant progress toward recovery of the species. The Service initiated this SSA to aid in determining the appropriateness of reclassifying the species. Should the species not be reclassified, the SSA will inform the development of a recovery plan. Importantly, the SSA does not result in a decision by the Service on whether this species should be proposed for reclassification under the Act. Instead, this SSA provides a review of the available information strictly related to the biological status of the dwarf-flowered heartleaf.

For the purpose of this assessment, we generally define viability as the ability of the species to sustain populations in its natural habitat over time. Using the SSA framework (Figure 1.1), we consider what the species needs to maintain viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation (Wolf et al. 2015, entire).

- **Resiliency** describes the ability of populations to withstand stochastic events (arising from random factors). We can measure resiliency based on metrics of population health; for example, birth versus death rates and population size. Highly resilient populations are better able to withstand disturbances such as random fluctuations in birth rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic activities.
- **Redundancy** describes the ability of a species to withstand catastrophic events. Measured by the number of populations, their resiliency, and their distribution (and connectivity), redundancy gauges the probability that the species has a margin of safety to withstand or can bounce back from catastrophic events (such as a rare destructive natural event or episode involving many populations).
- **Representation** describes the ability of a species to adapt to changing environmental conditions. Representation can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. The more representation, or diversity, a species has, the more it is capable of adapting to changes (natural or human caused) in its environment. In the absence of species-specific genetic and ecological diversity information, we evaluate representation based on the extent and variability of habitat characteristics across the geographical range.

DRAFT

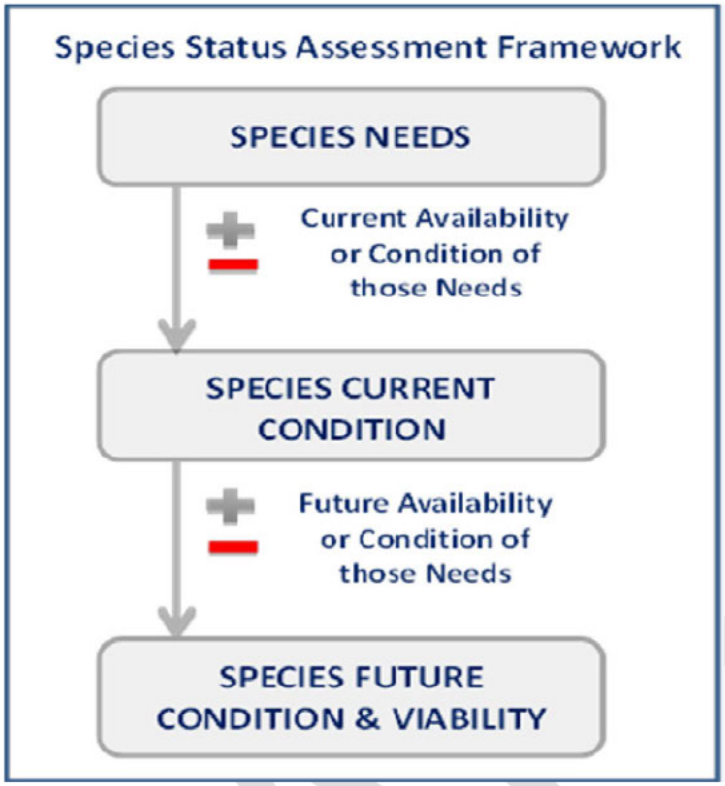


Figure 1.1. Species Status Assessment Framework

To evaluate the biological status of the dwarf-flowered heartleaf, both currently and into the future, we assessed a range of conditions to allow us to consider the species' resiliency, redundancy, and representation (together, the 3Rs). This SSA provides a thorough assessment of biology and natural history, and assesses demographic risks, stressors, and limiting factors in the context of determining the viability and risks of extinction for the species.

This document is a compilation of the best available scientific and commercial information, and includes: (1) biology and species needs, (2) current conditions, (3) influences on viability, and (4) future conditions.

DRAFT

Chapter 2: SPECIES BIOLOGY

In this chapter, we provide basic biological information about the dwarf-flowered heartleaf (*Hexastylis naniflora*), including its taxonomic history, species description, distribution, life history traits, and habitat characteristics. We then use this information to outline the resource needs of dwarf-flowered heartleaf.

Taxonomy and Species Description

Dwarf-flowered heartleaf is a rare, low growing herbaceous plant in the birthwort family (Aristolochiaceae). The species was described by Blomquist (1957) in his revision of the North American members of the genus *Hexastylis*. The dwarf-flowered heartleaf has been recognized as part of the Virginica group, and this group was further subdivided into three subgroups or complexes: Virginica, Shuttleworthii, and Heterophylla (Blomquist 1957; Whittemore and Gaddy 1997). Three species have been recognized in the Heterophylla complex, *Hexastylis naniflora, H. heterophylla* and *H. minor*, and field biologist have generally recognized that considerable morphological overlap occurs (Murrell et al. 2007). One concern regarding this complex is the inability to distinguish between species without access to fresh flowers. Even with fresh flowers, Blomquist (1957) and Gaddy (1987) still recognized considerable overlap in flower morphology making species delineation difficult.

Murell et al. 2007, conducted a comparative genetic analysis using Inter Simple Sequence Repeats, and were unable to separate *H. naniflora* from the other members within the complex. However, based on biogeographical, ecological, molecular, morphological, as well as micromorphological work, their results show that *H. naniflora* is a well-defined species.

Although there has been considerable disagreement on the generic distinctiveness of *Hexastylis* and *Asarum* (Barringer 1993 and Kelly 1997, 1998, 2001), a recent phylogeny estimate using chloroplast genes supports that *Hexastylis* is a monophyletic clade and should be recognized as a genus (Niedenberger 2010). Additionally, most North American publications recognize *Hexastylis* at the generic level (Flora of North America 1997, Weakley 2015).

The Service is not aware of any proposed changes in taxonomy that would affect the continued legal status of *H. naniflora* under the Act. However, within the range of *H. naniflora* there are populations which fall outside of the range of published values for key floral characteristics, overlapping with values described for *H. heterophylla* or *H. minor* (Figure 2.1; Weakley 2010; Murrell et al. 2007; Gaddy 1987). These geographic areas of overlap in key characters have been the focus of recent genetic analyses (Murrell et al. 2007; Renninger 2010; Murrell 2015).

DRAFT

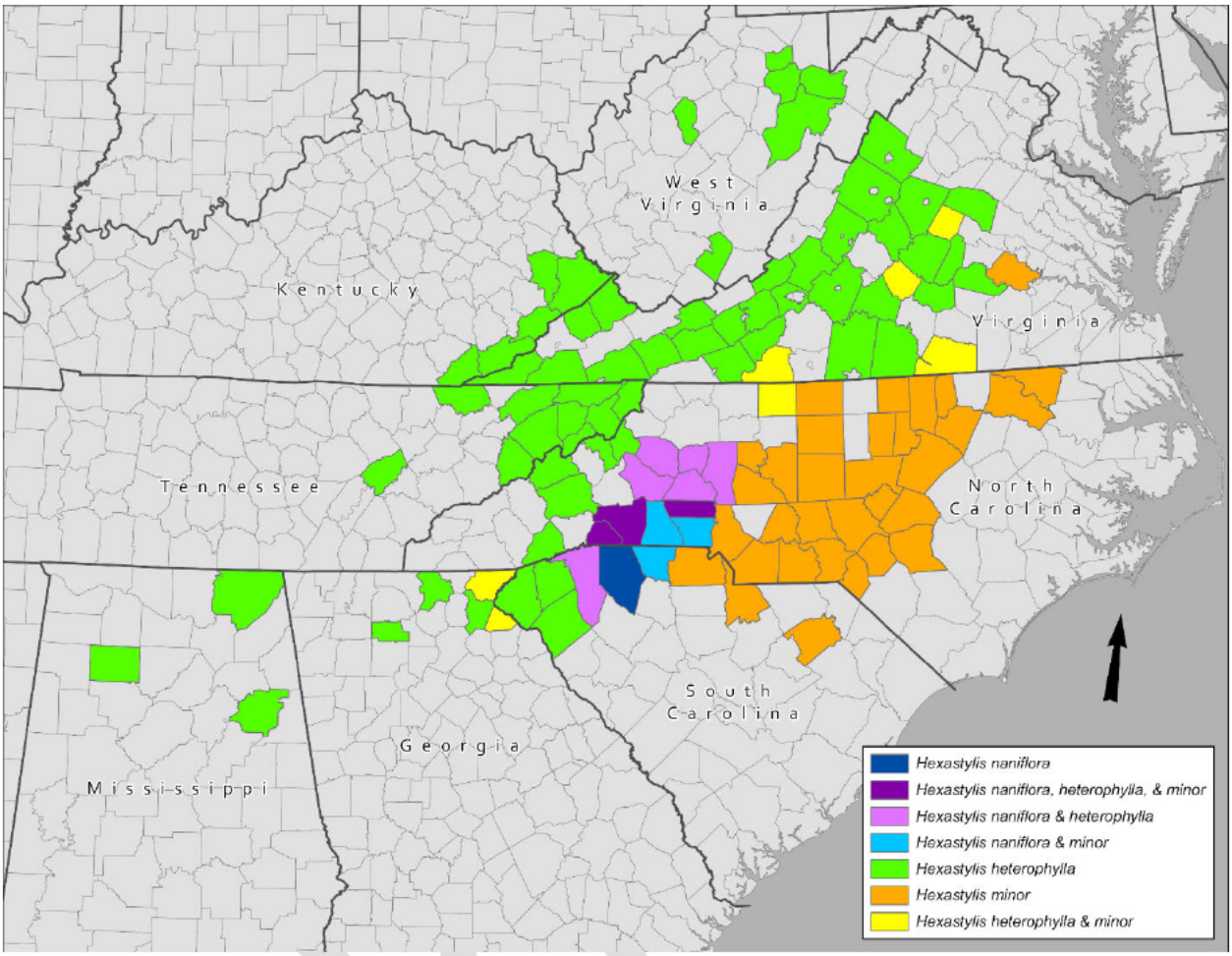


Figure 2.1. Distribution map showing county records for the three species in the Heterophylla complex. Data was gathered from herbarium specimens, element occurrence records and field studies. *Based on Murrell et al. 2007.*

The most outstanding characteristic of this species is the small flowers, which are one of the smallest of any *Hexastylis* species in North America (Blomquist 1957). The plant's heart shaped leaves are dark green in color, evergreen, and leathery, and are supported by long thin petioles from a subsurface rhizome. The shape of the leaf blades, their pattern of variegation, and the ridged reticulation inside the calyx-tube, place this species inside the Virginica group. It differs from all the other members of this group, aside from the small flowers, in having no flare in the calyx-tube. Maximum height rarely exceeds 15 centimeters (cm). The jug-shaped flowers are usually beige to dark brown in color and appear from mid-March to early June. They are small and inconspicuous and are found near the base of the petioles. The fruit matures from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981). Characteristics that distinguish it from other *Hexastylis* species are found in floral structures and pollen characters (Gaddy 1987, Padgett 2004, Niedenberger 2010). *H. naniflora* has a smaller calyx tube orifice, which is typically 5mm or less (sometimes up to 7mm) and the ovary is half-inferior, rather than superior (Blomquist 1957, Gaddy 1987, Padgett 2004, HDR 2005). Pollen surface features have also been shown to be an effective character to identify *H. naniflora*, as it has a microporate surface and, unlike any other *Hexastylis* species, lacks gemmae entirely (Padgett 2004, Niedenberger 2010).

Distribution

Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (USFWS 2010, NCNHP 2016). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include five additional counties in North Carolina. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is in Cherokee, Greenville, and Spartanburg Counties. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two states (Figure 2.2).

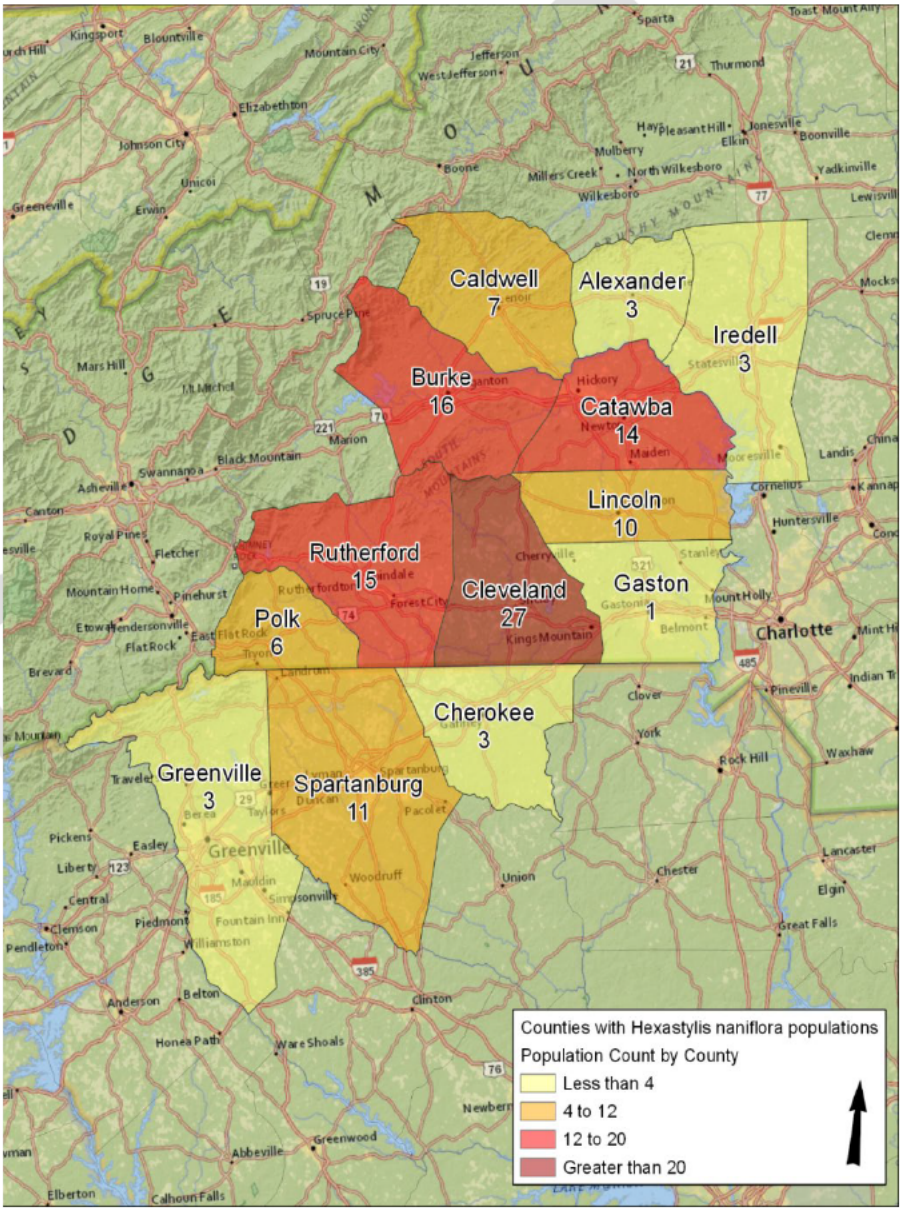


Figure 2.2. Current county distribution for dwarf-flowered heartleaf, with associated number of known populations within each county.

Many of those working with *Hexastylis naniflora* have used the terms "sub site", "site", "location", "occurrence" (often, but not always, in reference to Natural Heritage Program Element Occurrence (EO) records), "subpopulation" and "population" interchangeably. Others have aggregated smaller sites into populations according to subjective criteria which have never been explicitly defined. This generates discrepancies among sources with respect to the abundance and distribution of the species, resulting in data usually not comparable from one source to the next. We describe how the numerous small, site-specific locations containing *H. naniflora* have been aggregated into proxies for 119 biological populations for purposes of this review, using mapping standards devised by NatureServe and its network of Natural Heritage Programs, in Chapter 3 of this report.

Life History

Demographics

The Service is aware of a single effort to collect demographic-level data (survivorship and recruitment of tagged individuals) for dwarf-flowered heartleaf. Surveys occurred during the 1990-1991 field seasons, within a portion of the Peters Creek population in Spartanburg County, SC (Newberry 1993). This study demonstrated a 96.1% survival rate over these two consecutive seasons, with 50% of the mortality occurring in plants located at the highest position on the forested slope (away from the adjacent floodplain). Mortality was highest in small plants bearing fewer than four leaves. Plant size was variable, with the largest plant bearing 45 leaves and 33 flowers, and growing in the floodplain. In general, plants in the floodplain were larger than plants on adjacent slopes. The percentage of flowering plants averaged 70%, with the highest frequency of flowering occurring among plants in the floodplain (USFWS 2010).

Pollination and Dispersal

The pollination of *Hexastylis* has not been well studied but the genus was thought to be pollinated by insects including flies, wasps, and thrips (Otte 1977). Additionally, Lengyel et al. (2010) described how, within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal by ants). This supports Gaddy's work (1986), which found three species within the Heterophylla complex (*Hexastylis naniflora, H. heterophylla, and H. minor*), which employ myrmecochory as a method for seed dispersal.

Ants appear to be a primary dispersal agent for the dwarf-flowered heartleaf (Gaddy 1986; Jones et al. 2014). All diaspores of *H. naniflora* presented to ants (*Aphaenogaster rudis*) were quickly removed (Gaddy 1986). This is not to say that they are not occasionally, or even frequently, dispersed and/or pollinated by other means. Jones et al. (2014) suggests the pollination mechanism is facultative, benefiting from more than one method of pollination/fertilization. Ants were the pollinators in a controlled experiment, and their data supports that when outside molesting forces/pollinators (biotic and abiotic) were limited by their caging procedure, the efficiency of pollination decreased by almost 50%, however, caged flowers did produce seeds, indicating pollination occurred via some alternative method.

DRAFT

Habitat

Dwarf-flowered heartleaf appears to have a restricted range due to its habitat requirements. The habitat is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Wagner 2013). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of a given population. With the limited range and size in populations, questions arise regarding gene flow among populations. How much is occurring and how often does it occur? It is due, in part, to narrow habitat requirements that conservation measures have been implemented for the protection of the species.

Dwarf-flowered heartleaf occurs on piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, Weakley 2015, USFWS 2015), or moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993). Wagner (2013) conducted a habitat suitability study to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants.

Soils

The species appears to be restricted to Pacolet sandy loam, Madison gravelly sandy loam, and Musella fine sandy loam soils (Gaddy 1981,1987). The species grows in acidic soils along bluffs and adjacent slopes, in boggy areas next to streams and creekheads, and along the slopes of nearby hillsides and ravines (Gaddy 1980, 1981). It is primarily found inhabiting north- to northwest-facing slopes, bluffs, and ravines in close proximity to creeks or streams. Within these areas exists the soil type required for *Hexastylis naniflora* to grow. It grows primarily on well-drained, sandy, acidic soils, and will not grow in heavy clay (Gaddy 1981).

The results of soil samples analyzed at the Clemson Soil Lab suggest that major differences in soil chemistry requirements exist between the species in the Heterophylla complex (Murrell et al. 2007). Statistical analysis of the soil samples showed that many of the basic elements were significantly different among the three species. Those significant differences occurred in phosphorous (P), potassium (K), magnesium (Mg), zinc (Zn), manganese (Mn), sodium (Na), and cation exchange capacity (CEC). Slightly significant differences were seen in buffer pH and acidity.

Soil chemistry showed marked differences between the species in the complex (Murrell et al. 2007). The results indicated that soil chemistry is very different between *H. naniflora* and *H. minor* localities. The results also show that *H. heterophylla* and *H. naniflora* are found in soils where the chemistry is more similar, but still showed significant differences. It would appear that differentiation in soil types could be used as a proxy for species delineation. The soil analysis also indicates that soils must be considered when trying to select sites for relocation of imperiled populations of *H. naniflora*.

Thirteen population sites in North and South Carolina were examined using the Carolina Vegetation Survey (CVS) method to compare species richness between the three species of the Heterophylla complex (Murrell et al. 2007). The analysis did not show statistically significant differences among the three species in the complex. However, *H. naniflora* appears to have an association with three oak species that is lacking in the other two species in the complex. There are a number of oak species (*Quercus coccinea*, *Q. prinus* (*Q. montana*), and *Q. velutina*), that tend to co-occur with only *H. naniflora*, but are not present with the other two species in the complex. This may be the result of some microbial need or specific soil nutrient required for those species to occur in the same habitat.

Fire

There are little data on the response to fire by *Hexastylis naniflora*, however, prescribed burns have been conducted within the population at Cowpens National Battlefield in Cherokee County, SC. Preliminary data at this site and recent annual monitoring data of this population support the theory that moderate controlled burns do not negatively affect this population (Walker et al. 2009). Additionally, a dormant season wildfire did not show evidence of negative impacts to a population in Caldwell County (USFWS 2010). Fire suppression could be a hazard to *H. naniflora* by allowing fire intolerant, nonnative and invasive plants to thrive, as well as the accumulation of thick duff or leaf litter that may shade low growing species (Wagner 2013).

Genetics

Analyses on ecology, morphology, soil chemistry, pollen, and molecular genetics have been evaluated for *Hexastylis naniflora* to determine the boundaries within the Heterophylla complex, which consists of *H. heterophylla*, *H. minor*, and *H. naniflora* (Murrell 2015, Wagner 2013, Niedenburger 2010, USFWS 2010, Murrell et al. 2007, Padgett 2004). These analyses support the continued recognition of these taxa as well-defined, discrete species. Scanning electron microscopy (SEM) consistently distinguished *H. naniflora* from other members of the Heterophylla complex based on pollen microscopy. Principal Components Analysis of floral characters and soil chemistry also consistently distinguished *H. naniflora* from *H. minor* and *H. heterophylla*. However, efforts to obtain consistently distinct banding patterns using Inter Simple Sequence Repeats (ISSRs) were unsuccessful at distinguishing *H. naniflora* from other members of this complex (Murrell et al. 2007). These results were based upon an extremely small sample size (n=10 *H. naniflora* individuals), and therefore warrant further investigation.

Field observations demonstrate that there are some populations of dwarf-flowered heartleaf with morphological characteristics that do not fit within the range of published values for key traits, overlapping with values for *H. heterophylla* or *H. minor* (Gaddy 1987, Murrell et al. 2007, USFWS 2010, Weakley 2015). These populations were the focus of a genetic analysis conducted at Appalachian State University (ASU) through funding provided by the NC Department of Transportation (NCDOT) (Murrell 2015). In some populations, floral characteristics are highly variable, suggesting the potential for hybridization or individuals with highly variable flower size and shape (Murrell 2015). Additionally, no vegetative characters were previously known to consistently distinguish *H. naniflora* from other close relatives. Given the difficulties with field identification of the species, particularly when not in flower, this study sought to develop a

DRAFT

microsatellite library of molecular markers to resolve variation in populations of dwarf-flowered heartleaf and apply the markers to populations with highly variable characters, as identified by NCDOT biologists. The morphological and micromorphological information from those variable populations were compared to molecular results with morphological, micromophological, and distributional data to determine genetic structure, biological boundaries, and placement of putative hybrids or intermediate populations of *H. naniflora* (Murrell 2015).

The preliminary findings of this study suggest populations in the southern range of dwarf-flowered heartleaf exhibit a more uniform genetic pattern, with some possible hybridization with *H. minor*. Populations in the northern part of the range appear to have hybridized with both *H. heterophylla* and *H. minor*, although there are still individuals with "pure" *H. naniflora* genotypes in the northern range (Murrell 2015). It is critical to note that although these data provide anecdotal evidence of hybridization within the Heterophylla complex, intraspecific variation may be caused by forces other than hybridization, such as convergent morphological evolution (Dobzhansky 1937), or the species is in the process of speciation and this study shows a case of incomplete speciation (Murrell 2015), and/or other environmental factors are at play (Wagner 2013). On May 11, 2016, a meeting was held with the Service, NC Natural Heritage Program (NCNHP), NCDOT, and ASU to discuss the status of *H. naniflora* and the current work being conducted among the agencies (Amoroso 2016). Based on discussions during this meeting, the results of this study reported by ASU to NCDOT in 2015 are preliminary. Dr. Matt Estep (ASU) provided additional preliminary results to NCNHP in May 2016, showing which populations were sampled, sample size, and percent of samples that show evidence of hybridization, and hybridizing with which species. ASU continues to work towards a more definitive explanation of the variation in the Heterophylla complex (Murrell 2015, Amoroso 2016).

DRAFT

Chapter 3: SPECIES NEEDS

For the purpose of this report, we define viability as the ability of the species to sustain wild populations over time. Species with greater numbers (redundancy) of healthy populations (resiliency), encompassing a broad array of ecological and genetic diversity in a spatial arrangement that maintains adequate gene flow (representation), are more likely to be viable. Using the SSA framework, we describe the species' viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation.

Delineating Populations

As stated in the Service's five-year review, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to Natural Heritage Program EO records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This has generated considerable discrepancies among sources with respect to the number of known populations within a given area (or across the species' range), to the extent that numbers are not comparable from one source to the next. The past tendency to treat each location as a separate population also artificially inflated the actual number of populations known.

The Natural Heritage Programs collect information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as EO records. In recent years, NatureServe and its member Natural Heritage Programs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2002). Since the Service does not maintain its own database of known locations of *Hexastylis naniflora*, it regards the Natural Heritage Program databases as the best repository for this information (USFWS 2010).

We delineate populations for the purposes of this SSA according to the NatureServe (2002) convention. Separation distances are a key component to delineating populations from EO records. For the dwarf-flowered heartleaf, we used the EO Data Standard which provides a default separation distance of 1 km (~0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the NatureServe network as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several dwarf-flowered heartleaf populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

DRAFT

Population Resiliency

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include impacts to its habitat, particularly human development pressures, but also climate change and presence of invasive species. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include abundance within populations, and habitat factors such as soil type, aspect, elevation, and land use. Influencing those factors are elements of dwarf-flowered heartleaf ecology that determine whether populations can grow to maximize habitat occupancy, thereby increasing resiliency of populations. These factors and habitat elements are discussed below (Figure 3.1).

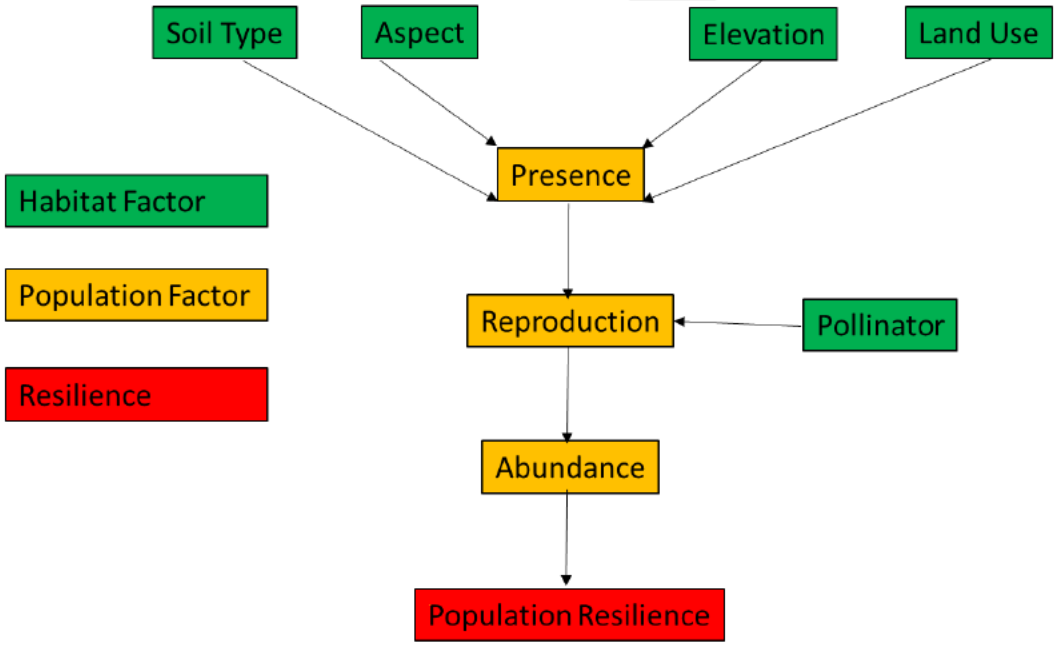


Figure 3.1. Conceptual diagram describing population and habitat factors influencing population resilience for dwarf-flowered heartleaf.

Habitat Factors: Soil Type, Aspect, Elevation, and Land Use

A previous habitat suitability study attempted to quantify the habitat requirements for dwarf-flowered heartleaf (Wagner 2013). With this model in mind, and the input of species experts as to important habitat factors for the species, we used updated habitat data, as well as inclusion of updated EOs, to create a new habitat model to identify potential habitat throughout the species range. All source datasets and variables created are described in Appendix 3.

Source Data and Model Variables

Fifty-three, 10-digit hydrologic units (HUC) comprise the analysis extent (Figure 3.2). In North Carolina, it includes all 10-digit HUC that fall within the boundaries of 8-digit HUC with known occurrence of *Hexastylis naniflora*. In South Carolina, we also included all 10-digit HUC that fell within the boundaries of 8-digit HUC with known occurrence of *H. naniflora*, but excluded the

southern portions of the HUC-8 areas due to the boundaries being exceedingly large and far away from any known occurrences.

H. naniflora EO data was obtained from the North Carolina Natural Heritage Program (NCNHP) and the South Carolina Heritage Trust Program (SCDNR). Current populations of *H. naniflora* were identified by reviewing the last observed data in the database and excluding all populations that have not been observed since 2005. To represent these current population areas in Maxent, a raster cell center was retained for every 30 x 30 meter pixel that was situated within the current EO data polygons.

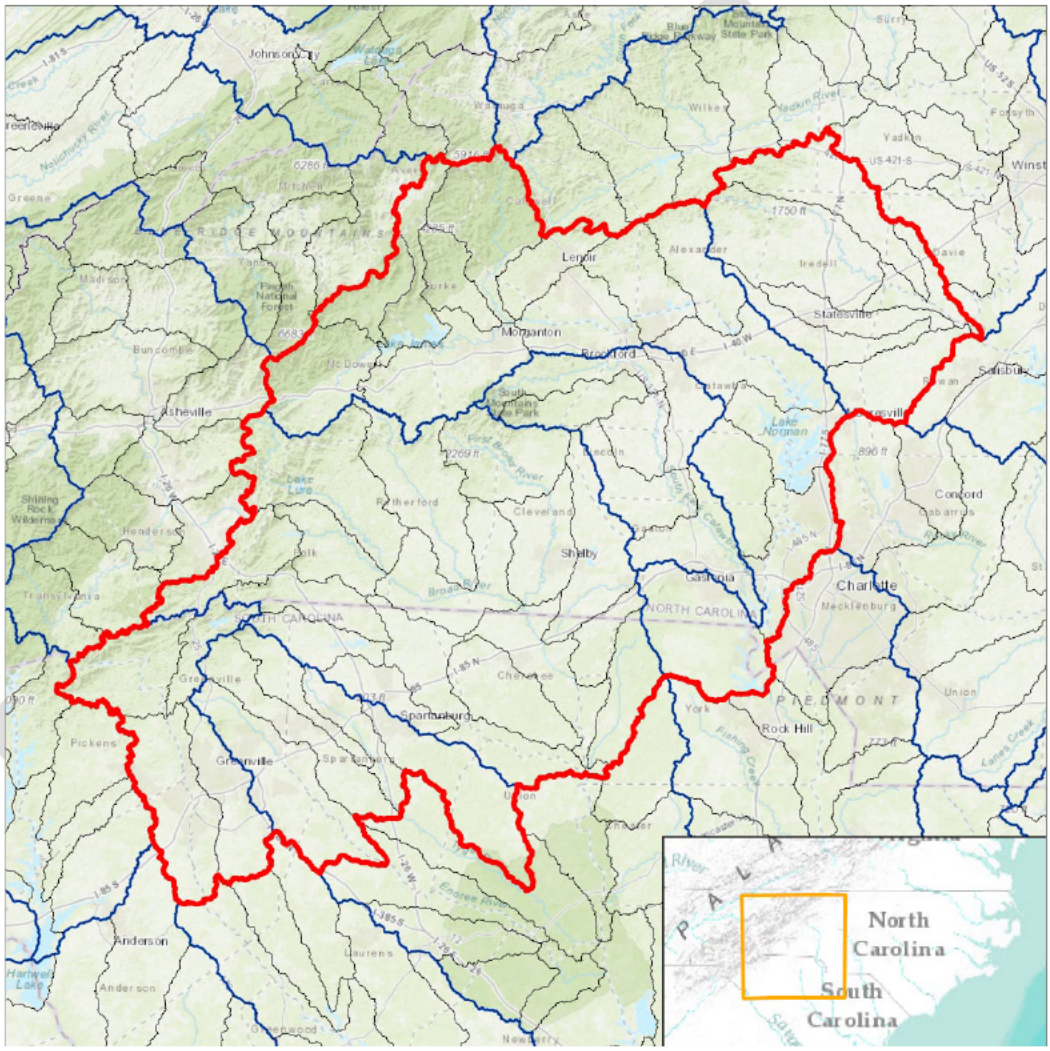


Figure 3.2. Analysis extent of the habitat model for *Hexastylis naniflora*. Red line indicates Maxent analysis extent, blue lines are 8-digit HUC boundaries, black lines are 10-digit HUC boundaries.

Model Development

We used Maxent software (version 3.4.1) for species habitat modeling (Philips et al. 2018). An initial single model Maxent run was done to determine which variables could be excluded due to limited contribution to the model. Any variable that contributed less than 1% to the single model

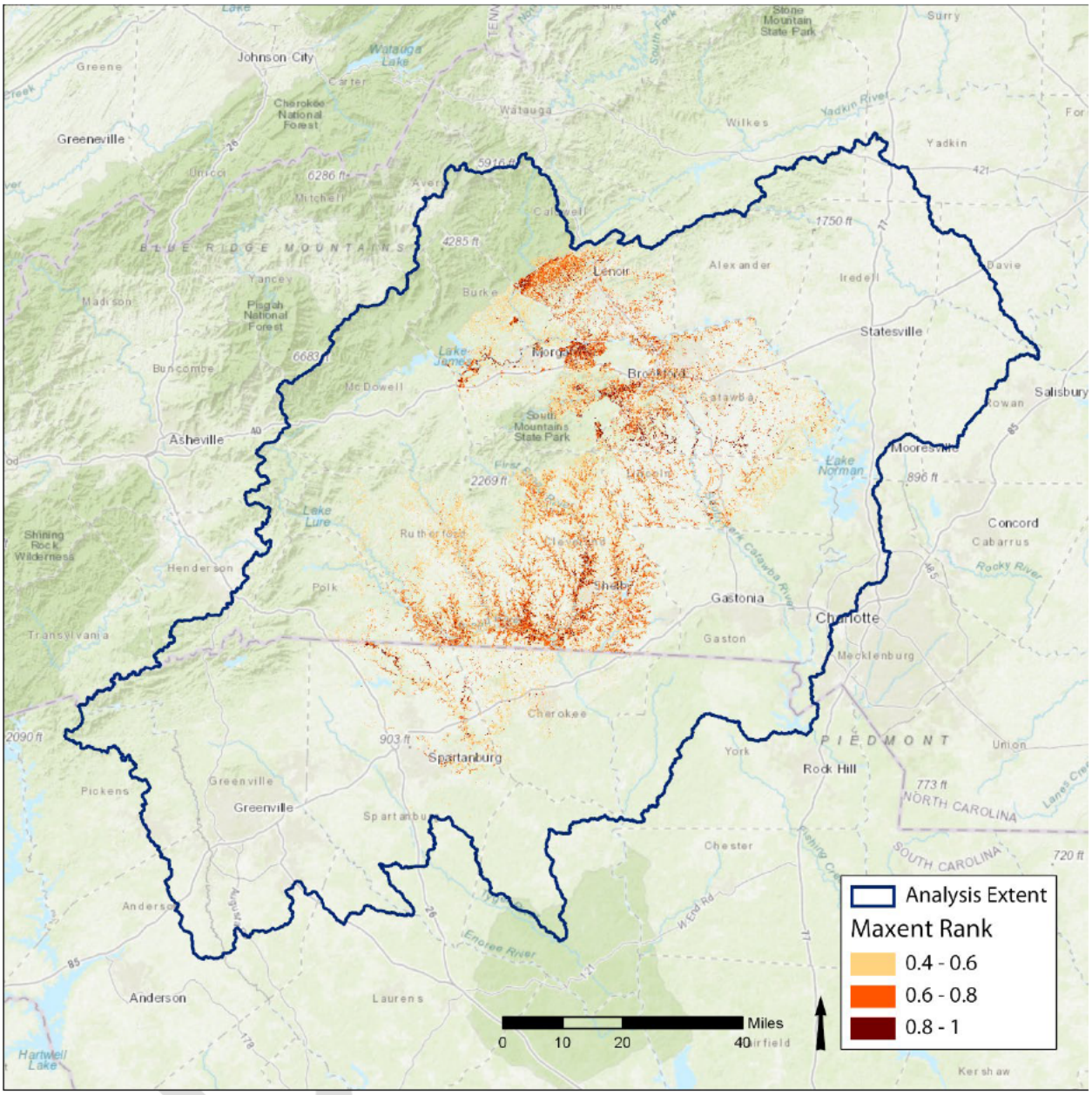
run results was excluded in the final model. The following variables were excluded: landcover diversity, canopy height, Soil Survey Geographic Database (SSURGO) drainage class, SSURGO hydrologic group, aspect 9-class, aspect 5-class, slope, solar radiation, and maximum annual temperature. It is interesting to note that a previous habitat modelling effort (Wagner 2013) included slope aspect, whereas the Maxent model excluded this variable. This does not mean the variable is not an important component of dwarf-flowered heartleaf habitat, but rather did not significantly improve the model. Also, landform data was included, and perhaps landform, which includes components of aspect and slope combined is a more meaningful variable than aspect or slope independently.

For the final model, a 10-run replicate Maxent model was created using cross-validation. For replicate models, the occurrence data is randomly split into a number of equal-sized groups called "folds", and separate models are created leaving out each fold in turn. The individual model runs are then averaged together to derive the final model.

Results

Figure 3.3 shows the model output. The minimum cutoff value (to determine if an area is considered potential habitat for a species) of 0.39 was determined by using the average 10th percentile training presence. The 10th percentile training presence uses the suitability threshold associated with the presence record that occurs at the 10th percentile of presence records (Phillips 2018). This value excludes some of the outlier population areas in the Maxent predictions to focus on the typical habitat conditions for this species. The total area ranked greater than 0.39 in the Maxent model was just 6% of the total analysis area (Table 3.1).

DRAFT


Analysis Extent
Maxent Rank
0.4 - 0.6
0.6 - 0.8
0.8 - 1
Miles
0
10
20
40
Johnson City
Greeneville
Asheville
Spartanburg
Greenville
Anderson
Gastonia
Charlotte
Rock Hill
Statesville
Salisbury
Concord
Hickory
Lenoir
Morganton
Brevard
Henderson
Transylvania
Pickens
Laurens
Chester
Union
Cabarrus
Mecklenburg
Gaston
Cleveland
Rutherford
Polk
Yancey
Madison
Buncombe
McDowell
Burke
Caldwell
Alexander
Iredell
Davie
Rowan
Wilkes
Yadkin
Surry
Watauga
Carter
Unicoi
Mitchell
Avery
Cherokee
Lincoln
Catawba
Shelby
York
Lancaster
Kershaw
Chesterfield
Darlington
Lee
Sumter
Richland
Fairfield
Newberry
Laurens
Greenwood
Abbeville
Edgefield
Aiken
Barnwell
Allendale
Hampton
Jasper
Beaufort
Colleton
Dorchester
Berkeley
Charleston
Georgetown
Horry
Marion
Florence
Dillon
Marlboro
Chesterfield
Lancaster
Kershaw
Lexington
Saluda
Edgefield
McCormick
Greenwood
Abbeville
Anderson
Oconee
Pickens
Greenville
Spartanburg
Cherokee
Union
Chester
Fairfield
Newberry
Laurens
Greenwood
Abbeville
Edgefield
Aiken
Barnwell
Allendale
Hampton
Jasper
Beaufort
Colleton
Dorchester
Berkeley
Charleston
Georgetown
Horry
Marion
Florence
Dillon
Marlboro
Chesterfield
Lancaster
Kershaw
Lexington
Saluda

predictions, with a mean AUC of 0.86 (AUC value of 0.5 is no better than random; AUC<0.5 is worse than random; AUC>0.5 is greater predictive power than random; Baldwin 2009).

The Maxent output supplies estimates of the relative contributions of the environmental variables to the Maxent model (Table 3.2). SSURGO map unit key (i.e. soil class) is the top contributing variable. One hundred and thirty-five individual soil types are present within the polygon boundaries of the *H. naniflora* EOs. Many of these individual soil types are part of soil complexes and are separated by things such as percent slope, erosion, how stony/rocky, and amount of clay. The most common individual soil type was Meadowfield-Rhodhiss complex, 25 to 60 percent slopes, very stony (14.1% of total). However, collectively the Meadowfield soils only comprised 14.3% of all soils. The individual Pacolet soil types were very common and collectively comprise 36% of all soil types present. Woolwine, Rion, and Fairview soils were also collectively common, comprising 10.4%, 9.7%, and 8.8% of all soils present respectively.

Table 3.2. Percent contribution of the environmental variables

Environmental Variable	Percent Contribution
SSURGO map unit key	23.5%
Minimum Annual Temperature	17.8%
Average Annual Precipitation	15.7%
Landcover	12.9%
Landcover Majority	12.0%
Landcover Hexastylis Grouping	5.4%
Geomorphons	4.9%
Elevation	4.6%
Canopy Cover	3.2%

The minimum annual average temperature range in the analysis extent is 39 – 51 degrees Fahrenheit. The majority of the *H. naniflora* EOs (89%) are found at 47 and 48 degrees. The average annual precipitation range in the analysis extent is 42 – 81 inches per year. The majority of the *H. naniflora* EOs (82%) are found in the 47 – 49 inches per year range.

Piedmont forested landcover habitats dominate the land area of the EOs. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier (53%), Southern Piedmont Mesic Forest (9%), Southern Piedmont Dry Oak-Pine Forest (5.2%), Southern Piedmont Small Floodplain and Riparian Forest (4.4%), and collectively comprise 71% of the EO area. Evergreen Plantation or Managed Pine (9%), Harvested Forest (7.2%), Developed, Open Space (5%), Pasture/Hay (2.1%) collectively comprise 22% of the total EO area. The remaining 6 percent of EO area is comprised of a mix of 14 other natural and disturbed landcover classes, but each at small percentages.

The landcover majority classification scheme reduces the total number of landcover classes present in the analysis extent from 23 to 11. Southern Piedmont Dry Oak-Pine Forest – Hardwood Modifier is still the dominant landcover class (58%). However disturbed categories are increased in area (sum total of 35%). Evergreen plantation or managed pine (12%) and Pasture/Hay (12%) are the only other categories that have at least 10% or greater area. The increase in disturbed landcover area representation in the landcover majority layer suggests that either many *H. naniflora* population areas are situated in areas impacted by disturbed landcover, or that the

majority of surveys have taken place in disturbed areas because of required surveys due to development.

The landcover *H. naniflora* grouping reveals the amount of disturbance present in *H. naniflora* population areas. Landcover classes grouped as disturbed comprises 27% of the total area. Mixed forest (deciduous and evergreen) comprises 58%, pasture/hay 12%, and hardwood forest 2%. Open water, evergreen and barren landcover groupings are all at less than 1% each.

Geomorphons revealed that the majority of *H. naniflora* EO areas are situated in concave landforms. Geomorphon categories hollow (13%), valley (46%), and depression (10%) collectively comprise 69% of all *H. naniflora* population areas. Flat landforms comprise 15.5% of the area and convex landforms the remaining 15.5%.

Within the analysis extent, the range of elevation present is 335 – 5,265 feet. For *H. naniflora*, the prime elevation range is from 666 – 908 feet (53% of total EO area). A lesser elevation range is present from 935 – 1,184 (37% of total EO area).

Canopy cover for the *H. naniflora* populations are dominated by Tree Cover 70-80% (20.2%) and Tree Cover 80-90% (63.9%). The rest of the canopy cover categories are 2% or less.

We performed a Kruskal-Wallis 1-way non-parametric Analysis of Variance (ANOVA) to investigate the relationship between Maxent scores and current resilience of populations (Table 3.3). There are significant differences in the average Maxent scores between the four resilience categories ($p = 0.04$) and the mean Maxent score increases as population resilience increases from low to very high. The model gives us some predictive ability regarding habitat suitability where higher Maxent scores, on average, result in higher population resilience. The model indicates that larger, more resilient populations occur in habitat that scored higher.

Table 3.3 Results of the Kruskal-Wallis 1-way non-parametric ANOVA investigating relationships between Maxent scores and current resilience groups for dwarf-flowered heartleaf.

Groups	*Count*	*Mean Rank*
low	13	30.7
moderate	25	30.7
high	5	42.8
very high	28	45.7

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	4375.7	4	1093.92	2.65	0.0404
Within Groups	28036.3	68	412.30		
Total	32412.0	72			

Reproduction and Presence of Pollinators

The pollination of *Hexastylis* has not been well studied but the genus is thought to be pollinated by insects including flies, wasps, and thrips (Otte 1977). Additionally, Lengyel et al. (2010) described how, within the family Aristolochiaeae, more than 50% of the plant lineage is myrmecochorous (seed dispersal via ants). This supports Gaddy's work (1986), which found three species within the Heterophylla complex (*H. heterophylla, H. naniflora, and H. minor*), which employ myrmecochory as a method for seed dispersal.

Because the flower for this species is often partially or completely covered with soil and leaf litter, possibly inhibiting pollinator activity (Gonzalez 1972), there is still uncertainty of the pollination mechanism for dwarf-flowered heartleaf. Otte (1977) suggests that a variety of possible pollinators reside in this leaf litter, however, the calyx opening is considered to be far too small for efficient pollinating (Gaddy 1981). There are, however, invertebrates within this proposed size limit that could theoretically act as pollinators. It is possible the species employs self-pollination, with or without a vector, or that cross-pollination occurs by a number of invertebrates. Jones et al. (2014) investigated pollination of dwarf-flowered heartleaf under a manipulative experimental design, and found that while insects may play a significant role in pollination, even without them, flowers managed to produce a partial seed set. Although flowers managed to produce seeds in the absence of insect pollinators, the efficiency of pollination decreased by almost 50%. Also, even if successful pollination occurs in the absence of insect vectors, the dispersal of plants amongst populations would be limited, and could result in decreased resilience due to genetic concerns such as limited gene flow and issues associated with potential inbreeding depression.

Abundance

The influence of stochastic variation in demographic (reproductive and mortality) rates is much higher for small populations than large ones. Stochastic variation in demographic rates causes small populations to fluctuate randomly in size. In general, the smaller the population, the greater the probability that fluctuations will lead to extinction. There are also genetic concerns with small populations, including reduced availability of compatible mates, genetic drift, and inbreeding depression. Small populations of dwarf-flowered heartleaf have low resilience, leaving them particularly vulnerable to stochastic events.

As of 2016, the combined databases of the NCNHP and SCDNR contain 239 EO records for *H. naniflora* (NCNHP 2016, SCDNR 2016). These EO records depict roughly 113 locations which are sufficiently geographically distinct to be regarded as proxies for populations of the species (See

Delineating Populations). Thus, the total number of populations has increased more than four-fold (from 24 to 113) since the species was listed in 1989.

At this time, the largest known populations have been monitored by NCNHP and NCDOT. The estimates for entire populations are based on a consistent monitoring methodology developed by NCDOT, the Service, and NCNHP with monitoring plots representing roughly 10% of a population. Populations were delineated to get a more accurate boundary and size of the area occupied. All rosettes were counted annually in each monitoring plot to estimate an extrapolated population size, based on the number and density in the plots. As a result of these efforts, better estimates of population sizes for the largest known populations are available, compared to when the last five-year review was completed in 2010 (Robinson and Padgett 2016).

The 113 EO records have been estimated to contain anywhere from a single rosette to over 100,000 rosettes. Appendix 1 was created by NCNHP (2016) to replicate the same format and population data as Table B2 of the most recent Service five-year review of *H. naniflora* (USFWS 2010), for comparison of changes since 2010, and summarizes the largest occurrences of *H. naniflora*, with the size of the population based on the number of rosettes it was last estimated to contain. The number of populations estimated to contain over 1,000 rosettes is 26. This is approximately 23% of the total known populations and many of these populations contain well over 1,000 individuals.

There are, however, 13 populations (12% of all known) that are simply known to be extant, with no available estimate of population size (NCNHP 2016, SCDNR 2016). If the most recent population estimates for each EO record are compiled across years of observation, the 113 populations could conservatively be estimated to contain a collective total of more than 300,000 rosettes (NCNHP 2016, SCDNR 2016).

Population Trends

Although abundance is critical in assessing the resilience of dwarf-flowered heartleaf, trends in population growth can also be informative. Long-term growth trends are typically defined as the degree of change in population size over 200 years, whereas short-term growth is typically measured as that degree of change over a 10 year period. We lack a robust data set to assess trends at either of these time scales. However, from 2012-2016, NCNHP conducted systematic annual surveys of thirteen of the largest populations across the range.

Based on the results of the five-year monitoring efforts completed in 2016, nine out of 13 populations remain stable during the five years of data collection (Robinson and Padgett 2016). The largest known population, Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop in Rutherford County, NC, is estimated to have over 100,000 rosettes (Robinson and Padgett 2016). This large population consists of many scattered subpopulations on private property; two of the subpopulations are protected as a Registered Heritage Area, although Registry is a non-binding agreement with landowners that can be cancelled at any time (NCNHP 2018).

Two of the 13 populations increased in numbers from 2012-2016: Cliffside Steam Station and Broad River: Floyds Creek, Long Branch. The Cliffside Steam Station is protected with a voluntary agreement with Duke Energy and was estimated to contain over 39,000 rosettes in 2016.

The Broad River: Floyds Creek, Long Branch population is not at all protected, but was last estimated to consist of over 12,000 individuals in 2016 (Robinson and Padgett 2016).

Based on the results of recent surveys and a review of all known populations of *H. naniflora*, the overall trend over approximately 30 years is estimated to be declining 10-30%. This is estimated by a combination of documented declines of some populations, while many others appear to be remaining relatively stable, and some have increased.

DRAFT

Chapter 4: CURRENT CONDITIONS

Below we assess current resilience, representation, and redundancy as they relate to population and habitat factors known to be important for species viability. Based on recent data and reports (Robinson and Padgett 2016; Robinson 2016), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple EOs and stand-alone EO records. Recent genetic research discussed in Chapter 2, suggests that dwarf-flowered heartleaf, as originally described, is found in the southern portion of its presumed range based on current EO locations, and the northern portion could be a currently undescribed species (Figure 4.1; Estep pers. Comm. 2018). The genetic analysis to support this is complete, but a review of the morphology is ongoing and a new species has not yet been described (Estep pers. Comm. 2018). For the purpose of this SSA, we assume all EO detections are *Hexastylis naniflora*, and represent the best currently available scientific data.

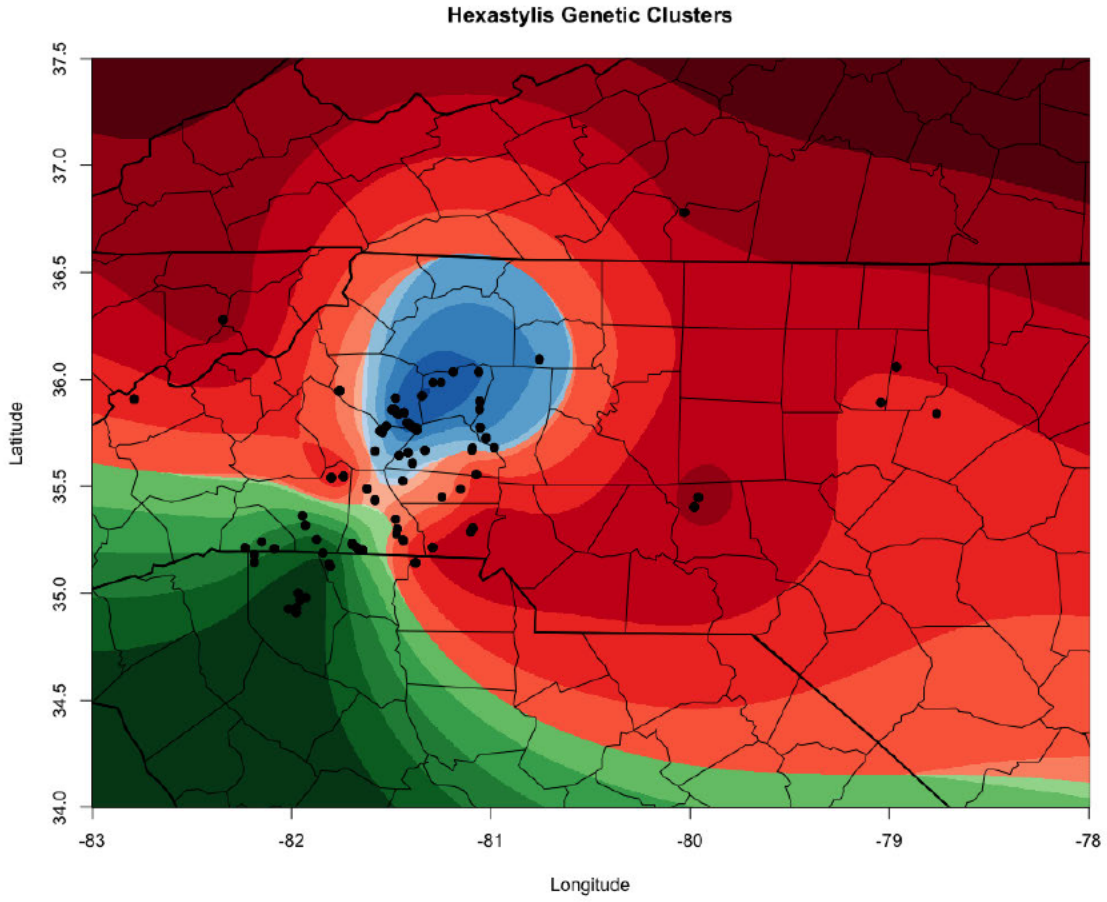


Figure 4.1. Recent genetic analyses detailing clustering of the genus *Hexastylis*. Black dots represent GIS locations of individual plants included in the genetic analysis. Green areas represent "true" *H. naniflora*; Blue represents a possible new species; Red represents other species in the genus (*H. minor, H. heterophylla*, etc.).

Current Population Resilience

Categorizing Resilience

For the purposes of this SSA, we use population size as the main driver of population resilience. The unit of measurement for population size in this species is a "clump" (rosette). As discussed previously, populations in North Carolina were delineated by NCNHP, whereas the Service defined populations in South Carolina. These delineations were based off of NatureServe criteria such as EO separation distance and intervening landscape matrix. EO data included a wide range of years since the species was last observed at a given location (1964-2017), so although recent data and reports suggest the species consists of 119 populations, some of that data is fairly outdated. For the purposes of this SSA, we only used EOs that were observed since 2005. We did this for several reasons. First, we did not want to go back too far and assume a population was still present. Second, we wanted to be consistent in what we considered "current" for both categorizing resilience and use in the habitat model. Also, experts concurred that records as old as 12 years are still likely to persist. Finally, there was a natural break in the data at the year 2005, coinciding with the year the last five-year review was initiated, where the number of EOs dropped off significantly in the years 2004 and earlier. It is important to note that many of the populations that we excluded from our analysis may still persist on the landscape. In fact, many EOs for this species have persisted for decades, despite not having intervening surveys to confirm their persistence.

Based on the criteria (excluding EOs prior to 2005), there are currently 78 populations distributed across the range of dwarf-flowered heartleaf, although this may be an underestimate as discussed above.

To determine overall resilience for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resilience categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are also incorporated secondarily. Appendix 2 shows the NCNHP EO rank specifications for dwarf-flowered heartleaf. The EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, given there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, depending on habitat conditions; poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016; Robinson and Padgett 2016) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat level information for every population we assessed, we synthesized all of the above population size information and created four resilience categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.

DRAFT

- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Occupancy and Abundance

There are 78 populations of dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). Table 4.2 shows the contribution of each resilience category as follows: 36% (very high); 7% (high); 34% (moderate); 23% (low). When looking at cumulative percentages of resilience, it is interesting to note that 77% of all of the populations are classified as moderate to very high resilience (Table 4.2).

Table 4.1. Current populations of dwarf-flowered heartleaf and associated resilience across the species range. Abundance and last observation date based on Natural Heritage Program data (2018).

Site Name	State	County	Last Observed	Total plants	Resilience
Glade Creek, Alex County	NC	Alexander	2017	>1000	very high
Catawba River: Hoyle Crk-Micol Crk	NC	Burke	2013	>1000	very high
Island Creek Heath Bluff	NC	Burke	2016	>1000	very high
Gunpowder Creek: South of Hudson	NC	Caldwell	2012	>1000	very high
Peaked Top Rare Plant Site/Foothills Landfill	NC	Caldwell	2014	>1000	very high
Jacob Fork West Corridor	NC	Catawba	2012	>1000	very high
Murrays Mill/Upper Balls Creek NA	NC	Catawba	2013	>1000	very high
NCDOT TIP: R-2824	NC	Catawba	2015	>1000	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	NC	Catawba	2013	>1000	very high
Cowpens NBF - Site 1	SC	Cherokee	2016	>1000	very high
Cliffside Steam Station	NC	Cleveland/Rutherford	2016	>1000	very high
Broad River/Sandy Run NA	NC	Cleveland	2012	>1000	very high
Broad River: Brushy Creek	NC	Cleveland	2016	>1000	very high
Buffalo Creek: Kings Mountain Res	NC	Cleveland	2016	>1000	very high
Buffalo Creek: Tributaries N and S of SR 2047	NC	Cleveland	2012	>1000	very high
Rhyne Conservation Preserve	NC	Lincoln	2016	>1000	very high
Mill Creek Forest and Seep	NC	Polk	2016	>1000	very high

DRAFT

Site Name	State	County	Last Observed	Total plants	Resilience
New Hope Springhead Swamp	NC	Polk	2016	>1000	very high
Big Horse Creek Rare Plant Site	NC	Rutherford	2015	>1000	very high
Broad River: Floyds Creek	NC	Rutherford	2016	>1000	very high
Davenport Road/Mountain View Rare Plant Site	NC	Rutherford	2016	>1000	very high
Facebook Site	NC	Rutherford	2016	>1000	very high
Floyds Creek Tributray Rare Plant Site	NC	Rutherford	2012	>1000	very high
New Bethel Rare Plant Site	NC	Rutherford	2015	>1000	very high
Richardson Creek trib above Toms Lake	NC	Rutherford	2016	>1000	very high
DNR Peters Creek Heritage Preserve	SC	Spartanburg	2016	>1000	very high
Taylor Blalock Res	SC	Spartanburg	2016	>1000	very high
Leepers Creek Heartleaf Site	NC	Lincoln	2006	>1000	very high
Little Gunpowder Creek Rare Plant Site 1	NC	Caldwell	2015	500-1000	high
Little Gunpowder Creek Rare Plant Site 2	NC	Caldwell	2015	500-1000	high
Northern Catawba County	NC	Catawba	2017	500-1000	high
Rock Barn Solar Farm	NC	Catawba	2010-2011	500-1000	high
Buffalo Creek Rare Plant Site	NC	Cleveland	2012	500-1000	high
Third Creek Rare Plant Site	NC	Alexander	2010	100-500	moderate
Hickory Area	NC	Burke/Catawba/ Caldwell	2016	100-500	moderate
Burke County - Drowning Creek UT	NC	Burke	2017	100-500	moderate
Simms Hill/Little River Uplands	NC	Burke	2015	100-500	moderate
Smith Cliff/Henry Fork River	NC	Burke	2015	100-500	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	NC	Catawba	2016	100-500	moderate
NCDOT TIP R-2824	NC	Catawba	2015	100-500	moderate
South Fork Catawba River, Henry Fork	NC	Catawba	2007	100-500	moderate
Broad River/Sandy Run NA	NC	Cleveland	2012	100-500	moderate
Brushy Creek Headwaters	NC	Cleveland	2014	100-500	moderate

DRAFT

Site Name	State	County	Last Observed	Total plants	Resilience
First Broad River: Crooked Run Creek	NC	Cleveland	2010	100-500	moderate
No Business Creek, Boyd Tract	NC	Cleveland	2007	100-500	moderate
West Shelby Mesic Slope	NC	Cleveland	2016	100-500	moderate
UT of Kings Mountain Res	NC	Gaston	2012	100-500	moderate
Buffalo Shoals Creek	NC	Iredell	2014	100-500	moderate
Cat Square Heartleaf Forest	NC	Lincoln	2012	100-500	moderate
Collinsville (Hughes) Creek Slopes	NC	Polk	2016	100-500	moderate
Fox Knoll Farm	NC	Polk	2016	100-500	moderate
Forest City: Adj to Isothermal CC	NC	Rutherford	2010	100-500	moderate
Jonas Road Rare Plant Site	NC	Rutherford	2014	100-500	moderate
Knob Creek NA	NC	Cleveland	2005	100-500	moderate
Buffalo Creek	NC	Cleveland	2005	100-500	moderate
Kross Keys NA	NC	Polk	2005	100-500	moderate
Catawba River: North Fork Mountain Creek	NC	Catawba	2005	100-500	moderate
Catawba River: Lake James	NC	Burke	2006	100-500	moderate
Hogpen Branch Transplant Site	NC	Rutherford	2005	100-500	moderate
NCDOT TIP R-3603A	NC	Alexander	2017	<100	low
South Mountains Pleasant Grove Uplands	NC	Burke	2016	<100	low
Gunpowder Creek	NC	Caldwell	2012	<100	low
Killian Crossroads	NC	Catawba	2010	<100	low
Pott Creek	NC	Catawba	2012	<100	low
Beaverdam Crk at First Broad River	NC	Cleveland	2011	<100	low
Buffalo Creek: Potts Creek	NC	Cleveland	2012	<100	low
Buffalo Creek: Ravine	NC	Cleveland	2007	<100	low
Hickory Creek - UT (Shelby High School)	NC	Cleveland	2016	<100	low
Boulder Creek Subdivision - Jordan Road	SC	Greenville	2016	<100	low
Gateway Elementary School	SC	Greenville	2017	<100	low
Fanjoy Road Site	NC	Iredell	2015	<100	low
Levan Family Farm	NC	Iredell	2013	<100	low
Lincoln County, SR-1314	NC	Lincoln	2014	<100	low
Northeast Lincolnton: UT Walker Branch	NC	Lincoln	2009	<100	low

DRAFT

Site Name	State	County	Last Observed	Total plants	Resilience
Sandy Spring Church Springhead Swamp	NC	Polk	2005	<100	low
First Broad River: Hickory Creek	NC	Cleveland	2006	<100	low
Smith Cliff/Henry Fork River	NC	Burke	2005	<100	low
First Broad River: Beaverdam Creek Tribs	NC	Cleveland	2006	<100	low

Table 4.2. Population resilience categories by county for dwarf-flowered heartleaf.

County	Very High	High	Moderate	Low	Totals
Alexander	1		1	1	3
Burke/Catawba/Caldwell			1		1
Burke	2		4	2	8
Caldwell	2	2		1	5
Catawba	4	2	4	2	12
Cherokee	1				1
Cleveland/Rutherford	1				1
Cleveland	4	1	7	6	18
Gaston			1		1
Greenville				2	2
Iredell			1	2	3
Lincoln	2		1	2	5
Polk	2		3	1	6
Rutherford	7		3		10
Spartanburg	2				2
Totals	**28**	**5**	**26**	**19**	**78**
% of total	*36*	*7*	*34*	*23*	*100*
Cumulative %	*40*	*43*	*77*	*100*	--

DRAFT

Population Trends

Although we lack an adequate past time series of abundance data for all populations to estimate growth rates or population trends, NCNHP conducted surveys of 13 of the largest populations across the range of the species from 2012-2016. Table 4.3 shows the results of all of these surveys. Two populations show an increasing trend, nine show a stable trend, and two show a decreasing trend.

Table 4.3. Summary of population trends over 5 years of monitoring data for 13 of the largest populations of dwarf-flowered heartleaf across its range (Robinson and Padgett 2016).

Trend	Survey	Site	2016 estimated number of plants (Rosettes)	2016 area occupied (Acres)
Increasing	NCNHP	Cliffside Steam Station (EO 276)	39,535	52
	NCNHP	Broad River: Floyds Creek, Long Branch (EO 177)	12,687	5.67
Stable	NCNHP	Island Creek Bluff/Love Lady Site (EO 029)	50,481	61.76
	NCNHP	Rhyne Preserve (EO 302)	19,873	22.43
	NCNHP	Mills Creek Forest and Seep (EO 023)	1,733	1.39
	NCNHP	New Hope Springhead Swamp (EO 125)	12,235	5.03
	NCNHP	Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop (EO099)	106,940	83.39
	NCNHP	Broad River: Cleghorn Creek, US 221 (EO 176)	6,750	7.24
	NCNHP	Cowpens National Battlefield (SC EO 016, 017, 018)	2,823	6.05
	NCNHP	Peters Creek Preserve (SC EO 011)	3,306	8.98
	NCNHP	Blalock Reservoir (SC EO 007, 031)	3,505	7.59
Decreasing	NCNHP	Second Broad River (Forest City Industrial Complex) (EO 154)	2,576	4.74
	NCNHP	South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)	123	0.09

Current Species Representation

Representation describes the ability of a species to adapt to changing environmental conditions. We lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species.

Current Species Redundancy

For the dwarf-flowered heartleaf to maintain viability, the species also needs to exhibit some degree of redundancy. Species-level redundancy reflects the ability of a species to withstand catastrophic events, and is best achieved by having multiple, widely distributed populations relative to the spatial occurrence of catastrophic events. Redundancy for dwarf-flowered heartleaf is the total number and resilience of population segments and their distribution across the species range.

An important question when investigating redundancy for dwarf-flowered heartleaf is, "what exactly is a catastrophe?" We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, like hurricanes, and often with devastating effects, however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010).

As stated previously, there are 78 populations of dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). The populations are spread across the range, although a majority occurs in North Carolina. Although, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances, the species range is very small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

DRAFT

Chapter 5: INFLUENCES ON VIABILITY

Hexastylis naniflora populations occur in rapidly growing urban areas with expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, SC, to the south. At the time of listing, the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. In addition to threats associated with residential, commercial, and industrial development, other documented threats include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of ponds, impacts from grazing cattle, ORV damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or siltation (NCNHP 2016, Robinson and Padgett 2016). Climate change may exacerbate these risk factors through changes in temperature and precipitation.

Threats were assessed for populations monitored by NCNHP during 2012-2016 (Robinson and Padgett 2016), and EOs were reviewed for other documented threats to populations. Indirect or direct threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank for each threat factor determines the overall value for each threat observed at each population. No significant changes in threats within populations were noted from 2012-2016. Threats observed during these years included development, incompatible forestry practices, agriculture, trampling, invasive exotic species, sedimentation, erosion, and road construction.

Below, we summarize primary threats to the viability of dwarf-flowered heartleaf. Primary influences will be carried forward in our future projections in the next section.

Human Population Change

Increasing human populations drive development. With increases in population, there will be increasing conversion of open space to more impervious cover, with a subsequent increase in roads and other associated infrastructure. Increases in roads and impervious cover have the potential to lead to habitat loss and/or fragmentation, a primary risk factor for dwarf-flowered heartleaf. Tables 5.1-5.2 and Figures 5.1-5.2 show the estimated human population increases for North and South Carolina counties within the range of the species. The most populous counties include Greenville and Spartanburg in South Carolina, and Catawba, Gaston, and Iredell in North Carolina.

DRAFT

Table 5.1. Human population projections for North Carolina counties within the range of dwarf-flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

County	2018	2023	2028	2033	2037
Alexander	38,609	39,244	39,686	39,992	40,169
Burke	90,865	93,124	95,382	97,644	99,452
Caldwell	83,919	86,723	88,689	91,126	92,870
Catawba	157,424	159,799	162,175	164,549	166,447
Cleveland	98,862	99,685	100,004	100,128	100,170
Gaston	221,112	227,667	237,344	245,276	252,388
Iredell	179,740	195,623	211,501	227,383	240,088
Lincoln	84,494	91,034	96,865	103,069	107,858
Polk	21,273	21,823	22,288	22,681	22,955
Rutherford	67,880	68,154	68,283	68,341	68,368

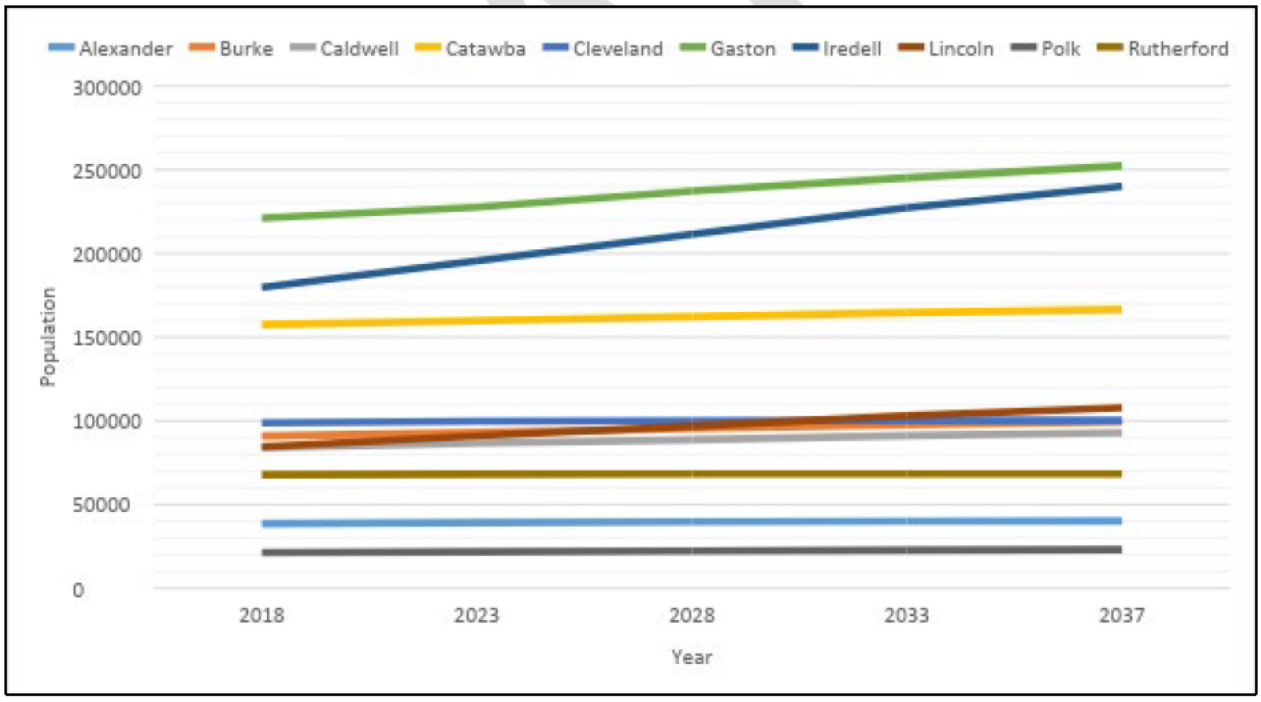


Figure 5.1. Human population projections for North Carolina counties within the range of dwarf-flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

Table 5.2. Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

County	2020	2025	2030	2035
Cherokee	61,760	64,760	67,350	70,170
Greenville	492,890	517,740	542,290	567,010
Spartanburg	310,220	323,550	336,810	350,110

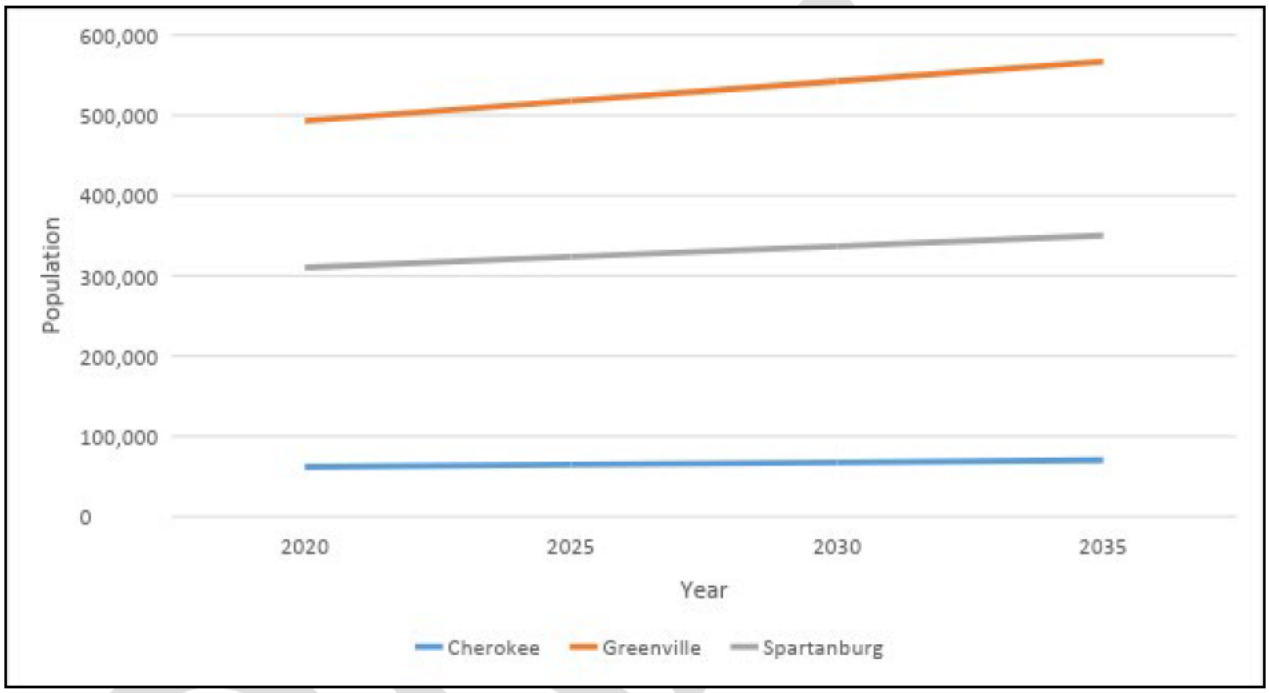


Figure 5.2. Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

Development

A large number of the known populations occur near expanding urban areas and are threatened by the residential, commercial, and industrial development associated with this growth. Populations occurring in more rural areas are threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds.

A 2010 review of existing NHP EO data revealed that all or portions of 26 populations (24% of the total) had been directly or indirectly impacted through development projects or other causes such as trash disposal, expansion of residential lawns, cattle, or invasive exotics (NCNHP 2010; SCDNR 2010). Another 16 populations have been specifically reported to be threatened by one or more of these same sources. Therefore, threats have either occurred or are reasonably

foreseeable within 42 populations (corresponding to 37% of all known populations). Of these 42 populations, all or portions of 22 (50%) had been adversely impacted by activities requiring ESA Section 7 consultation with the Service. The fact that nearly 20% of all known populations had been subject to formal Section 7 consultation illustrates the threats faced by the species.

In the same 2010 review, the most recurrent source of habitat destruction, and certainly the most common trigger for Section 7 consultations involving *Hexastylis naniflora* is road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of Section 7 consultations between the Service and the NCDOT. Collectively, these projects have adversely impacted or are currently expected to impact some 22,135 rosettes. In most cases, the Section 7 process has resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection to those plants remaining (post-construction) within NCDOT right-of-way (ROW).

Other forms of economic development have also resulted in the destruction or modification of habitats occupied by *H. naniflora*; in many cases, these activities have also required Section 7 consultations with the Service. Examples of these activities include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities (in compliance with Federal Aviation Administration standards) at a regional airport. Collectively, these activities have involved the loss or relocation of several thousand rosettes.

Blalock Reservoir in Spartanburg County, South Carolina was once estimated to contain the largest population of *H. naniflora*, with over 11,000 rosettes reported here in 1997 (JJ&G 1998). This population was the subject of a Section 7 consultation as a result of a proposal to raise the elevation of Blalock Reservoir, which provides water supply storage to Spartanburg County and the City of Spartanburg (USFWS 2001). Approximately one-third of this population was directly threatened by inundation, and the Federal agency committed to the relocation of some 3,054 rosettes to remaining areas of occupied habitat around the reservoir. At the conclusion of formal Section 7 consultation, the Service anticipated that as many as 6,619 rosettes (assuming that all transplants survived) would be afforded protection through restrictive covenants placed on properties owned by the Spartanburg Water System (SWS) surrounding Blalock Reservoir. However, this population was last reported to contain a mere 1,400 rosettes (Newberry 2006), and has twice since been impacted by encroachments from adjacent landowners (Newberry 2009; Schneider 2006, and JJ&G 2006). Some of these apparent declines could be partially an artifact of incomplete survey effort, in that the exhaustive surveys which led to the 1997 estimate (of 11,000 rosettes) have never been repeated. However, it seems unlikely that plants occurring on privately owned shoreline not subject to restrictive covenants would be any more stable than those occurring on properties specifically protected and managed for the species (by SWS).

Invasive Species and Woody Encroachment

Several populations of dwarf-flowered heartleaf occur on steep ravine slopes with stands of mixed hardwoods and an understory of mountain laurel (*Kalmia latifolia*) or *Rhododendron spp*. These stands are often very dense and reduce the amount of light reaching the dwarf-flowered heartleaf plants growing below. Under these conditions the plants often show reduced vigor and reduced

flower and fruit production. Careful, selective logging or natural tree fall and limited understory removal would open up these populations to more light. Additional light, if not accompanied by increased siltation from the intensive soil disturbances associated with forest clear-cutting, probably would benefit these populations (Gaddy 1981).

Invasive exotic plant species occur across the range of this species. Plants such as English Ivy, Chinese privet, Japanese honeysuckle and Japanese stiltgrass are known at several sites which contain dwarf-flowered heartleaf. Invasive, exotic species were identified as a threat at eight of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17-19). The eight populations include four stand-alone EOs and four parent EOs with 19 sub-EOs. Of the four stand-alone EOs, one has an invasive threat rank of B (moderate to severe, imminent threat for a significant portion (20-60%) of the population, occurrences, or area), two have a rank of F (low severity threat for most or significant proportion of population, occurrences, or area), and one has a rank of G (low severity threat for a small proportion of population, occurrences, or area). Of the 19 sub-EOs, nine have invasive, exotic species identified as a threat. Of the nine sub-EOs, one has an invasive threat rank of A (moderate to severe, imminent threat for most (>60%) of population, occurrences, or area), four have a rank of B (moderate to severe, imminent threat for a significant portion (20-60%) of the population, occurrences, or area), two have a rank of E (moderate to severe threat for small proportion of population, occurrences, or area), and two have a rank of G (low severity threat for a small proportion of population, occurrences, or area). The one stand-alone and five sub-EOs with the highest threat ranks (A and B) are located in three populations. Based on the most recent monitoring data, one is increasing, one is stable, and one is decreasing (Robinson and Padgett 2016, p.11).

Invasive exotic species were identified as a threat at all (three) South Carolina populations monitored by NCNHP and all sites had an invasive threat rank of F (low severity threat for most or significant proportion of population, occurrences, or area) (Robinson and Padgett 2016, pp. 20). Based on the most recent monitoring data, all populations are stable (Robinson and Padgett 2016, p.11).

This data indicates that dwarf-flowered heartleaf populations can persist and increase in the presence of exotic invasive species. Despite the long-term presence of invasive, exotic plants, from 2012 to 2016 there were no significant changes in the threats facing the plant (NCNHP 2016, p. 8).

Climate Change

There is a growing concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin et al. 2002, p. 6074; Golladay et al. 2004, p. 504; Cook et al. 2004, p. 1015). Because typical habitats for this species include moist soils adjacent to creeks, streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993), specific effects of climate change to the dwarf-flowered heartleaf are likely related to changes in soil moisture associated with potential increases in drought.

DRAFT

Warming in the Southeast is expected to be greatest in the summer (NCCV 2016) which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p.7; NCCV 2016). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p.7).

Despite the recognition of potential climate effects on ecosystem processes, there is uncertainty about what the exact climate future for the Southeastern US will be and how the ecosystems and species in this region will respond. Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. As a result, impacts from rapid urbanization in the region might be exacerbated under even a mild to moderate climate future.

Regardless of a pessimistic, optimistic, or status quo climate future, the following systematic changes are expected to be realized to varying degrees in the Southeastern US (IPCC 2013):

- More frequent drought
- More extreme heat (resulting in increases in air and water temperatures)
- Increased heavy precipitation events (e.g., flooding)
- More intense storms (e.g., frequency of major hurricanes increases)
- Rising sea level and accompanying storm surge

In recent years, the Southeast has experienced moderate to severe droughts that many observers have implicated in population declines and poor transplant survivorship (NCNHP 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County; Golder and Associates 2009), and although moderate controlled burns do not negatively affect this population (Walker et al. 2009), severe wildfires could have negative effects. Accelerated climate change is expected to increase the frequency and extent of drought conditions across the southeast (Karl, et al. 2009). The extent to which these climate changes will significantly affect populations of dwarf-flowered heartleaf is currently unknown.

Appendices 4a and 4b gives summary reports on historical and future predicted climate parameters from the USGS National Climate Change Viewer for both North and South Carolina. As discussed above, the trend for these States is consistent with the general trend in the Southeast: more frequent drought, more extreme heat, and increased precipitation events. If these predictions hold true, dwarf-flowered heartleaf habitat would likely be impacted through increased evaporative rates and decreased soil moisture (Appendices 4a and 4b), increased potential for catastrophic wildfire events, as well as potential disruption of stream bank morphology through increased flooding events. Our habitat model indicates a preferred temperature and precipitation range, indicating that the species would be sensitive to a changing climate.

DRAFT

Chapter 6: FUTURE CONDITION

Future Considerations

Our analysis of the past, current, and future influences on what the dwarf-flowered heartleaf needs for long term viability revealed that there are several influences that pose risks to future viability of the species. These risks are primarily related to habitat changes from development and long term climate change. We use projections of urban development to assess potential habitat loss and fragmentation. We also considered how climate change may exacerbate the impacts of development in a qualitative fashion using a narrative approach.

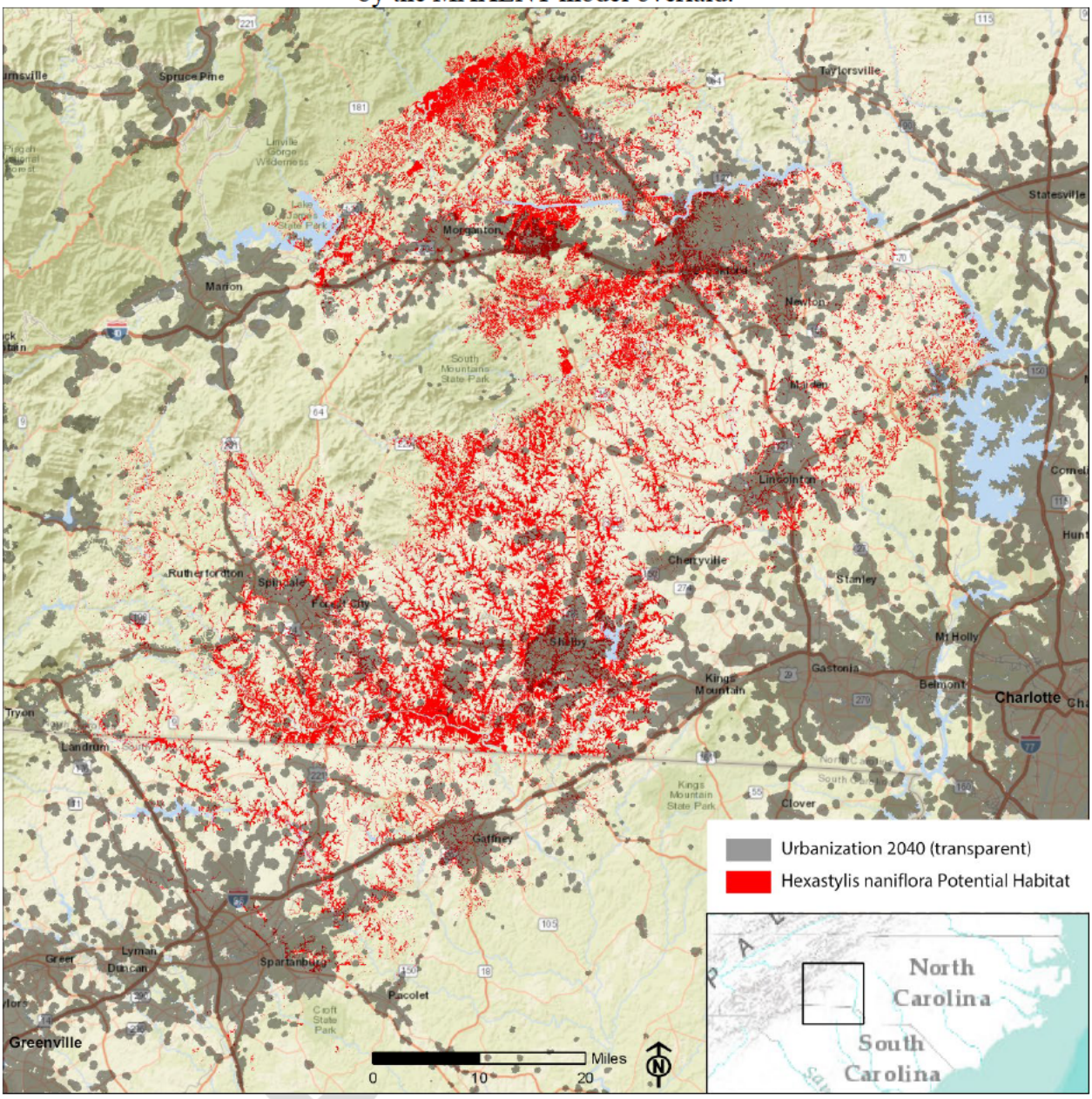
Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below. Based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape, we chose to project populations out to the year 2040 under each scenario, but no further.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040 (Figure 6.1). SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995).

DRAFT

Figure 6.1. Results of the SLEUTH model with *Hexastylis naniflora* potential habitat predicted by the MAXENT model overlaid.



The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0-100%. We chose 80% probability as our cutoff, as this cutoff has been used by USGS and other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- % increase in projected development (SLEUTH probability of urbanization >80%) within current populations
- % increase in projected development (SLEUTH probability of urbanization >80%) within areas delineated as potential habitat by the Maxent habitat model

There is no data available on the exact relationships between urbanization and the impacts to dwarf-flowered heartleaf. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for % increase in urban development to capture potential deleterious effects: 25% and 50%. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25% of the area of current populations was likely to have some negative impacts; development increase of at least 50% was likely to have significant impacts to populations. We also assume that populations currently on protected lands are likely to see smaller impacts from urbanization compared to those that are not protected, but protection status (perpetuity vs non-perpetuity) matters. For example, Registered Heritage Areas are non-binding agreements with a land owner, and if the land changes ownership, or the owner decides not to continue with the agreement, then the Registry is no longer valid. Appendix 5 shows the protection status of each delineated population which helped to inform our assessment of resilience under each scenario.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios: Targeted Conservation and Status Quo. We believe this is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider for Current Conditions include detections that have occurred within the last few years. Second, we did not include many older detections (i.e. only included detections since 2005), although many of those detections are likely to persist. Dwarf-flowered heartleaf is a long-lived perennial, and several EOs have been revisited after more than 10 years and the species was present. For example, one such EO was first observed in 1957 and next observed in 2001. It seems as long as suitable habitat is still present, it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future, was to identify EOs from populations that were last observed prior to 2005 (i.e. our cut-off for current populations). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005-current) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005-current. If these older EOs within current populations that were not included in our Current Condition assessment are found to be likely to persist, then it is possible we underestimated the resilience of that population.

Once these older EOs were identified, we created a 1,000-meter buffer around the population and calculated a number of useful metrics including resilience category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20-25 year projection window. Resilience categories were assessed using last known abundance in the same way as populations assessed in the Current Conditions section (i.e. low = less than 100 individuals; moderate = 100-500 individuals; high = 500-1000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and % Maxent classified as 0.8-1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000-meter buffer. The % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat within the 1,000-meter buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000-meter buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-flowered heartleaf is likely to persist. Table 6.1 (North Carolina) and 6.2 (South Carolina) show all of the EOs we considered and the corresponding metrics associated with resilience categories, urban development, and habitat scores.

Table 6.1. North Carolina raw data for metrics assessed to investigate potential sites where dwarf-flowered heartleaf was historically found and is likely to persist. Resilience categories are based on last known abundance estimates as follows: 1 = low; 2 = moderate; 3 = high; 4 = very high. MAXENT Average Mean refers to the mean Maxent score of all potential habitat. % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat that falls within the highest habitat class. % Urban Development refers to the percentage of the 1,000-meter buffer around the EO that is projected to be urbanized in the year 2040.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	2	34	1	3
2				
3	2	22	0	10
4	2	22	0	7
5	2	21	0	0
6				
8	1	27	0	6
9	3	44	4	0
10	4	33	2	0
11				
12	4	54	10	0

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
13	1	31	1	30
14	2	61	16	7
15				
16	4	18	0	47
17	1	50	13	0
18	1	36	8	2
19				
20	2	22	1	88
21	2	34	4	54
23	4	15	0	8
25	1	47	15	30
27				
28	2	43	12	29
29	4	43	8	30
30	4	27	2	74
31	4	30	3	86
32	2	34	2	47
33	2	33	3	0
34	1	49	13	63
35	1	42	10	23
36	1	19	0	12
37	4	41	6	17
38	2	14	0	46
39	1	19	0	11
40	2	37	2	32
44	4	20	0	59
45	1	27	5	13
46	3	42	6	6
47	1	28	1	96
48	1	14	0	12
49	4	61	14	5
50				
51	4	52	11	18
52	2	46	4	0
53	1	35	4	24
54	1	35	1	10
55	4	30	0	0
56	2	40	2	6
57	2	21	0	80

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
58	1	42	5	0
59	2	11	0	49
60	1	25	0	2
61	3	41	0	0
62	2	34	0	0
63	1	27	0	6
64	2	39	9	11
69	2	46	11	19
70	2	38	1	0
71	2	30	2	0
72	2	52	14	0
73	4	60	17	1
74	3	65	14	4
75	4	47	6	9
76	4	42	4	10
77	3	31	1	27
79	2	39	1	0
80	1	43	4	15
83	2	17	0	11
84	2	13	0	1
85	2	42	4	5
87				
89	2	13	2	0
90	2	28	2	0
91	1	49	5	0
92	2	15	0	30
106	4	39	4	38
107	1	14	0	40
113	4	46	4	7
114				
115	2	37	3	26
118	3	42	0	9
121	2	41	5	0
122	1	12	0	39
124	1	12	0	9
125	4	15	0	41
130	2	17	0	24
149	4	64	17	3
151	2	16	0	27

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
154	4	30	1	22
157	2	20	0	0
158	3	36	7	5
159	4	62	24	60
160	3	62	24	32
161	4	64	28	30
162	1	32	2	58
163	2	15	0	56
164	3	18	0	52
165	1	13	0	56
166	1	14	0	40
167	4	30	0	20
168	4	19	0	34
169	1	30	0	12
170	2	17	0	40
172	1	39	3	7
173	2	30	1	48
174	1	42	4	16
175				
180	2	21	1	0
181	4	29	2	0
182	4	45	4	0
183	2	15	0	5
184	4	19	0	19
187	2	20	1	35
188	2	24	0	53
189	1	25	0	14
190				
191	2	34	2	0
192	2	35	3	0
193	2	36	7	6
194	4	51	14	18
195	1	21	0	96
196	1	23	4	67
197	4	35	8	38
198	2	32	6	25
199	2	29	5	43
200	1	26	2	87
201	1	39	4	63

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
202	4	35	4	85
203	1	43	4	49
204				
205	2	43	1	49
206	1	37	3	66
207	2	33	2	85
208	1	32	1	67
209	2	33	2	94
210				
212	1	37	3	85
213	1	36	4	72
219	1	32	1	4
222	2	23	3	7
223				
224	1	22	3	17
225	2	24	2	12
227	4	55	2	5
229	2	28	0	21
230	1	54	15	13
231	1	41	7	0
233	4	53	12	14
235	2	50	8	6
236	2	62	14	5
237	2	67	16	5
238	4	51	15	0
239	2	63	14	5
240	1	57	18	0
241	2	62	16	3
242	1	53	9	0
246	1	62	13	4
249	4	47	5	0
250	4	45	4	0
251	4	43	4	0
254	2	54	18	6
255				
256	2	54	15	13
258	3	19	0	51
259	4	25	0	0
262	4	29	2	50

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
263				
264				
265				
266				
267	2	29	1	0
268	1	33	2	0
269	2	49	17	0
270	1	46	18	1
271	1	26	7	0
272	1	33	0	71
273	2	28	2	0
274	2	50	8	0
275	2	12	0	0
276	4	42	5	21
277				
278				
279	1	32	4	89
280	2	64	30	30
281	1	64	31	36
282	1	64	31	51
283	1	65	34	59
284	1	64	35	45
286				
287	2	15	0	35
291	2	21	1	84
292	2	14	0	83
293	1	8	0	16
294	2	36	4	61
296	2	3	0	5
297				
298	2	16	0	1
299	1	12	0	0
300	1	9	0	18
303	2	31	0	0
304	2	31	0	0
305	1	30	2	0
306	1	4	0	53
308	2	15	0	3
309	1	5	0	0

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
310	4	58	26	35
311	2	15	0	0
312	4	17	0	57
313				
314				
315	1	36	4	61
317	1	15	0	53
318	2	34	4	52
319	4	43	4	10
320	4	41	6	98
321				
Min	1	3	0	0
Max	4	67	35	98

Table 6.2. South Carolina raw data for metrics assessed to investigate potential sites where dwarf-flowered heartleaf was historically found and is likely to persist. Resilience categories are based on last known abundance estimates as follows: 1 = low; 2 = moderate; 3 = high; 4 = very high. MAXENT Average Mean refers to the mean Maxent score of all potential habitat. % Maxent classified as 0.8-1.0 represents the percentage of all potential habitat that falls within the highest habitat class. % Urban Development refers to the percentage of the 1,000-meter buffer around the EO that is projected to be urbanized in the year 2040.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	2	21	0	0
2	2	1	0	4
3				
4	1	13	0	10
5	2	0	0	64
6	1	0	0	36
7	4	27	0	35
8	2	0	0	14
9				
10				
11	4	14	0	52
12				
13	1	7	0	100

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
14	4	14	0	43
15	1	0	0	4
16	4	22	0	38
17	4	22	0	33
18	3	19	0	52
19	1	12	0	65
20	2	5	0	100
21	3	5	0	90
22	1	0	0	0
23				
24	1	4	0	3
25	1	14	0	48
26	4	12	0	65
27	4	18	1	40
28	4	19	1	49
29				
30	2	7	0	88
31	4	0	0	0
32	2	7	0	93
33	2	2	0	20
34	1	31	3	1
35	1	23	1	53
36	2	6	0	0
37	1	24	2	0
38	4	5	0	37
39	1	6	0	1
40	2	6	0	20
41	1	11	0	87
42	2	3	0	6
43	1	23	0	43
44				
45				
46	1	10	0	96
47				
48				
49	3	8	0	70
50	2	5	0	54
51	1	0	0	35
52	3	0	0	0

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
53	2	10	0	66
54	2	9	0	91
55	1	4	0	99
56	2	14	0	96
57	3	15	0	38
59	2	4	0	17
60	4	17	1	12
Min	1	0	0	0
Max	4	31	3	100

Next, we implemented a set of ranking rules using the data from Tables 6.1 and 6.2 to further assess which EOs had a higher likelihood of persistence on the landscape. We used additive weighting methodology to quantify and implement our ranking rules. Because the metrics of interest vary in data type (i.e. categorical vs continuous) and range of values (i.e. not all continuous variables have the same maximum and minimum), our first step was to normalize all of the data on a scale of 0-100. Normalization allows for aggregation of criteria with numerical and comparable data. We decided to analyze North and South Carolina data separately because the Maxent model predicts habitat differently across state lines due to differences in soil classification. We weighted each variable according to our opinion of the level of contribution each variable had to the probability of persistence of that particular EO. This resulted in abundance having the highest weight (100%), with habitat (as calculated by average Maxent score) and urbanization given relatively similar weighting (80%). The results of the normalization procedure and weighting can be found in Tables 6.3 and 6.4.

Table 6.3. Normalized scores for North Carolina EOs and category weights.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	33	49	3	97
2				
3	33	30	0	90
4	33	29	0	93
5	33	28	1	100
6				
8	0	37	0	94
9	67	65	11	100

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
10	100	46	6	100
11				
12	100	80	28	100
13	0	43	2	69
14	33	90	44	93
15				
16	100	23	0	52
17	0	73	37	100
18	0	52	22	98
19				
20	33	30	3	11
21	33	48	12	45
23	100	19	0	92
25	0	68	42	69
27				
28	33	62	33	71
29	100	63	22	69
30	100	38	5	24
31	100	43	8	12
32	33	48	5	52
33	33	47	8	100
34	0	73	37	35
35	0	60	29	77
36	0	25	0	88
37	100	60	17	82
38	33	17	0	53
39	0	24	0	89
40	33	54	7	67
44	100	26	1	40
45	0	37	14	86
46	67	60	18	94
47	0	39	2	2
48	0	17	0	88
49	100	91	39	95
50				
51	100	77	31	82
52	33	68	11	100
53	0	50	11	76
54	0	49	1	90

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
55	100	43	0	100
56	33	58	7	94
57	33	28	0	19
58	0	60	15	100
59	33	12	0	50
60	0	34	1	98
61	67	59	1	100
62	33	49	0	100
63	0	38	0	94
64	33	56	24	88
69	33	67	31	80
70	33	55	3	100
71	33	42	5	100
72	33	77	41	100
73	100	89	48	99
74	67	97	41	95
75	100	69	16	91
76	100	61	11	89
77	67	43	2	72
79	33	56	4	100
80	0	62	11	85
83	33	22	0	89
84	33	15	0	99
85	33	61	10	95
87				
89	33	15	5	100
90	33	38	5	100
91	0	71	13	100
92	33	18	0	70
106	100	56	10	61
107	0	16	0	59
113	100	68	11	93
114				
115	33	53	8	74
118	67	61	1	91
121	33	59	13	100
122	0	14	0	60
124	0	13	0	91
125	100	19	0	58

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
130	33	22	0	76
149	100	95	49	97
151	33	20	0	72
154	100	41	2	78
157	33	26	0	100
158	67	51	20	95
159	100	92	69	39
160	67	92	69	68
161	100	95	79	69
162	0	45	7	41
163	33	18	0	43
164	67	24	0	47
165	0	16	0	43
166	0	16	0	59
167	100	41	0	79
168	100	25	0	65
169	0	42	0	88
170	33	22	0	60
172	0	56	8	93
173	33	42	3	52
174	0	62	12	84
175				
180	33	28	2	100
181	100	41	6	100
182	100	66	12	100
183	33	18	1	95
184	100	24	0	81
187	33	27	2	64
188	33	33	0	46
189	0	33	1	86
190				
191	33	48	7	100
192	33	49	10	100
193	33	51	19	94
194	100	75	40	81
195	0	28	0	3
196	0	30	10	32
197	100	50	24	61
198	33	45	18	74

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
199	33	41	14	56
200	0	35	6	11
201	0	56	11	36
202	100	49	11	13
203	0	62	11	50
204				
205	33	62	4	50
206	0	52	8	33
207	33	47	4	14
208	0	45	4	32
209	33	46	5	4
210				
212	0	53	9	14
213	0	52	11	27
219	0	45	2	96
222	33	31	9	92
223				
224	0	29	8	83
225	33	32	6	88
227	100	81	7	95
229	33	39	0	79
230	0	80	44	87
231	0	59	20	100
233	100	79	34	86
235	33	74	22	94
236	33	93	41	95
237	33	100	46	95
238	100	74	41	100
239	33	94	40	94
240	0	85	51	100
241	33	93	47	97
242	0	78	27	100
246	0	93	38	95
249	100	68	13	100
250	100	65	12	100
251	100	62	11	100
254	33	80	51	93
255				
256	33	80	44	87

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
258	67	25	0	48
259	100	34	0	100
262	100	41	6	49
263				
264				
265				
266				
267	33	41	3	100
268	0	46	7	100
269	33	72	49	100
270	0	67	52	99
271	0	35	19	100
272	0	47	0	28
273	33	39	7	100
274	33	73	23	100
275	33	14	0	100
276	100	61	14	79
277				
278				
279	0	46	11	9
280	33	95	85	70
281	0	95	88	64
282	0	96	88	48
283	0	97	95	40
284	0	95	100	54
286				
287	33	18	0	64
291	33	28	4	14
292	33	16	0	16
293	0	7	0	84
294	33	52	11	38
296	33	0	0	95
297				
298	33	20	0	99
299	0	13	0	100
300	0	9	0	82
303	33	44	1	100
304	33	43	0	100
305	0	42	5	100

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
306	0	1	0	46
308	33	18	0	97
309	0	3	0	100
310	100	86	75	64
311	33	19	0	100
312	100	22	0	42
313				
314				
315	0	51	10	38
317	0	19	0	46
318	33	48	12	47
319	100	63	12	89
320	100	60	17	0
321				

Weights			
100	60	20	80

Table 6.4. Normalized scores for South Carolina EOs and category weights.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
1	33	67	14	100
2	33	2	0	96
3				
4	0	42	3	90
5	33	0	0	36
6	0	0	0	64
7	100	87	2	65
8	33	0	0	86
9				
10				
11	100	43	0	48
12				
13	0	23	0	0
14	100	43	0	57
15	0	0	0	96

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
16	100	72	1	62
17	100	70	1	67
18	67	62	0	48
19	0	37	0	35
20	33	16	0	0
21	67	15	0	10
22	0	1	0	100
23				
24	0	13	0	97
25	0	44	0	52
26	100	40	0	35
27	100	56	18	60
28	100	60	28	51
29				
30	33	22	0	12
31	100	0	0	100
32	33	23	0	7
33	33	5	0	80
34	0	100	100	99
35	0	75	34	47
36	33	18	0	100
37	0	78	66	100
38	100	16	0	63
39	0	19	0	99
40	33	18	0	80
41	0	36	0	13
42	33	10	0	94
43	0	72	0	57
44				
45				
46	0	32	0	4
47				
48				
49	67	27	0	30
50	33	16	0	46
51	0	1	0	65
52	67	0	0	100
53	33	33	0	34
54	33	29	0	9

DRAFT

EO_Code	Resilience Category	Average Maxent Score	% Maxent classified as 0.8-1.0	% Urban Development
55	0	13	0	1
56	33	43	0	4
57	67	47	8	62
59	33	13	0	83
60	100	53	21	88

Weights			
100	60	20	80

To determine a final rank for likelihood of persistence, we calculated a weighted sum for each EO. We then converted the weighted sum to a final rank value that ranged from 0-100. Finally, we determined the top 10% or 90th percentile, and top 25% or 75th percentile ranking for EOs in each state. Table 6.5 summarizes the final ranks and top 10% and 25% for North and South Carolina. We will include the top 10% in the Status Quo scenario, and the top 25% in the Targeted Conservation scenario.

DRAFT

Table 6.5. Final rank scores for EOs in North and South Carolina. Dark green represents the top 10% of scores, and light green includes the top 25% of scores.

EO not part of a current population
EO included as part of a current population
EO is a part of a current population but last detection was prior to 2005
Eliminated/not scored

South Carolina	
EO_Code	Final Score
60	79
7	79
17	75
16	74
27	71
28	70
31	69
14	66
11	63
38	62
34	61
1	60
26	59
52	56
57	56
18	55
37	54
36	48
42	44
2	43
40	42
59	41
49	41
8	39
33	39
4	37
39	35
35	34
43	34
24	33
21	32
22	31
53	31
50	31

North Carolina	
EO_Code	Final Score
149	94
73	93
49	92
12	90
238	90
161	88
227	87
249	86
233	86
182	85
250	85
251	84
194	84
51	84
310	84
75	84
113	84
319	81
76	81
74	81
10	80
181	79
55	79
37	79
276	78
259	77
159	77
29	76
160	73
167	72
9	72
154	72
23	71
106	71

South Carolina	
EO Code	Final Score
15	30
25	26
56	24
5	24
54	22
30	22
32	20
51	20
6	20
19	19
20	17
41	12
46	8
13	5
55	3
3	0
9	0
10	0
12	0
23	0
29	0
44	0
45	0
47	0
48	0

North Carolina	
EO Code	Final Score
197	71
61	70
46	70
184	69
237	69
158	68
118	68
241	68
239	67
236	66
14	66
72	64
168	64
254	64
269	64
262	64
280	63
274	62
256	62
125	61
235	60
52	60
16	60
121	58
77	58
85	57
79	57
44	57
70	57
312	56
192	56
56	56
69	55
33	55
30	55
191	55
193	55
64	55
62	55

DRAFT

North Carolina	
EO_Code	**Final Score**
202	55
240	54
1	54
303	54
246	54
71	54
320	54
304	54
267	53
273	53
90	53
31	53
28	51
242	51
17	51
5	50
180	50
270	50
157	50
222	49
230	49
115	48
281	48
91	48
4	48
298	48
311	48
225	48
198	47
89	47
3	47
84	47
308	47
275	47
183	46
40	46
284	46
258	46
231	46

DRAFT

North Carolina	
EO Code	EO Code
229	46
58	46
164	46
83	45
282	44
18	44
205	43
172	42
296	42
283	42
268	42
80	41
130	41
174	41
305	41
199	41
271	40
25	40
32	40
219	40
35	40
151	40
54	39
318	39
187	39
173	39
92	39
21	39
60	38
63	38
8	38
294	37
169	37
287	37
170	36
45	36
53	36
188	34
189	34

DRAFT

North Carolina	
EO Code	EO Code
299	34
38	33
224	33
39	33
36	33
13	32
309	31
124	31
59	31
48	31
34	30
203	30
163	30
207	28
293	27
300	27
57	25
209	25
201	25
315	24
291	24
162	23
20	23
206	23
107	22
166	22
122	22
292	21
213	21
208	20
272	20
317	19
196	18
212	17
165	17
306	14
279	14
200	12
47	10

DRAFT

North Carolina	
EO Code	EO Code
195	7
2	0
6	0
11	0
15	0
19	0
27	0
50	0
87	0
114	0
175	0
190	0
204	0
210	0
223	0
255	0
263	0
264	0
265	0
266	0
277	0
278	0
286	0
297	0
313	0
314	0
321	0

Below we describe how we integrated potential positive and negative influences across the scenarios. We can assume there is some tipping point at which an area becomes so urbanized it is unsuitable for dwarf-flowered heartleaf, but we don't know exactly what that tipping point is. Similarly, we can assume additional populations are likely to be found or rediscovered across the range, but there is no clear way to predict the exact number or location of these populations. Although there is great uncertainty associated with how the species will be influenced by these factors, the three scenarios are intended to capture the range of this uncertainty. Note, changes in climate have potential to exacerbate the effects of urbanization, but these effects are not likely to occur within our projection window (e.g. 2040).

DRAFT

Status Quo Scenario

Under the Status Quo scenario, we assume a few populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the percent increase in urban development and whether a population is protected or not. We assessed population resilience under the following assumptions:

- Two populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no negative impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

High Development Scenario

Under the High Development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resilience under the following assumptions:

- No populations are identified as persisting
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
        - Voluntary protection/non-perpetuity— population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold; extirpation of populations if % increase in urbanization exceeds >90% threshold.

DRAFT

Targeted Conservation Scenario

Under the Targeted Conservation scenario, we assume it is likely several additional populations (i.e. more than Status Quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as the Status Quo scenario. We assessed population resilience under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH Model projections focused on current delineated populations:
    - Protected areas
        - Protected in perpetuity—no impacts from urbanization
        - Voluntary protection/non-perpetuity—population drops 1 resilience rank if % increase in urbanization exceeds >50% threshold
    - Non-protected—population drops 1 resilience rank if % increase in urbanization exceeds >25% threshold; population drops 2 resilience ranks if % increase in urbanization exceeds >50% threshold

Future Resilience

Our focus on future resilience of dwarf-flowered heartleaf is on the potential impacts from urbanization. Table 6.6 shows a summary of currently delineated populations and the predicted urban development to occur within each of the populations. The table only includes those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Populations not included in this table are not predicted to be urbanized at all, so for the purposes of future analysis, will be assumed to retain the same resilience category as current. For those populations included in the table, we focus on those populations that are anticipated to increase in urbanization beyond a threshold value, depending on the scenario, but thresholds include >25% >50%, and >90% increases. Also taken into account is whether or not a population is on protected lands, and if so, whether the population is protected in perpetuity or not. Below is a summary of projected future resilience under each of the three scenarios.

DRAFT

Table 6.6. Results of the SLEUTH model. Populations consist of both stand-alone EOs and aggregates of multiple EOs following the definition of delineating demographic populations from Chapter 4. Included are only those populations that already have some current amount of urban development, or are predicted to have some amount of development occur by the year 2040. Red cells indicate populations that are predicted to increase >50% in urbanization. Orange cells indicate populations that are predicted to increase >25% in urbanization.

Population Number	Total Area (sq m)	Already classed Urban	80% chance	90% chance	95% chance	97.5% chance	100% chance	>80%
206	17346.37096	0.40%	0.00%	0.00%	0.00%	6.24%	93.41%	99.65%
306	7804.656249	0.00%	15.11%	49.91%	7.83%	0.00%	22.40%	95.24%
208	55360.86786	17.31%	0.00%	0.00%	0.00%	0.00%	82.69%	82.69%
279	1951.661571	0.00%	0.00%	0.00%	0.00%	0.00%	80.85%	80.85%
214	15043.2984	0.00%	0.00%	1.44%	10.97%	0.00%	55.72%	68.13%
248	25486.15611	28.80%	0.00%	3.22%	0.02%	0.02%	53.03%	56.30%
316	43177.79587	20.06%	0.00%	16.68%	7.08%	0.00%	20.67%	44.43%
247	49898.17159	5.87%	0.00%	6.37%	0.00%	0.00%	23.35%	29.73%
291	11666.76374	35.39%	12.28%	13.53%	2.43%	0.00%	0.23%	28.47%
287	7901.775408	0.00%	0.00%	11.50%	0.00%	0.00%	14.25%	25.75%
312	6535.273235	0.00%	25.28%	0.00%	0.00%	0.00%	0.00%	25.28%
32	31220.60253	60.74%	0.00%	20.39%	0.00%	0.00%	0.00%	20.39%
177	26954.54153	25.34%	12.19%	0.92%	0.10%	5.31%	0.13%	18.66%
292	15611.18205	0.00%	0.00%	0.00%	0.00%	0.00%	18.40%	18.40%
261	21644.22924	0.00%	0.00%	13.21%	3.35%	0.00%	0.00%	16.56%
295	23486.00987	18.20%	0.00%	3.41%	11.99%	0.25%	0.00%	15.65%
125	20742.3249	0.00%	1.02%	5.65%	0.00%	6.67%	0.00%	13.34%
59	8172.007769	0.00%	13.09%	0.00%	0.00%	0.00%	0.00%	13.09%
302	120342.0641	1.46%	2.55%	2.55%	0.77%	2.33%	3.98%	12.19%
178	376781.2214	28.59%	2.79%	2.40%	0.68%	0.59%	2.64%	9.11%
93	43754.11642	0.19%	0.00%	0.00%	0.00%	0.00%	7.82%	7.82%
77	6044.427562	0.00%	1.51%	6.14%	0.00%	0.00%	0.00%	7.64%
179	15145.19453	85.06%	1.14%	0.00%	5.12%	0.00%	0.49%	6.75%
44	15081.76951	61.17%	0.27%	0.00%	0.00%	0.00%	4.68%	4.95%
252	39595.93143	63.47%	0.00%	3.80%	0.00%	0.00%	0.00%	3.80%
100	423621.7376	9.01%	1.32%	1.10%	0.72%	0.14%	0.00%	3.27%
276	123688.7819	0.61%	0.36%	1.87%	0.01%	0.00%	0.00%	2.24%
216	66424.06073	0.00%	0.91%	0.00%	0.00%	0.00%	0.00%	0.91%
154	33924.92259	0.00%	0.00%	0.37%	0.00%	0.00%	0.00%	0.37%
29	249998.8742	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.05%
1	30711.68144	0.41%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2	36339.91976	11.32%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3	24498.03483	24.77%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
31	42929.76479	100.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
96	95947.32128	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
130	1168.240433	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
176	39787.48373	0.89%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
195	7805.599588	99.94%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
317	584.7346337	99.70%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
318	5396.859208	99.74%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
320	125.5182447	98.79%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Status Quo Scenario

In the Status Quo scenario, there are predicted to be 75 populations of dwarf-flowered heartleaf on the landscape in 2040 (Table 6.7). The predicted resilience of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and two additional populations identified as persisting, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Table 6.7. Predicted resilience categories for *Hexastylis naniflora* populations under the Status Quo scenario, and comparison to current condition.

Site Name	Current Resilience	Status Quo
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	high
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributray Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high

DRAFT

Site Name	Current Resilience	Status Quo
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	high
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low

Site Name	Current Resilience	Status Quo
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	low
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low
First Broad River (North Carolina)	n/a	present
Cherokee Creek/Bonner and Robin School Roads	n/a	present

High Development Scenario

In the High Development scenario, there are predicted to be 72 populations of dwarf-flowered heartleaf on the landscape in 2040 (Table 6.8). The predicted resilience of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to moderate resilience; one high resilience population is predicted to drop to moderate; two moderate populations are predicted to drop to low resilience; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Table 6.8. Predicted resilience categories for *Hexastylis naniflora* populations under the High Development scenario, and comparison to current condition.

Site Name	Current Resilience	High Development
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high

Site Name	Current Resilience	High Development
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	moderate
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributary Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	moderate
Rock Barn Solar Farm	high	high
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate

DRAFT

Site Name	Current Resilience	High Development
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	extirpated
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low

Targeted Conservation Scenario

In the Targeted Conservation scenario, there are predicted to be 79 populations of dwarf-flowered heartleaf on the landscape in 2040 (Table 6.9). The predicted resilience of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and six additional populations identified as persisting, with an unknown resilience. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resilience is unchanged because each of the populations are already predicted to be of very high resilience. When comparing future population resilience to current condition a few populations drop in their resilience category. One current population of very high resilience is predicted to drop to high

resilience; two moderate populations are predicted to drop to low resilience; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Table 6.9. Predicted resilience categories for *Hexastylis naniflora* populations under the Targeted Conservation scenario, and comparison to current condition.

Site Name	Current Resilience	Targeted Conservation
DNR Peters Creek Heritage Preserve	very high	very high
Cowpens NBF	very high	very high
Mill Creek Forest and Seep	very high	very high
Island Creek Heath Bluff	very high	very high
NCDOT TIP: R-2824	very high	very high
Murrays Mill/Upper Balls Creek NA	very high	very high
Big Horse Creek Rare Plant Site	very high	very high
Broad River/Sandy Run NA	very high	very high
New Hope Springhead Swamp	very high	very high
Facebook Site	very high	very high
Davenport Road/Mountain View Rare Plant Site	very high	very high
Broad River: Floyds Creek	very high	very high
Catawba River: Hoyle Crk-Micol Crk	very high	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	very high	very high
Buffalo Creek: Tributaries N and S of SR 2047	very high	high
Buffalo Creek: Kings Mountain Res	very high	very high
Broad River: Brushy Creek	very high	very high
Peaked Top Rare Plant Site/Foothills Landfill	very high	very high
Jacob Fork West Corridor	very high	very high
Floyds Creek Tributray Rare Plant Site	very high	very high
New Bethel Rare Plant Site	very high	very high
Leepers Creek Heartleaf Site	very high	very high
Cliffside Steam Station	very high	very high
Rhyne Conservation Preserve	very high	very high
Glade Creek, Alex County	very high	very high
Richardson Creek trib above Toms Lake	very high	very high
Gunpowder Creek: South of Hudson	very high	very high
Taylor Blaylock Res	very high	very high
Little Gunpowder Creek Rare Plant Site 1	high	high
Little Gunpowder Creek Rare Plant Site 2	high	high
Buffalo Creek Rare Plant Site	high	high
Northern Catawba County	high	high
Rock Barn Solar Farm	high	high

DRAFT

Site Name	Current Resilience	Targeted Conservation
NCDOT TIP R-2824	moderate	moderate
Third Creek Rare Plant Site	moderate	moderate
Knob Creek NA	moderate	moderate
Buffalo Creek: Northeast of SR 1903	moderate	moderate
West Shelby Mesic Slope	moderate	low
Cat Square Heartleaf Forest	moderate	low
Kross Keys NA	moderate	moderate
First Broad River: Crooked Run Creek	moderate	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	moderate	moderate
Catawba River: North Fork Mountain Creek	moderate	moderate
Catawba River: Lake James	moderate	moderate
Hogpen Branch Transplant Site	moderate	moderate
Jonas Road Rare Plant Site	moderate	extirpated
South Fork Catawba River, Henry Fork	moderate	moderate
No Business Creek, Boyd Tract	moderate	moderate
Broad River/Sandy Run NA	moderate	moderate
Buffalo Shoals Creek	moderate	moderate
Fox Knoll Farm	moderate	moderate
Forest City: Adj to Isothermal CC	moderate	moderate
Hickory Area	moderate	moderate
UT of Kings Mountain Res	moderate	moderate
Brushy Creek Headwaters	moderate	moderate
Smith Cliff/Henry Fork River	moderate	moderate
Simms Hill/Little River Uplands	moderate	moderate
Collinsville (Hughes) Creek Slopes	moderate	moderate
Burke County - Drowning Creek UT	moderate	moderate
Sandy Spring Church Springhead Swamp	low	low
First Broad River: Hickory Creek	low	low
Buffalo Creek: Ravine	low	extirpated
Buffalo Creek: Potts Creek	low	extirpated
Smith Cliff/Henry Fork River	low	low
Pott Creek	low	low
Northeast Lincolnton: UT Walker Branch	low	extirpated
Gunpowder Creek	low	low
Killian Crossroads	low	low
Beaverdam Crk at First Broad River	low	low
Lincoln County, SR-1314	low	low
Levan Family Farm	low	low
Fanjoy Road Site	low	extirpated

DRAFT

Site Name	Current Resilience	Targeted Conservation
First Broad River: Beaverdam Creek Tribs	low	low
South Mountains Pleasant Grove Uplands	low	low
NCDOT TIP R-3603A	low	low
Hickory Creek - UT (Shelby High School)	low	low
Boulder Creek Subdivision	low	low
Gateway Elementary School	low	low
First Broad River (North Carolina)	n/a	present
First Broad Hop-Hornbeam NA	n/a	present
Big Island Carolina Hemlock Bluff	n/a	present
Cherokee Creek/Bonner and Robin School Roads	n/a	present
Arrowood Branch	n/a	present
Cherokee Creek/SC 11	n/a	present

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resilience and extirpation of a few populations is offset by the fact that several additional populations were found to persist in the Status Quo and Targeted Conservation scenarios. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resilience in several additional populations. Regardless of the scenario, the majority of the populations expected to persist on the landscape in 2040 are of at least moderate resilience.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances; however, the species range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change.

Given that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. It is worth noting that in two of our scenarios (Status Quo and Targeted Conservation), additional populations are found to persist in South Carolina, an area where we have relatively few current populations. As discussed below, we believe there are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, we believe our scenarios do not predict declines in species representation.

Table 6.10. Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	Current	Status Quo	High Development	Targeted Conservation
Very High	28	27	27	27
High	5	6	4	6
Moderate	26	23	25	23
Low	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total	**78**	**75**	**72**	**79**

Opportunities for Additional Conservation

Although our scenarios focus on areas where dwarf-flowered heartleaf have been found in the past, the Maxent model identifies a number of areas as high quality potential habitat for the species that falls outside the immediately known occurrence areas. A few of these areas are detailed below (Figure 6.2).

1. West of the city of Lenoir, south of Highway 90/Adako Rd., north of Highway 64 within Caldwell County. This area identifies a large block of potential habitat. This area falls just outside the administrative boundary of the Pisgah National Forest. The bluffs and tributaries along the Johns River are identified as the best habitat, but there is also ample habitat identified along the forested areas of Celia, Husband, Abingdon and Greasy Creeks. The only known occurrence within this area is associated with Abingdon Creek and is under a conservation easement.
2. Henry Fork River bluffs and tributaries east of Highway 18 within Burke County. A historic EO is present by the Burke County line, but the entire area is identified as good quality potential habitat for the species where forested habitats remain.
3. Southwest corner of Catawba County west of Highway 321. Several disjointed patches of high quality potential habitat are identified in this region associated with the river and creek slopes. Rock Creek, Jacob Fork River, Pott Creek, and their associated tributaries all contain blocks of potential habitat. A number of EOs are identified within this area, but additional habitat is identified both upstream and downstream of the known occurrences.
4. Clark, Pinch Gut, Maiden, and Allen Creeks, north of the town of Maiden. The slopes along these creeks all contain quality potential habitat. Known EOs are in the general area, but none are situated within the creeks listed.
5. First Broad River north of Highway 74, Rutherford County. Two older EOs are located within this area, however, the forested bluffs along the First Broad River and associated tributaries are identified as good quality potential habitat in many additional upstream and downstream areas in this system.

DRAFT

6. Hickory Creek, Sulphur Springs Branch (Little Hickory), Shoal Creek, and tributaries draining into First Broad River south of the Town of Shelby, north of the South Carolina border. The town of Shelby has likely disconnected this site from area 5 listed above. Here, slopes along the creeks and tributaries draining into the First Broad River are identified as potential habitat more so than the slopes along the First Broad River themselves. There is only a single EO known upstream along Hickory Creek.
7. North Pacolet River and Obed Creek, north of where they join. The majority of potential habitat falls along the slopes of the North Pacolet River. Two older EOs (1991 last observation) are found in the tributaries draining into the North Pacolet River, and many occurrences are found further upstream. The habitat model suggests that additional undiscovered habitat areas are present.
8. Pacolet River and Island Creek, north of Peters Creek, downstream of the Pacolet River dam. This area displays limited amounts of good quality potential habitat. Recent EOs are present in the upper headwaters of Peters and Zekial Creeks (Zekial Creek drains into Peters Creek) and in areas north of the Pacolet River dam, but none are known along the areas identified in this immediate area.

DRAFT

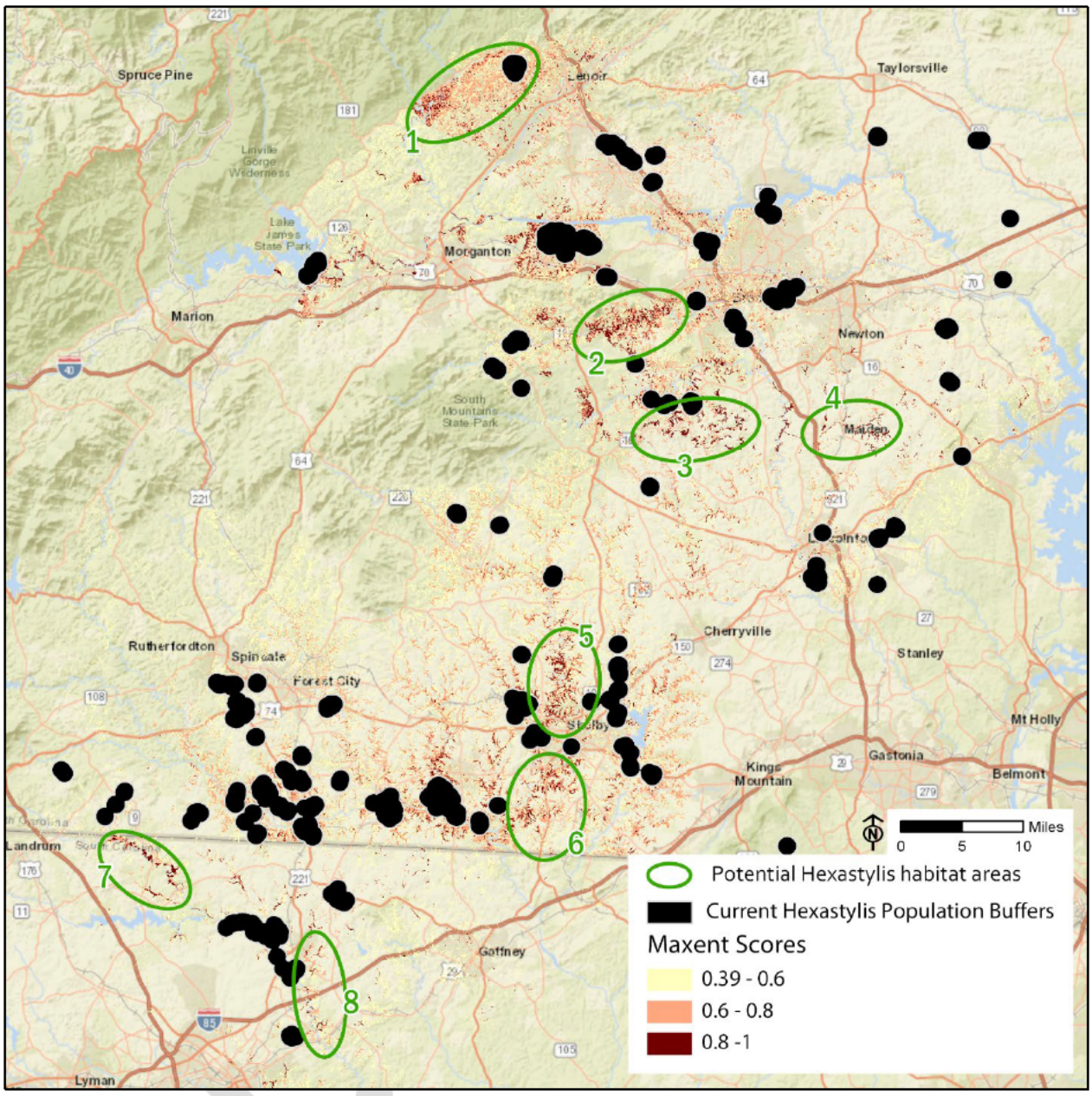


Figure 6.2. Areas identified as high quality potential habitat by Maxent model for *Hexastylis naniflora* that fall outside the immediately known occurrence areas.

Literature Cited

Amoroso, J.L. 2016. *Hexastylis naniflora* status meeting with USFWS, NCNHP, ASU, and NCDOT [meeting minutes]. North Carolina Department of Natural and Cultural Resources office, Asheville, NC, 11 May 2016.

Baldwin, R.A. 2009. Use of maximum entropy modeling in wildlife research. Entropy. 11:854-866.

Barringer, K. 1993. New combinations in North American *Asarum* (Aristolochiaceae). Novon 3:225-227.

Blomquist, H.L. 1957. A Revision of *Hexastylis* in North America. Brittonia 8:255-281.

Clarke, K.C., Riggan, P., and Brass, J.A., 1995. A cellular automaton model of wildfire propagation and extinction, Photogram. Eng. Rem S. 60, 1355-1367.

Dobzhansky, T. 1937. Genetics and the origin of species. Columbia University Press, New York, NY.

DeWan, A., N. Dubois, K. Theoharides, and J. Boshoven. 2010. Understanding the impacts of climate change on fish and wildlife in North Carolina.

Flora of North America 1997. Flora of North America north of Mexico. Volume 3, Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York, NY. 590 pp. Contains Whittemore and Gaddy's treatment of *Asarum* and *Hexastylis*.

Gaddy, L.L. 1980. Status Report on *Hexastylis naniflora* Blomquist. Prepared for and submitted to USFWS, Endangered Species Office, Region 4, Atlanta, Georgia. July 1980.

Gaddy, L.L. 1981. The status of *Hexastlylis naniflora* Blomquist in North Carolina. Unpublished report prepared under contract to the Plant Conservation Program, North Carolina Department of Agriculture, Raleigh.

Gaddy, L. 1986. Twelve new ant-dispersed species from the southern Appalachians. *Bulletin of the Torrey Botanical Club* 113: 247-251.

Gaddy, L.L. 1987. A review of the taxonomy and biogeography of *Hexastylis* (Aristolochiaceae). Castanea 52(3):186-196.

Golder Associates, Inc. 2009. Year 5 Monitoring Report, *Hexastylis naniflora*, Foothills Conservation Area, Caldwell County, North Carolina. Submitted to: Republic Services of North Carolina, LLC; copies (per cover letter) distributed to US Army Corps of Engineers, Asheville Regulatory Office and USFWS Asheville ES Office. June 26, 2009.

Golladay SW, Gagnon P, Kearns M, Battle JM. Hicks DW. Response of freshwater mussel assemblages (Bivalvia: Unionidae) to a record drought in the Gulf Coastal Plain of southwest Georgia. J. N. Am. Benthol. Soc. 2004;23:494–506.

DRAFT

Gonzalez, V. C. 1972. The ecology of *Hexastylis arifolia*, an evergreen herb in the North Carolina deciduous forest. Ph.D. disseration, Duke University. Durham, North Carolina, USA. HDR. 2005. Identification of *Hexastylis naniflora*. Notes on characteristics and field observations provided to the North Carolina Natural Heritage Program, Raleigh.

IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

Jones M.S., T. H. Jones, and J. J. English. 2014. The Pollination of *Hexastylis naniflora* in Cleveland County, North Carolina. Castanea: June 2014, Vol. 79, No. 2, pp. 74-77.

Jordan, Jones and Goulding (JJ&G), Inc. 1998. Section 404 Application and Conceptual Mitigation Plan, Lake Blalock Expansion Project. USFWS Log number 4-6-97-358. ACOE Project # 80-97-1732 (S). Section 9: *Hexastylis naniflora* Biological Assessment. Received by the Asheville Field Office July 16, 1998.

Jordan, Jones and Goulding (JJ&G), Inc. 2006. Lake Blalock Buffer Disturbance – Vicinity of Casey Creek Road. Memorandum to: Eddie Dearbury, Spartanburg Water Systems. Date: October 25, 2006.

Karl, T. R., Melillo, J. M., & Peterson, T. C. (Eds.). (2009). Global Climate Change Impacts in the United States. Washington, DC: U.S. Global Change Research Program.

Kelly, L. M. 1997. A Cladistic Analysis of *Asarum* (Aristolochiaceae) and Implications for the Evolution of Herkogamy. American Journal of Botany 84:1752-1765.

Kelly, L. M. 1998. Phylogenetic Relationships in *Asarum* (Aristolochiaceae) Based on Morphology and ITS Sequences. American Journal of Botany 85:1454-1467.

Kelly, L. M. 2001. Taxonomy of *Asarum* Section *Asarum* (Aristolochiaceae). Systematic Botany 26:17-53.

Lengyel, S., A. D. Gove, A. M. Latimer, J. D. Majer, and R. R. Dunn. 2010. Convergent evolution of seed dispersal by ants, and phylogeny and biogeography in flowering plants: A global survey. *Perspectives in Plant Ecology, Evolution and Systematic*s 12: 43-55.

McLaughlin, J.F. et al. (2002). Climate change hastens population extinctions. Proceedings of the National Academy of Sciences 99(9): 6070–6074.

Murrell, Z. et al. 2007. Ecological, Morphological, Micromorphological and Molecular Analyses of the Species in the *Hexastylis heterophylla* Complex. A report to the North Carolina Department of Transportation. NCDOT and CTE Joint Project 2002-2004, FHWA/NC/2004-01. May 2007.

DRAFT

Murrell, Z. 2015. Development of molecular and morphological tools to circumscribe and identify the Dwarf Flowered Heartleaf (*Hexastylis naniflora*). Report to the North Carolina Department of Transportation, NCDOT Project 2012-2111, July 2015.

National Climate Change Viewer. 2016. USGS. Accessed at https://www2.usgs.gov/climate_landuse/clu_rd/nccv.asp, January 2018.

NatureServe. 2002. Element Occurrence Data Standard, 6 February 2002. NatureServe, Arlington, Virginia. Accessed at http://www.natureserve.org/library/deliminting_plant_eos_Oct_2004.pdf, August 2016.

NCOSBM. North Carolina Budget and Management County and State Population Projections. Accessed at https://www.osbm.nc.gov/demog/county-projections, March 2018.

Newberry, G. 2006. South Carolina Populations of *Hexastylis naniflora*: 2006 updates. Received by the USFWS Asheville Field Office, September 7, 2006.

Newberry, G. 2009. University of South Carolina at Spartanburg. Evaluation of damage to *Hexastylis naniflora* plants on acreage bordering the hunt club. Letter to Jon Morgan, Lake Warden, Spartanburg Water Systems. Dated February 24, 2009.

North Carolina Natural Heritage Program (NCNHP). 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: August 5, 2016.

North Carolina Natural Heritage Program (NCNHP). 2018. Natural Heritage Element Occurrences. Accessed at https://www.ncnhp.org/activities/conservation/natural-heritage-element-occurrences, January 2018.

Newberry, G. 1993. Progress Report on Monitoring Studies of *Hexastylis naniflora*. Unpublished report. Copy submitted to the USFWS Asheville Field Office, on September 7, 2006.

Niedenberger, B.A. 2010. Molecular phylogeny and comparative pollen morphology of the genus *Hexastylis* (Aristolochiaceae). M.S. thesis. Appalachian State University, Boone, NC.

Otte, D. 1977. The pollination biology of *Hexastylis arifolia* (Michx.) Small var. *arifolia* and *H. minor* (Ashe) Blomquist (Aristolochiaceae) in the area of Chapel Hill, North Carolina. M.S. Thesis, University of North Carolina Chapel Hill, Chapel Hill, North Carolina, USA.

Padgett, J. E. 2004. Biogeographical, ecological, morphological, and micromorphological analyses of the species in the *Hexastylis heterophylla* complex. M.S. thesis. Appalachian State University, Boone, NC.

Phillips, S. J. 2018. A Brief Tutorial on Maxent. Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-02/21.

Renninger, H. 2010. North Carolina Department of Transportation (NCDOT). E-mail communication to Carolyn Wells, USFWS Asheville Field Office. Date: May 28, 2010. Subject: Dwarf-flowered heartleaf research proposal.

DRAFT

Robinson L.G. 2016. Dwarf-flowered Heartleaf range-wide status report. Final report to U.S. Department of Interior—U.S. Fish and Wildlife Service by North Carolina Natural Heritage Program. August 2016.

Robinson, L.G. and J.E. Padgett. 2016. Dwarf-flowered Heartleaf (*Hexastylis naniflora*) comprehensive review and monitoring report. Final report to the U.S. Department of Interior—U.S. Fish and Wildlife Service by the North Carolina Natural Heritage Program. August 2016.

Schneider, S. 2006. Spartanburg Water System (SWS) & Sanitary Sewer District, Assistant General Manager. E-mail communication to Lora Zimmerman, USFWS (formerly with the Charleston Field Office), dated December 18, 2006. Subject: Meeting at SWS on December 21, 2006 [to discuss Lake Blalock Buffer Disturbance].

South Carolina Department of Natural Resources (SCDNR) Heritage Trust. 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: February 4, 2016.

USFWS. 2001. Biological Opinion for Spartanburg Water System, Lake Blalock, P/N 2000-IP-194-W, USFWS log number 4-6-01-F-115. May 10, 2001.

USFWS. 2010. Draft Five Year Review for *Hexastylis naniflora* (dwarf flowered heartleaf). September 30, 2010. Submitted to the USFWS Southeast Regional Office September 30, 2010.

USFWS. 2015, August. Fact sheet for *Hexastylis naniflora*. Retrieved from https://www.fws.gov/raleigh/species/es_dwarf-flowered_heartleaf.html.

USFWS. 2016. USFWS species status assessment framework: an integrated analytical framework for conservation. Version 3.4.8, August 2016.

Wagner, J. 2013. Developing new morphological, geographic, and molecular tools to circumscribe *Hexastylis naniflora*. M.S. thesis. Appalachian State University, Boone, NC.

Walker, J. et al. 2009. What are the effects of prescribed fire on *Hexastylis naniflora*, a federally protected plant species? Unpublished final report prepared by U.S. Forest Service, Southern Research Station, Clemson University, Clemson, SC. Submitted to Timothy Stone, Superintendent, Cowpens National Battlefield. In partial fulfillment for Agreement 04-IA-11330138-234, between the NPS and USFS Southern Research Station. Revised March 19, 2009.

Warren II, R. J., 2008. Mechanisms driving understory evergreen herb distributions across slope aspects: as derived from landscape position. *Plant Ecology* 198: 297-308.

Weakley, A. 2010. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Working Draft as of March 8, 2010.

Weakley, A. 2015. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Working Draft as of 21 May 2015.

DRAFT

Whittemore, A. T., and L. L. Gaddy. 1997. Hexastylis. In Flora of North America Editorial Committee [Eds.], Flora of North America north of Mexico, vol. 3, 54–58. Oxford University Press, New York, New York, USA.

Wolf. S., B. Hartl, C. Carroll, M.C. Neel, and D.N. Greenwald. 2015. Beyond PVA: why recovery under the Endangered Species Act is more than population viability. BioScience 65:200-207.

DRAFT

Hamilton, Byron <byron_hamilton@fws.gov>

Re: Proposed delisting rule for Dwarf-flowered heartleaf

Craghead, Anissa <anissa_craghead@fws.gov> Wed, Jul 24, 2019 at 1:50 PM
To: Byron Hamilton <byron_hamilton@fws.gov>
Cc: "Wilkinson, Susan" <Susan_Wilkinson@fws.gov>, "Sara_Prigan@fws.gov" <Sara_Prigan@fws.gov>, Madonna Baucum Madonna Baucum@fw gov , Timothy Merritt timothy merritt@fw gov , Kri ti Young kri ti young@fw gov , "McRae, Sarah" <sarah_mcrae@fws.gov>

Hi, all. Thanks for your patience. Attached is the file showing PRB's edits and comments in tracked changes. I started this review several days ago, and finished it in bits while handling pressing assignments. I think I remember making a very, very few mall edit before remembering to turn on track change , o while mo t of my edits will be visible, a tiny few may not be.

That said, ***please use the attached file as your master file going forward.***

Let me know if you have any questions about my review.

This email serves as PRB surname of the attached file (file name is "20190724_Dwarf flowered heartleaf pDeL withPRB(alc) doc ")

Best,
Anissa Craghead
Senior Regulatory Analyst
Division of Policy, Economics, Risk Management, and Analytics (PERMA)
Policy and Regulations Branch
JOINT ADMINISTRATIVE OPERATIONS | U.S. Fish & Wildlife Service
ani a craghead@fw gov | office (703) 358 2445

JAO mission: To deliver innovative administrative services that advance the mission of the U.S. Fish & Wildlife Service.

[Quoted text hidden]

20190724_Dwarf flowered heartleaf_pDeL_withPRB(alc).docx
89K

United States Department of the Interior
OFFICE OF THE SOLICITOR
Southeast Regional Office
Richard B. Russell Federal Building
75 Ted Turner Drive, S.W., Room 304
Atlanta, Georgia 30303

FWS.SE.0442.MPS

July 16, 2019

BY E-MAIL

TO: Leopoldo Miranda, Regional Director

FROM: Shannon Goessling, Regional Solicitor SHANNON GOESSLING Digitally signed by SHANNON GOESSLING Date: 2019.07.16 10:19:39 -04'00'

SUBJECT: Review of Federal Register listing document: proposed rule to delist dwarf-flowered heartleaf

You have asked us to review the referenced rule, which was prepared pursuant to Section 4(a)(1) of the Endangered Species Act. Based on our review, we are surnaming the rule (surname pages enclosed).

If you have any questions, please contact Michael Stevens at (404) 331-5617.

cc: Kristi Young, Ecological Services
Nicole Rankin, Ecological Services
Timothy Merritt, Ecological Services
Jack Arnold, Ecological Services

Enclosures

[ATTORNEY-CLIENT PRIVILEGED COMMUNICATION]
SUMMARY RESULTS OF LEGAL REVIEW OF
DRAFT SECTION 4 (ESA) DOCUMENTS

DESCRIPTION OF DRAFT DOCUMENT: Proposed rule to delist dwarf-flowered heartleaf

REVIEWING OFFICE: Regional Solicitor, Southeast Region

DATE OF RECEIPT: June 10, 2019

RESULTS OF LEGAL REVIEW:

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

This summary is issued by:

SHANNON GOESSLING Digitally signed by SHANNON GOESSLING Date: 2019.07.16 10:20:16 -04'00'

Date: July 16, 2019

Regional Solicitor

Note: Any Solicitor's Office "surname" attaches only to the draft that was submitted for review, unless subsequent amendments are specifically referred for follow-up review.

SHANNON GOESSLING
Digitally signed by SHANNON GOESSLING
Date: 2019.07.16 10:20:59 -04'00'

The Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2018-XXXX; FXES11130900000-189-FF0932000]

RIN

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; availability of draft post-delisting monitoring plan.

SUMMARY: We, the U.S. Fish & Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicates that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened or endangered species under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan. If this proposal is finalized, *Hexastylis naniflora* will be removed from the List.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

Literature Cited for Dwarf-flowered heartleaf

Amoroso, J.L. 2016. *Hexastylis naniflora* status meeting with USFWS, NCNHP, ASU, and NCDOT [meeting minutes]. North Carolina Department of Natural and Cultural Resources office, Asheville, NC, 11 May 2016.

Baldwin, R.A. 2009. Use of maximum entropy modeling in wildlife research. Entropy. 11:854-866.

Barringer, K. 1993. New combinations in North American *Asarum* (Aristolochiaceae). Novon 3:225-227.

Blomquist, H.L. 1957. A Revision of *Hexastylis* in North America. Brittonia 8:255-281.

Clarke, K.C., Riggan, P., and Brass, J.A., 1995. A cellular automaton model of wildfire propagation and extinction, Photogram. Eng. Rem S. 60, 1355-1367.

Dobzhansky, T. 1937. Genetics and the origin of species. Columbia University Press, New York, NY.

DeWan, A., N. Dubois, K. Theoharides, and J. Boshoven. 2010. Understanding the impacts of climate change on fish and wildlife in North Carolina.

Flora of North America 1997. Flora of North America north of Mexico. Volume 3, Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York, NY. 590 pp. Contains Whittemore and Gaddy's treatment of *Asarum* and *Hexastylis*.

Gaddy, L.L. 1980. Status Report on *Hexastylis naniflora* Blomquist. Prepared for and submitted to USFWS, Endangered Species Office, Region 4, Atlanta, Georgia. July 1980.

Gaddy, L.L. 1981. The status of *Hexastlylis naniflora* Blomquist in North Carolina. Unpublished report prepared under contract to the Plant Conservation Program, North Carolina Department of Agriculture, Raleigh.

Gaddy, L. 1986. Twelve new ant-dispersed species from the southern Appalachians. *Bulletin of the Torrey Botanical Club* 113: 247-251.

Gaddy, L.L. 1987. A review of the taxonomy and biogeography of *Hexastylis* (Aristolochiaceae). Castanea 52(3):186-196.

Golder Associates, Inc. 2009. Year 5 Monitoring Report, *Hexastylis naniflora*, Foothills Conservation Area, Caldwell County, North Carolina. Submitted to: Republic Services of North Carolina, LLC; copies (per cover letter) distributed to US Army Corps of Engineers, Asheville Regulatory Office and USFWS Asheville ES Office. June 26, 2009.

Golladay SW, Gagnon P, Kearns M, Battle JM. Hicks DW. Response of freshwater mussel assemblages (Bivalvia: Unionidae) to a record drought in the Gulf Coastal Plain of southwest Georgia. J. N. Am. Benthol. Soc. 2004;23:494–506.

Gonzalez, V. C. 1972. The ecology of *Hexastylis arifolia*, an evergreen herb in the North Carolina deciduous forest. Ph.D. disseration, Duke University. Durham, North Carolina, USA. HDR. 2005. Identification of *Hexastylis naniflora*. Notes on characteristics and field observations provided to the North Carolina Natural Heritage Program, Raleigh.

IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

Jones M.S., T. H. Jones, and J. J. English. 2014. The Pollination of *Hexastylis naniflora* in Cleveland County, North Carolina. Castanea: June 2014, Vol. 79, No. 2, pp. 74-77.

Jordan, Jones and Goulding (JJ&G), Inc. 1998. Section 404 Application and Conceptual Mitigation Plan, Lake Blalock Expansion Project. USFWS Log number 4-6-97-358. ACOE Project # 80-97-1732 (S). Section 9: *Hexastylis naniflora* Biological Assessment. Received by the Asheville Field Office July 16, 1998.

Jordan, Jones and Goulding (JJ&G), Inc. 2006. Lake Blalock Buffer Disturbance – Vicinity of Casey Creek Road. Memorandum to: Eddie Dearbury, Spartanburg Water Systems. Date: October 25, 2006.

Karl, T. R., Melillo, J. M., & Peterson, T. C. (Eds.). (2009). Global Climate Change Impacts in the United States. Washington, DC: U.S. Global Change Research Program.

Kelly, L. M. 1997. A Cladistic Analysis of *Asarum* (Aristolochiaceae) and Implications for the Evolution of Herkogamy. American Journal of Botany 84:1752-1765.

Kelly, L. M. 1998. Phylogenetic Relationships in *Asarum* (Aristolochiaceae) Based on Morphology and ITS Sequences. American Journal of Botany 85:1454-1467.

Kelly, L. M. 2001. Taxonomy of *Asarum* Section *Asarum* (Aristolochiaceae). Systematic Botany 26:17-53.

Lengyel, S., A. D. Gove, A. M. Latimer, J. D. Majer, and R. R. Dunn. 2010. Convergent evolution of seed dispersal by ants, and phylogeny and biogeography in flowering plants: A global survey. *Perspectives in Plant Ecology, Evolution and Systematic*s 12: 43-55.

McLaughlin, J.F. et al. (2002). Climate change hastens population extinctions. Proceedings of the National Academy of Sciences 99(9): 6070–6074.

Murrell, Z. et al. 2007. Ecological, Morphological, Micromorphological and Molecular Analyses of the Species in the *Hexastylis heterophylla* Complex. A report to the North Carolina Department of Transportation. NCDOT and CTE Joint Project 2002-2004, FHWA/NC/2004-01. May 2007.

Murrell, Z. 2015. Development of molecular and morphological tools to circumscribe and identify the Dwarf Flowered Heartleaf (*Hexastylis naniflora*). Report to the North Carolina Department of Transportation, NCDOT Project 2012-2111, July 2015.

National Climate Change Viewer. 2016. USGS. Accessed at https://www2.usgs.gov/climate_landuse/clu_rd/nccv.asp, January 2018.

NatureServe. 2002. Element Occurrence Data Standard, 6 February 2002. NatureServe, Arlington, Virginia. Accessed at http://www.natureserve.org/library/deliminting_plant_eos_Oct_2004.pdf, August 2016.

NCOSBM. North Carolina Budget and Management County and State Population Projections. Accessed at https://www.osbm.nc.gov/demog/county-projections, March 2018.

Newberry, G. 2006. South Carolina Populations of *Hexastylis naniflora*: 2006 updates. Received by the USFWS Asheville Field Office, September 7, 2006.

Newberry, G. 2009. University of South Carolina at Spartanburg. Evaluation of damage to *Hexastylis naniflora* plants on acreage bordering the hunt club. Letter to Jon Morgan, Lake Warden, Spartanburg Water Systems. Dated February 24, 2009.

North Carolina Natural Heritage Program (NCNHP). 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: August 5, 2016.

North Carolina Natural Heritage Program (NCNHP). 2018. Natural Heritage Element Occurrences. Accessed at https://www.ncnhp.org/activities/conservation/natural-heritage-element-occurrences, January 2018.

Newberry, G. 1993. Progress Report on Monitoring Studies of *Hexastylis naniflora*. Unpublished report. Copy submitted to the USFWS Asheville Field Office, on September 7, 2006.

Niedenberger, B.A. 2010. Molecular phylogeny and comparative pollen morphology of the genus *Hexastylis* (Aristolochiaceae). M.S. thesis. Appalachian State University, Boone, NC.

Otte, D. 1977. The pollination biology of *Hexastylis arifolia* (Michx.) Small var. *arifolia* and *H. minor* (Ashe) Blomquist (Aristolochiaceae) in the area of Chapel Hill, North Carolina. M.S. Thesis, University of North Carolina Chapel Hill, Chapel Hill, North Carolina, USA.

Padgett, J. E. 2004. Biogeographical, ecological, morphological, and micromorphological analyses of the species in the *Hexastylis heterophylla* complex. M.S. thesis. Appalachian State University, Boone, NC.

Phillips, S. J. 2018. A Brief Tutorial on Maxent. Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-02/21.

Renninger, H. 2010. North Carolina Department of Transportation (NCDOT). E-mail communication to Carolyn Wells, USFWS Asheville Field Office. Date: May 28, 2010. Subject: Dwarf-flowered heartleaf research proposal.

Robinson L.G. 2016. Dwarf-flowered Heartleaf range-wide status report. Final report to U.S. Department of Interior—U.S. Fish and Wildlife Service by North Carolina Natural Heritage Program. August 2016.

Robinson, L.G. and J.E. Padgett. 2016. Dwarf-flowered Heartleaf (*Hexastylis naniflora*) comprehensive review and monitoring report. Final report to the U.S. Department of Interior—U.S. Fish and Wildlife Service by the North Carolina Natural Heritage Program. August 2016.

Schneider, S. 2006. Spartanburg Water System (SWS) & Sanitary Sewer District, Assistant General Manager. E-mail communication to Lora Zimmerman, USFWS (formerly with the Charleston Field Office), dated December 18, 2006. Subject: Meeting at SWS on December 21, 2006 [to discuss Lake Blalock Buffer Disturbance].

South Carolina Department of Natural Resources (SCDNR) Heritage Trust. 2016. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: February 4, 2016.

USFWS. 2001. Biological Opinion for Spartanburg Water System, Lake Blalock, P/N 2000-IP-194-W, USFWS log number 4-6-01-F-115. May 10, 2001.

USFWS. 2010. Draft Five Year Review for *Hexastylis naniflora* (dwarf flowered heartleaf). September 30, 2010. Submitted to the USFWS Southeast Regional Office September 30, 2010.

USFWS. 2015, August. Fact sheet for *Hexastylis naniflora*. Retrieved from https://www.fws.gov/raleigh/species/es_dwarf-flowered_heartleaf.html.

USFWS. 2016. USFWS species status assessment framework: an integrated analytical framework for conservation. Version 3.4.8, August 2016.

Wagner, J. 2013. Developing new morphological, geographic, and molecular tools to circumscribe *Hexastylis naniflora*. M.S. thesis. Appalachian State University, Boone, NC.

Walker, J. et al. 2009. What are the effects of prescribed fire on *Hexastylis naniflora*, a federally protected plant species? Unpublished final report prepared by U.S. Forest Service, Southern Research Station, Clemson University, Clemson, SC. Submitted to Timothy Stone, Superintendent, Cowpens National Battlefield. In partial fulfillment for Agreement 04-IA-11330138-234, between the NPS and USFS Southern Research Station. Revised March 19, 2009.

Warren II, R. J., 2008. Mechanisms driving understory evergreen herb distributions across slope aspects: as derived from landscape position. *Plant Ecology* 198: 297-308.

Weakley, A. 2010. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Working Draft as of March 8, 2010.

Weakley, A. 2015. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Working Draft as of 21 May 2015.

Whittemore, A. T., and L. L. Gaddy. 1997. Hexastylis. In Flora of North America Editorial Committee [Eds.], Flora of North America north of Mexico, vol. 3, 54–58. Oxford University Press, New York, New York, USA.

Wolf. S., B. Hartl, C. Carroll, M.C. Neel, and D.N. Greenwald. 2015. Beyond PVA: why recovery under the Endangered Species Act is more than population viability. BioScience 65:200-207.

Re: Dwarf flowered heartleaf info for HQ

Morgan, Don <don_morgan@fws.gov>

Thu 9/26/2019 3:22 PM

To: Merritt, Timothy <timothy_merritt@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>; Young, Kristi <kristi_young@fws.gov>; Ketram, Natchanon N <natchanon_ketram@fws.gov>

Hi Tim,

Attached are comments from Bridget on the Dwarf-flowered heartleaf proposed delisting package.

Please let me know if you have any questions.

Don

_____
Don R. Morgan
U.S. Fish and Wildlife Service
Chief, Branch Delisting and Foreign Species
5275 Leesburg Pike
Falls Church, VA 22041-3803
Phone (703) 358-2444
Fax (703) 358-1800

On Wed, Jul 31, 2019 at 2:34 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Dwarf-flowered heartleaf for your reading pleasure.
> Tim
>
> ---------- Forwarded message ---------
> From: **Hamilton, Byron** <byron_hamilton@fws.gov>
> Date: Wed, Jul 31, 2019 at 2:25 PM
> Subject: Dwarf-flowered heartleaf info for HQ
> To: Timothy Merritt <timothy_merritt@fws.gov>
>
> Tim,
>
> See attachments.
>
> --
> **Byron Hamilton, Sr.**
> **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> **U.S. Fish & Wildlife Service**
> **1875 Century Blvd.**
> **Atlanta, GA 30345**
> **Work - (404) 679-4119**
> **Cell - (803) 707-9518**

--

_____
Timothy Merritt
Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
615-574-8812 cell

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

Briefing Paper for Departmental Clearance of *Federal Register* Documents

I. Subject: Proposed Delisting Rule for Dwarf-flowered heartleaf

II. RIN (for rulemaking documents): 1018-BD95

III. Docket or tracking number: FWS-R4-ES-2019-0081

IV. DCN (from DTS):

V. Summary: We are proposing to delist the dwarf-flowered heartleaf (*Hexastylis naniflora*). This recommendation is based on a thorough review of the best available scientific and commercial information, which indicates that this species does not meet the definition on an endangered species or threatened species.

VI. Is the action controversial? ☐ Yes. ☒ No.

If yes, please answer the following:

a. What are the controversial issues?

b. Who will care about these issues?

c. How strongly will they care?

(b)(5) DPP

(b)(5) DPP

VII. Communications:

a. Has the bureau communications office coordinated with DOI communications staff?

☒ Yes. ☐ No.

If yes, please note whom you contacted and how (e.g., email, voicemail):

Brian Hires via email.

b. Does this document require a press release?

☒ Yes. ☐ No.

Press release title: Conservation Success Story: Threatened Plant Proposed for Removal from Endangered species List

Press release first paragraph: Tens of thousands of threatened dwarf-flowered heartleaf plants are conserved by Duke Energy along the Broad River. Another population is conserved at Cowpens National Battlefield, in upstate South Carolina. A third is part of the Broad River Greenway, a local park in North Carolina's Cleveland County. These are three of many conservation efforts for the heartleaf, leading the U.S. Fish and Wildlife Service (Service) to propose removing it from the federal threatened and endangered species list.

Deleted: ¶

Deleted: ¶

Formatted: Font: (Default) Times New Roman, 12 pt

Formatted: List Paragraph, Indent: Left: 0 , Hanging: 0.19 , Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.25 + Indent at: 0.5

Deleted: ¶

VIII. Is timing critical? ☒ Yes. ☐ No.

Target date to clear DOI: 9/30/2019, or as priorities allow.

No-later-than date to clear DOI (if applicable): 9/30/2019.

If you provided an NLT date, please answer the following:

a. What is the main driver of the timing? This action is on our National Delisting/ Downlisting Workplan for FY19

b. What happens if the deadline is missed?

IX. Background: The dwarf-flowered heartleaf is a low growing herbaceous plant in the birthwort family. On April 14, 1989, we listed the dwarf-flowered heartleaf as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing (FR 54 14964). A recovery plan for the species was never completed. Over the last 29 years, the Service has worked closely with partners to recover this species. When dwarf-flowered heartleaf listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two states. Therefore, we propose to delist the dwarf-flowered heartleaf due to recovery.

X. Is there an information collection associated with this document?

☐ Yes. ☒ No.

If yes, please answer the following:

a. Does the document have any approved OMB control number(s)? ☐ Yes. ☐ No.

If yes, provide the OMB control number(s) and expiration date(s):

b. Does the document require ☐ a new OMB control number or ☐ a renewal of an existing approval?

If a new number or a renewal is required, what is the current status?

XI. Approval is requested to send the document to:

☒ The Office of the Federal Register for publication, or

☐ OIRA for review.

XII. Primary contact:

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Deleted: ¶ ¶

Deleted: ing

Deleted: We

Deleted: remove

Deleted: ¶ ¶ ¶

Name: Gary Frazer, Assistant Director – Ecological Services

Phone: 202-208-4646

Email: gary_frazer@fws.gov

Deleted: i

Deleted: ,

Deleted: i

Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2019–0081; FXES11130900000-189-FF0932000]

RIN 1018-BD95

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicate that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened species, and does not meet the definition of an endangered species, under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: *Written comments:* You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2019–0081, which is the docket number for this rulemaking. Then, click on the Search button. On the resulting page, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rule box to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2019–0081, U.S. Fish and Wildlife Service, MS: JAO/1N, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see **Information Requested**, below, for more information).

Document availability: The proposed rule, draft PDM plan, and supporting documents (including the species status assessment (SSA) report, references cited, and 5-year review) are available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and

Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC 28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from other concerned governmental agencies (including, but not limited to, State and Federal agencies and city or county governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information we receive during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

(1) Information concerning the biology and ecology of *Hexastylis naniflora*;

(b)(5) DPP

(2) Relevant data concerning any threats (or lack thereof) to *Hexastylis naniflora*, particularly any data on the possible effects of climate change as it relates to habitat, as well as the extent of State protection and management that would be provided to this plant as a delisted species;

(3) Current or planned activities within the geographic range of *Hexastylis naniflora* that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All

comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment—including your personal identifying information—on *http://www.regulations.gov*. You may request, at the top of your document, that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee we will be able to do so.

Comments and materials we receive, as well as supporting documentation used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act (16 U.S.C. 1531 et seq.) directs that determinations as to whether any species is an endangered or threatened species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for a public hearing on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the *Federal Register* (see **DATES**, above). Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the *Federal Register* at least 15 days before the hearing.

Peer Review

In accordance with our joint policy on peer review published in the *Federal Register* on July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we sought the expert opinions of seven appropriate specialists regarding the species status assessment (SSA) report, which informed this proposed rule. The purpose of peer review is to ensure our determination is based on scientifically sound data, assumptions, and analyses.

Because we will consider all comments and information received during the comment period, our final determinations may differ from this proposal. Based on the new information we receive (and any comments on that new information), we may conclude that the species is still in danger of extinction, either now or in the foreseeable future. Such final decisions would be a logical outgrowth of this proposal, as long as we: (a) base the decisions on the best scientific and commercial data available after considering all of the relevant factors; (2) do not rely on factors Congress has not intended us to consider; and (3) articulate a rational connection between the facts found and the conclusions made, including why we changed our conclusion

Previous Federal Actions

On April 14, 1989, we listed *Hexastylis naniflora* as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting, and cattle grazing (54 FR 14964). A recovery plan for the species was never completed. However, over the last 30 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf species status assessment (SSA) to aid in determining the appropriateness of reclassifying the species.

Background

Deleted: have

(b)(5) DPP(b)(5) DPP

(b)(5) DPP

Hexastylis naniflora is a plant species endemic to the Upper Piedmont region of western North Carolina and upstate South Carolina. It is a low-growing herbaceous plant in the birthwort family (Aristolochiaceae). Although *Hexastylis naniflora* is restricted in range, it is not as rare as once thought (Service 2010, p. 15; NCNHP 2016, p. 4). When *Hexastylis naniflora* was federally listed in 1989, the listing rule described 24 extant populations (and one extirpated population) distributed across eight counties in the Upper Piedmont of North and South Carolina. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two States. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Hexastylis naniflora appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of *Hexastylis naniflora*, but also the size of any population.

Hexastylis naniflora occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, p. 114; Weakley 2015, p. 129; Service 2015, entire), or in moist soils adjacent to creeks or streamheads, or along lakes and rivers. Plants grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). A habitat suitability study was conducted to quantify the habitat requirements for *Hexastylis naniflora*, which may be used for helping identify the species

Deleted: species of

Deleted: rare,

(b)(5) DPP

(b)(5) DPP

Deleted: have been observed to

Deleted: Wagner (2013, pp 30–32) conducted a

when not in flower (relative to other *Hexastylis* species' habitat preferences), finding new populations, or identifying suitable sites for transplants (Wagner 2013, pp. 30-32). The unit of measurement for population size in this species is a "clump" (rosette).

A thorough review of the taxonomy, life history, ecology, and overall viability of the *Hexastylis naniflora* is presented in the SSA report (Service 2018, entire; available at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081).

Regulatory and Analytical Framework

Regulatory Framework

Formatted: Font: (Default) Times New Roman, 12 pt

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an "endangered species" or a "threatened species." The Act defines an endangered species as a species that is "in danger of extinction throughout all or a significant portion of its range," and a threatened species as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether any species is an "endangered species" or a "threatened species" because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future. These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term "threat" to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term "threat" includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term "threat" may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the

Moved (insertion) [2]

Formatted: Font: (Default) Times New Roman, 12 pt

species—such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term "foreseeable future," which appears in the statutory definition of "threatened species." Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term foreseeable future extends only so far into the future as the Services can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. "Reliable" does not mean "certain"; it means sufficient to provide a reasonable degree of confidence in the prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework The SSA report documents the results of our comprehensive biological status review for *Hexastylis naniflora*, including an assessment of the potential stressors to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for removal from the List of Endangered and Threatened Plants

(b)(5) DPP
(b)(5) DPP

(i.e., "delisting"). It does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate the species' individual life-history needs. In the next stage, we assessed the historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize the species' viability (i.e., its ability to sustain populations in the wild over time). We used this information to inform this proposed rule.

Deleted: utilized

Summary of Biological Status and Threats

Formatted: Font: Bold, Italic

Formatted: Space After: 8 pt, Widow/Orphan control, Don't keep with next

Current Condition

Resiliency

For *Hexastylis naniflora* to maintain viability, its populations, or some portion thereof, must be resilient. Resiliency is assessed at the level of populations and reflects a species' ability to withstand stochastic events (events arising from random factors). Resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates and

fecundity (demographic stochasticity), variations in rainfall (environmental stochasticity), and the effects of anthropogenic activities. Stochastic factors that have the potential to affect *Hexastylis naniflora* include habitat impacts, particularly human development pressures, but also climate change, and exotic, invasive species. Factors influencing the resiliency of *Hexastylis naniflora* populations include population size, available habitat, and elements of *Hexastylis naniflora* ecology that determine whether populations can maximize habitat occupancy.

The Natural Heritage Program (NHP) collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member NHPs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2004, n.p.). We regard the NHP database as the best repository for known locations of the dwarf-flowered heartleaf (Service 2010, p. 41). Based on recent reports using the data sources described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple sub-EOs and stand-alone EO records. For the purpose of assessing resiliency, 78 populations observed since 2005 were assessed due to the high confidence in their persistence.

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The

(b)(5) DPP

(b)(5) DPP

Deleted: s

Deleted: s

Deleted: this information

(b)(5) DPP

(b)(5) DPP

Deleted: only the

primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

- Very high—populations with more than 1,000 individuals; very high probability of persistence for 20–30 years at or above the current population size.
- High—populations with 500 to 1,000 individuals; moderately high probability of persistence for 20–30 years at or above the current population size.
- Moderate—populations with 100 to 500 individuals; low probability of persistence for 20–30 years at or above the current population size.
- Low—populations with fewer than 100 individuals; low probability of persistence for 20–30 years at or above the current population size, and moderately high probability of extirpation.

Of the 78 populations assessed, 28 have very high resiliency, 5 have high resiliency, 26 have moderate resiliency, and 19 have low resiliency.

Redundancy

Redundancy is also assessed at the species level and reflects a species' ability to withstand catastrophic events (such as a rare destructive natural event or episode involving many populations) by spreading the risk of such an event across multiple, resilient populations. We measured redundancy for *Hexastylis naniflora* by the number and distribution of resilient

populations across the range of the species. It is important to note that *Hexastylis naniflora* has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area. Redundancy for *Hexastylis naniflora* is the total number and resiliency of population segments and their distribution across the species' range.

We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with devastating effects; however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of *Hexastylis naniflora* ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long-term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions such as temperature and precipitation changes (DeWan et al. 2010, pp. 7–10). There are 119 populations of *Hexastylis naniflora*, spread across 13 counties. This is an increase from 24 populations across eight counties at the time of listing. There appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press disturbances.

(b)(5) DPP

(b)(5) DPP

Representation

We lack genetic and ecological diversity data to characterize representation for *Hexastylis naniflora*. In the absence of species-specific genetic and ecological diversity

information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. Instead, we used the EO data standard, which provides a default separation distance of 1 kilometer (km) (0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several *Hexastylis naniflora* populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Summary of Threats and Conservation Measures that Affect the Species

The North Carolina (NC) NHP assessed threats in the populations they monitored from 2012 through 2016 (Robinson and Padgett 2016, pp. 7–8, 17–20). Threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank (A through G) for each threat factor determined an overall value for each threat observed at each population. Threats observed during these years included development; incompatible forestry practices; agriculture; trampling; invasive, exotic species; sedimentation; erosion; and road construction. In this rule, we only discuss the major threats affecting the species which are development, climate change and invasive, exotic species.

Development

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Hexastylis naniflora populations occur in rapidly growing urban areas within expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, South Carolina (SC), to the south. At the time of listing, the species was determined to be most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

The most recent 5-year review for the species identified the most recurrent source of habitat destruction as road and bridge improvement projects, which is the most common trigger for consultations under section 7 of the Act involving *Hexastylis naniflora*. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of section 7 consultations. Collectively, these projects have adversely impacted or were expected to impact approximately 22,135 rosettes. In most cases, the section 7 process resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection. Significant portions of other populations have been purchased by the NC Department of Transportation (NCDOT) as off-site conservation measures in association with these consultations. Other forms of economic development have also resulted in the destruction or modification of habitats occupied by *Hexastylis naniflora*; in many cases, these activities have also required section 7 consultations with the Service. Examples include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities at a regional airport. Collectively, these activities involved the loss or relocation of several thousand rosettes.

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Deleted: , and certainly

(b)(5) DPP

The North Carolina Plant Protection and Conservation Act (North Carolina General Statutes, sections 106-202.12 et seq.) lists native plants as threatened, endangered, or species of concern, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. In South Carolina, plants are protected only from disturbance where they occur on those properties owned by the State and specifically managed as South Carolina Heritage Preserves (South Carolina Code of State Regulations, chapter 123, sections 123-200 through 123-204).

The overwhelming majority of *Hexastylis naniflora* populations have been discovered as a direct result of surveys conducted to ensure compliance with the Act. Even more significantly, the majority of sites that have the potential to afford long-term protection to the species have been protected as a direct result of the provisions of section 7 of the Act, which directs consulting agencies to minimize adverse effects to federally listed species through conservation measures pledged as a part of the project description.

Invasive, Exotic Species

Invasive, exotic plant species occur across the range of this species. Plants such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and Japanese stiltgrass (*Microstegium vimineum*) are known at several sites that contain *Hexastylis naniflora* (Service 2011, p. 15). Invasive, exotic species were identified as a threat at 8 of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17–19). The eight populations include four stand-alone EOs and four parent EOs with 19 sub-EOs. Of the four stand-alone EOs, one has an invasive threat rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area),

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

two have a rank of F (low severity threat for most or a significant proportion of population, occurrences, or area), and one has a rank of G (low severity threat for a small proportion of population, occurrences, or area). Of the 19 sub-EOs, 9 have invasive, exotic species identified as a threat. Of the nine sub-EOs, one has an invasive threat rank of A (moderate to severe, imminent threat for most (more than 60 percent) of population, occurrences, or area), four have a rank of B, two have a rank of E (moderate to severe threat for a small proportion of population, occurrences, or area), and two have a rank of G. The one stand-alone EO and five sub-EOs with the highest threat ranks (A and B) are located in three populations. Based on the most recent monitoring data, one is increasing, one is stable, and one is decreasing (Robinson and Padgett 2016, p. 11). Thus, even where nonnative species are ranked as a high threat, it does not mean that the dwarf-flowered heartleaf is responding negatively.

Deleted: (moderate to severe

(b)(5) DPP

(b)(5) DPP

Invasive, exotic species were identified as a threat at all (three) South Carolina populations monitored by NCNHP, and all sites had an invasive threat rank of F (Robinson and Padgett 2016, p. 20). Based on the most recent monitoring data, all populations are stable (Robinson and Padgett 2016, p. 11).

(b)(5) DPP

In short, the data indicate that *Hexastylis naniflora* populations can persist and increase in the presence of invasive, exotic species. Despite the long-term presence of invasive, exotic plants, from 2012 to 2016, there were no changes in the severity of threats observed in the field from these species significant enough to elevate the threat ranks of *Hexastylis naniflora* populations evaluated (NCNHP 2016, p. 8).

Climate Change

There is concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Because typical habitats for this species include

(b)(5) DPP

Deleted:

moist soils adjacent to creeks or streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams, potential increases in drought due to the effects of climate change are likely related to changes in soil moisture. Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.), which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p. 7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages, resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p. 7). Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. In recent years, the Southeast has experienced moderate to severe droughts, which many observers have implicated in population declines and poor transplant survivorship (NCNHP 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County, NC; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, entire). Although climate change is likely to affect terrestrial habitats in the Southeast, currently, we have no evidence that climate change effects observed to date have had any adverse impact on the species or its habitats. Additionally, *Hexastylis naniflora* is found in 13 counties, up from 8 at listing, and is known from 119 populations, up from 24 at listing.

Deleted: specific effects

Deleted: of

Deleted: to *Hexastylis naniflora*

(b)(5) DPP

Deleted:

Deleted:

(b)(5) DPP

(b)(5) DPP

Deleted: ;

Deleted: however

Future Condition

Our analysis of the past, current, and future influences on what *Hexastylis naniflora* needs for long-term viability revealed that there are several influences that may pose risks to the future viability of the species. These risks are primarily related to invasive species, climate change, and habitat changes from development. We have identified 2040 as our foreseeable future based on the lifespan of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape (see SSA report, available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081, for further explanation). We discuss in greater detail how we define "foreseeable future" for this species below, under ***Determination.***

Invasive, Exotic Species

As discussed above, invasive, exotic plants were identified as a threat at the time of listing; however, the threat may not be as significant as once thought. The NCNHP monitored 13 populations of *Hexastylis naniflora* and assessed threats at each population. Of monitored sites, only 9 percent of populations (one of 11) where invasive, exotic species are present are also in decline, indicating the species has at least some capacity to withstand the presence of invasive, exotic species. The number of populations has increased dramatically since listing; the invasive, exotic plant threat posed at many of the largest populations is low (NCNHP 2016, pp. 8, 17–20); and the number of populations under conservation ownership with management has increased.

Therefore, we do not believe that competition from invasive, exotic species will be a significant threat in the foreseeable future.

Climate Change

Moved (insertion) [1]

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Deleted: Their results show that, o

(b)(5) DPP

(b)(5) DPP(b)(5) DPP

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

(b)(5) DPP

(b)(5) DPP

According to IPCC, "most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change on most landscapes" (IPCC 2014, p. 13). Plant species with restricted ranges may experience population declines as a result of the effects of climate change. The concept of changing climate can be meaningfully assessed both by looking into the future and reviewing past changes.

As part of the current, worldwide collaboration in climate modelling under the IPCC, climate assessments of the full dataset of 30 climate models for historical and 21st century comparisons provide predictions at scales ranging from global to county level in the United States (U.S. Geological Survey (USGS) National Climate Change Viewer (NCCV) 2019). This global climate information has been recently downscaled by the National Aeronautics and Space Administration to scales relevant to our region of interest, and projected into the future under two different scenarios of possible emissions of greenhouse gases (Alder and Hostetler 2017, p.

Deleted: ; *https://www2.usgs.gov/landresources/lcs/nccv.asp*

Deleted:

3). Using the NCCV and assuming the more extreme "representative concentration pathways" (RCP) greenhouse gas emission scenario (RCP 8.5), we calculated projected annual mean changes comparing actual temperatures from 1981–2010 to those projected for 2025–2049 for maximum temperature (+2.9–3.1 degrees Fahrenheit (°F) in NC and +2.9 °F in SC), precipitation (+0.02 inches per month for NC and SC), soil storage (-0.1 inch for NC and SC), and evaporative deficit (no change for NC or SC) in all counties where *Hexastylis naniflora* occurs (Adler and Hostetler 2017, entire). Based on these results, all 13 counties within the range of *Hexastylis naniflora* will be subjected to higher temperatures (annual mean increase of 2.9 °F) and slightly higher precipitation (annual mean increase of 0.2 inches per month) relative to the period of 1981–2010. Because the average annual increase in precipitation is predicted to be only slight, the loss in soil storage is likely primarily the result of higher predicted temperatures. While the predictions of a changing climate could negatively impact *Hexastylis naniflora*, the species possesses other biological traits to provide resiliency to this threat.

(b)(5) DPP

Hexastylis naniflora is a long-lived perennial species. Several populations have been revisited after decades and the species was still present. For example, one population in Rutherford County was first observed in 1957, and was next observed in 2001 (NCNHP 2018, n.p.). In their analyses of life-history traits in relation to potential vulnerability to variability in demographic vital rates caused by increased variability in climatic patterns, researchers concluded that longer-lived species should be less influenced by climate-driven increases in demographic variability (Morris *et al.* 2008, p. 22; Dalgleish *et al.* 2010, p. 216).

(b)(5) DPP

Deleted:

(b)(5) DPP

Within the family Aristolochiaeae, more than 50 percent of the plant lineage is myrmecochorous (seed dispersal by ants) (Lengyel et al. 2010, p. 49). Likewise, *Hexastylis naniflora* employs myrmecochory as a method for seed dispersal (Gaddy1986, entire). While

(b)(5) DPP

Deleted: ,

species with ant-dispersed seeds have slower migration rates than species with seeds that are adhesive or ingested (Brunet and Von Oheimb 1998, p. 429), myrmecochory provides the multiple adaptive advantages for plants. Ants can disperse seeds to sites that might be nutrient-enhanced or where plant fitness will be higher. Additionally, ants bury seeds, which may protect them from fire and drought (Boyd 2001, p. 235), two conditions exacerbated by climate change.

Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, p. 111). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations of *Hexastylis naniflora* in 2009 (Golder and Associates 2009). However, anecdotal observation suggests that the species was not appreciably harmed by this fire (Service 2011, p. 14). Additionally, the National Park Service (NPS) uses prescribed fire as a vegetation management tool at Cowpens National Battlefield. The NPS's prescribed burning activity includes the majority of the *Hexastylis naniflora* population on site; burning appears to have had no adverse effects upon growth or flowering (Walker et al. 2009, p. 14).

Populations are located within various ecological settings within the species' range. *Hexastylis naniflora* occurs on Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (Padgett 2004, p. 114; Weakley 2015, p. 129), or moist soils adjacent to creeks or streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats, demonstrating the species' ability to adapt to different environmental conditions that could be brought on by climate change.

Deleted: been shown to have

Deleted: the multiple benefits

(b)(5) DPP(b)(5) DPP

Deleted: are known to

Deleted: and some studies show burying seeds

Deleted: scope of

Deleted:

Deleted: Monitoring data suggest that b

Deleted: has

(b)(5) DPP

Although climate change is almost certain to affect *Hexastylis naniflora* habitats in North and South Carolina (USGS NCCV 2019), there is uncertainty about the specific effects of climate change on the plant. As discussed above, we have no direct evidence that climate change has had any adverse impact on *Hexastylis naniflora* or its habitat, and we are uncertain of how projected changes in temperature, precipitation, and soil moisture will influence the species in the future. However, based on the biological traits discussed above, we do not believe that climate change is a threat to the plant now or within the foreseeable future.

Development

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status quo, targeted conservation, and high development. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040, a time period for which the models provide reliable data. The SLEUTH model has been successfully applied worldwide over the last 15 years to simulate land use change, including urbanization (Clarke 1995, entire).

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Deleted: ;
https://www2.usgs.gov/landresources/lcs/nccv.asp…

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Deleted: would

(b)(5) DPP

The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0 to 100 percent. We chose 80 percent probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- Percent increase in projected development within current populations; and
- Percent increase in projected development within areas delineated as potential habitat

by the Maxent habitat model.

We know that urban development has extirpated dwarf-flowered heartleaf populations in the past through loss of habitat. There are no data available on the relationships between urbanization and indirect? impacts to ***Hexastylis naniflora*** although several current populations are located in areas with surrounding urban landscapes. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from nearby urban development. Also, we used two thresholds for percent increase in urban development to capture potential deleterious effects: 25 percent and 50 percent. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25 percent of the area of current populations was likely to have some negative impacts; and development increase of at least 50 percent was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios (targeted conservation and status quo). This is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider under **Current Conditions**, above, include

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP(b)(5) DPP

Deleted: also

Deleted: led to extirpation of

Deleted: exact

(b)(5) DPP

Deleted: the

Deleted: We do know that

Formatted: Font: Not Italic

(b)(5) DPP

detections that have occurred within the last few years. Second, we did not include many older detections (i.e., we only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years, and the species was present. For example, one such EO was first observed in 1957, and next observed in 2001. It seems as long as suitable habitat is still present, it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where *Hexastylis naniflora* is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e., we define current populations as those observed between 2005 and present day). Although our focus is on older EOs, where *Hexastylis naniflora* is likely to persist into the future, we also included current EOs (2005–current day) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005 to today. If these older EOs within current populations that were not included in our **Current Conditions** discussion, above, are found to be likely to persist, then it is possible we underestimated the resiliency of that population.

(b)(5) DPP

Once these older EOs were identified, we created a 1,000-meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH

model to further refine a list of potential sites where the species would likely be found to persist within our 20–25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed under **Current Conditions**, above (i.e., low = fewer than 100 individuals; moderate = 100–500 individuals; high = 500–1,000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and percent Maxent classified as 0.8–1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000-meter buffer. The percent Maxent classified as 0.8–1.0 represents the percentage of all potential habitat within the 1,000-meter buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000-meter buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where *Hexastylis naniflora* is likely to persist.

Status Quo Scenario

Under the status quo scenario, we estimate that 75 populations will persist throughout the range, and that there will be a range of impacts from urbanization that are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.

(b)(5) DPP

Deleted: assume

Deleted: be identified as

Deleted: ing

- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—no negative impacts from urbanization; and
        - Voluntary protection/non-perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold.
    - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

High Development Scenario

Under the high development scenario, we estimate no additional populations will persist throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

Deleted: assume

Deleted: be identified as

Deleted: ing

(b)(5) DPP(b)(5) DPP

- No additional populations are identified as persisting.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold; and
        - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

- Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold; extirpation of populations if percent increase in urbanization exceeds 90 percent threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we estimate it is likely that several additional populations (i.e., more than in the status quo scenario) will persist throughout the range. The range of impacts from urbanization are the same as in the status quo scenario. We assessed population resiliency under the following assumptions:

(b)(5) DPP

Deleted: assume

Deleted: be identified as persisting

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
  - Protected areas:
    - Protected in perpetuity—no impacts from urbanization; and
    - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 50 percent threshold.
  - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

Future Resiliency

Status Quo Scenario

In the status quo scenario, we predict 75 populations of *Hexastylis naniflora* will be extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

(b)(5) DPP

Deleted: there are

Deleted: ed

Deleted: to be

Deleted: on the landscape

High Development Scenario

In the high development scenario, we predict 72 populations of *Hexastylis naniflora* will remain extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Deleted: there are

Deleted: ed

Deleted: to be

Deleted: on the landscape

Targeted Conservation Scenario

In the targeted conservation scenario, we predicted 79 populations of *Hexastylis naniflora* will be extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Deleted: there are

Deleted: to be

Deleted: on the landscape

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few populations is offset in the status quo and targeted conservation scenarios by the persistence of several additional populations. In the high development scenario, there is a predicted loss of six populations, with loss of resiliency in several additional populations. However, in all three scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press catastrophic

disturbances; however, the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change, over the next 20 to 30 years.

(b)(5) DPP

Based on the assumption that *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (status quo and targeted conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. Here are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Table of viability summary for *Hexastylis naniflora* under three future scenarios (projected to year 2040) and compared to current condition.

	Current Condition	Status Quo Scenario	High Development Scenario	Targeted Conservation Scenario
Very High Resiliency	28	27	27	27
High Resiliency	5	6	4	6
Moderate Resiliency	26	23	25	23
Low Resiliency	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total Populations	**78**	**75**	**72**	**79**

Determination of Dwarf-flowered Heartleaf Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." For a more detailed discussion on the factors considered when determining whether a species meets the definition of "endangered species" or "threatened species" and our analysis on how we determine the foreseeable future in making these decisions, please see the *Regulatory Framework* section above.

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to *Hexastylis naniflora*. Currently, there are a total of 119 known populations in 13 counties, 78 of which have been documented since 2005. This is a significant increase from 24 known populations in eight counties at the time of listing. Of the 78 populations, 75 percent are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend.

(b)(5) DPP

When *Hexastylis naniflora* was listed (54 FR 14964; April 14, 1989), the two prominent threats identified were invasive, exotic plants and habitat loss or destruction. As discussed above, invasive, exotic species are not as significant a threat to *Hexastylis naniflora* as originally thought. Only one of the 11 monitored populations where invasive, exotic species occur was identified is declining. Additionally, *Hexastylis naniflora* has the capacity to withstand habitat loss and destruction due to development. The species currently has significant redundancy (119 populations), resilient populations (33 of 78 evaluated populations with high or very high viability), and representation in two different ecological settings. Even under our high

(b)(5) DPP

(b)(5) DPP(b)(5) DPP

development scenario, only two high or very high viability populations are predicted to have lower viability as a result of development. Therefore, we do not believe that competition from invasive, exotic species or habitat loss and destruction are significant threats to the species. Additionally, since listing, there has been a nearly four-fold increase in the number of known populations, and several populations have entered into conservation ownership by organizations with management staff (e.g., Broad River Greenway) or have commitments of management (e.g., N.C. Department of Transportation). We conclude that the species is currently not in danger of extinction throughout its range.

Deleted: lost to a lower

Deleted: rank

(b)(5) DPP

In order to more closely examine the future threat posed by habitat loss or destruction, the Service analyzed three different development scenarios into the future to 2040. Under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (five or six) of currently low resilient populations are projected to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Approximately 31 percent of the 78 currently known populations are permanently protected, and another 23 or so percent are somewhat protected (through voluntary agreements or another type of protection), reducing the likelihood of development impacting those populations. Recent examination of the species also identified climate change and invasive species as potential future threats. The broadened range (8 counties to 13) and significantly increased population numbers (24 to 119) since listing in 1989 indicate that the species benefits from sufficient redundancy and resiliency to withstand perturbations from climate change as well as from invasive species. Based on this analysis, we

(b)(5) DPP

conclude that the species is neither currently in danger of extinction, nor likely to become so within the foreseeable future.

Determination of Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range (SPR). Where the best available information allows the Services to determine a status for the species rangewide, that determination should be given conclusive weight because a rangewide determination of status more accurately reflects the species' degree of imperilment and better promotes the purposes of the Act. Under this reading, we should first consider whether the species warrants listing "throughout all" of its range and proceed to conduct a "significant portion of its range" analysis if, and only if, a species does not qualify for listing as either an endangered or a threatened species according to the "throughout all" language.

Having determined that *Hexastylis naniflora* is not in danger of extinction nor likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in an SPR. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do the "screening" analysis, we ask whether there are portions of the species' range for which there is substantial information indicating that: (1) The portion may be significant; and (2) the species may be, in that portion, either in danger of extinction or likely to become so in the foreseeable future. For a particular portion, if we cannot answer both questions in the affirmative, then that portion does not warrant further consideration and the

species does not warrant listing because of its status in that portion of its range. We emphasize that answering these questions in the affirmative is not a determination that the species is in danger of extinction or likely to become so in the foreseeable future throughout a significant portion of its range—rather, it is a step in determining whether a more detailed analysis of the issue is required.

If we answer these questions in the affirmative, we then conduct a more thorough analysis to determine whether the portion does indeed meet both of the SPR prongs: (1) The portion is significant; and (2) the species is, in that portion, either in danger of extinction or likely to become so in the foreseeable future. Confirmation that a portion does indeed meet one of these prongs does not create a presumption, prejudgment, or other determination as to whether the species is an endangered species or threatened species. Rather, we must then undertake a more detailed analysis of the other prong to make that determination. Only if the portion does indeed meet both SPR prongs would the species warrant listing because of its status in a significant portion of its range.

At both stages in this process—the stage of screening potential portions to identify any portions that warrant further consideration and the stage of undertaking the more detailed analysis of any portions that do warrant further consideration—it might be more efficient for us to address the "significance" question or the "status" question first. Our selection of which question to address first for a particular portion depends on the biology of the species, its range, and the threats it faces. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range.

For *Hexastylis naniflora*, we chose to evaluate the status question (i.e., identifying portions where *Hexastylis naniflora* may be in danger of extinction or likely to become so in the foreseeable future) first. To conduct this screening, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. We examined the following threats: LIST THREATS HERE, including cumulative effects.

The NCNHP monitored 13 populations of *Hexastylis naniflora* throughout the species' range. Eleven of the 13 populations had invasive, exotic species identified as a threat, indicating that invasive, exotic species are found throughout the range and not concentrated in any specific location. Climate change effects, as discussed previously, are very uniform throughout the range. The opportunity for habitat loss and destruction due to development is higher on privately owned lands that could be sold for future development. Of the 78 populations evaluated, we determined that 31 percent are permanently protected and another 23 percent are partially protected (i.e., voluntary landowner agreements). The unprotected populations are spread throughout the species' range and not geographically clustered together. While there is some variability in the habitats occupied by *Hexastylis naniflora* across its range, the basic ecological components required for the species to complete its life cycle are present throughout the habitats occupied by the 119 populations of the species. Thus, we found no concentration of threats in any portion of the dwarf-flowered heartleaf range at a biologically meaningful scale.

If both (1) a species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range and (2) the threats to the species are essentially uniform throughout its range, then the species could not be in danger of extinction or likely to become so in the foreseeable future in any biologically meaningful portion of its range. For the *Hexastylis naniflora*, we found both: the species is not in danger of extinction or likely to

(b)(5) DPP

Formatted: Indent: First line: 0.5

(b)(5) DPP
(b)(5) DPP

Formatted: Highlight

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Formatted: Font: (Default) Times New Roman, 12 pt

Deleted:

Formatted: Font: (Default) Times New Roman, 12 pt

Formatted: Font

(b)(5) DPP(b)(5) DPP

Formatted: Not Highlight

become so in the foreseeable future throughout all of its range, and there is no geographical concentration of threats so the threats to the species are essentially uniform throughout its range. Therefore, no portions warrant further consideration through a more detailed analysis, and the species is not in danger of extinction or likely to become so in the foreseeable future in any significant portion of its range. Our approach to analyzing SPR in this determination is consistent with the court's holding in *Desert Survivors v. Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018).

Hexastylis naniflora Determination of Status

Our review of the best available scientific and commercial information indicates that the dwarf-flowered heartleaf does not meet the definition of an endangered species or a threatened species in accordance with sections 3(6) and 3(20) of the Act. On the basis of this evaluation we propose to remove *Hexastylis naniflora* from the Federal List of Endangered and Threatened Plants (50 CFR 17.12(h)).

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Formatted: Font: Italic

Formatted: Font: (Default) Times New Roman, 12 pt

Formatted: Font: (Default) Times New Roman, 12 pt

(b)(5) DPP

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove *Hexastylis naniflora* from the Federal List of Endangered and Threatened Plants. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect *Hexastylis naniflora*.

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as an endangered or threatened species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2019–0081. Copies can also be obtained from the Service's Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**). We seek information, data, and comments from the public regarding *Hexastylis naniflora* and the PDM plan. We are also seeking peer review of the draft PDM plan concurrently with this comment period. We anticipate finalizing the PDM plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are not clearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act

We have determined that we do not need to prepare an environmental assessment or environmental impact statement, as defined in the National Environmental Policy Act (42 U.S.C. 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act. We published a notice outlining our reasons for this determination in the *Federal Register* on October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands affected by this proposed rule.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081 and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

§ 17.12 [Amended]

2. Amend § 17.12(h) by removing the entry for "*Hexastylis naniflora*" under "FLOWERING PLANTS" from the List of Endangered and Threatened Plants.

Dated: _____

_____

Margaret E. Everson,
Principal Deputy Director,
U.S. Fish and Wildlife Service,
Exercising the Authority of the Director,
U.S. Fish and Wildlife Service.

~~[Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants]~~

Information Memorandum for the Secretary/Director

Date: July 16, 2018

From: Gary Frazer, Assistant Director, Ecological Services

Telephone: 202-208-4646

Subject: Dwarf-flowered Heartleaf Proposed Delisting

I. Introduction

We are proposing to delist the dwarf-flowered heartleaf (*Hexastylis naniflora*). This proposal is based on a thorough review of the best available scientific and commercial information, which indicates that this species does not meet the definition of an endangered species or threatened species.

II. Background

On April 14, 1989, we listed the dwarf-flowered heartleaf as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing (FR 54 14964). A recovery plan for the species was never completed. Over the last 29 years, the Service has worked closely with partners to recover this species. The Service initiated a Species Status Assessment (SSA) to aid in determining the appropriateness of reclassifying the species in 2018.

Formatted: Line spacing: single

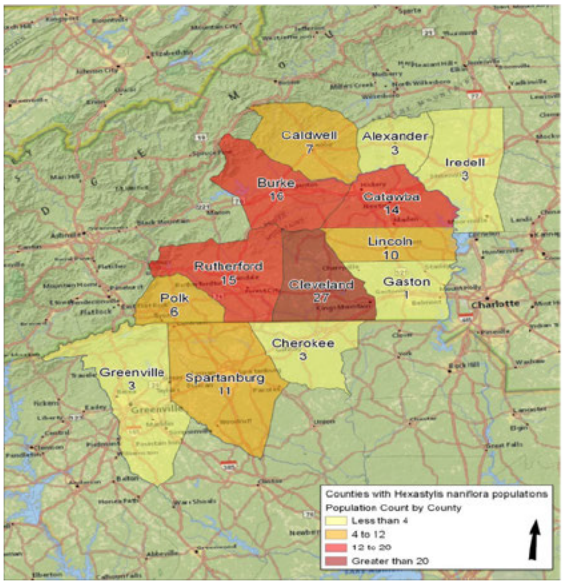
Deleted: i

Deleted: recommendation

Deleted: published a final rule in the Federal Register (FR 54 14964) listing

Deleted: However,

Deleted: o



Key Drivers of Species Status

CURRENT AND FUTURE CONDITIONS - The dwarf-flowered heartleaf is a low growing herbaceous plant in the birthwort family. When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include five additional counties in North Carolina. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is in Cherokee, Greenville, and Spartanburg Counties. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two states.

Formatted: Left, Line spacing: single

At the time of listing, the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. In addition, other documented threats include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of ponds, impacts from grazing cattle, ORV damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or siltation. In the SSA, we assessed these same factors as well as climate change to determine the viability of the dwarf-flowered heartleaf currently and in the future. Climate change through changes in temperature and precipitation may exacerbate these risk factors to the species.

(b)(5) DPP

To determine current resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary

(b)(5) DPP

factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focused monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information (b)(5) DPP(b)(5) DPP for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Of the 78 populations assessed, 28 had very high resiliency, five had high, 26 had moderate, while 19 had low resiliency.

We assessed the future condition of the dwarf-flowered heartleaf under three scenarios projected out to the year 2040. In the Status Quo scenario, there are predicted to be 75 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and two additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. In the High Development scenario, there are predicted to be 72 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate; two moderate populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development. In the Targeted Conservation scenario, there are predicted to be 79 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and six additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. Thus, after considering the best available scientific and commercial information, we determine the dwarf-flowered heartleaf is not likely to become in danger of extinction in the foreseeable future.

(b)(5) DPP

(b)(5) DPP

Data Sources (b)(5) DPP

The data set available for determining species abundance, distribution, and factors influencing the species viability predominantly relies on existing information from unpublished field survey results, research project reports, peer reviewed scientific publications, unpublished field observations by experienced biologists, personal communications, latest 5-year review, and the species status assessment report.

Conservation Efforts

(b)(5) DPP

The North Carolina Plant Conservation and Protection Act (NC State Code Article 19B, § 106-202.12) provides limited protection from unauthorized collection and trade of plants listed under that statute. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. Plant species are afforded even less protection in South Carolina, where they are protected only from disturbance where they occur on those properties owned by the state and specifically managed as South Carolina Heritage Preserves (SC State Code of Regulations Part 123 § 200-204). There are no other federal or state statutes that afford significant protections to *Hexastylis naniflora*.

The overwhelming majority of *Hexastylis naniflora* populations have been discovered as a direct result of surveys conducted to ensure compliance with the Endangered Species Act. Even more significantly, the majority of sites that have the potential to afford long-term protection to the species have been protected as a direct result of the provisions of Section 7 of the ESA.

(b)(5) DPP

Deleted: ,

Tens of thousands of threatened dwarf-flowered heartleaf plants are conserved by Duke Energy along the Broad River. Another population is conserved at Cowpens National Battlefield, in upstate South Carolina. A third is part of the Broad River Greenway, a local park in North Carolina's Cleveland County. These are three of many conservation efforts for the heartleaf, leading the USFWS to propose removing it from the federal threatened and endangered species list. Key to that conservation effort has been organizations acquiring and permanently protecting sites where the plant grows. Foothills Conservancy, Catawba Lands Conservancy, and The Nature Conservancy all protect sites. The North Carolina Department of Transportation is one of the greatest contributors to conservation, acquiring land and conserving multiple populations over the years, including land that became part of Cleveland County's Broad River Greenway.

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Post-Delisting Monitoring

The purpose of post-delisting monitoring is to verify that the dwarf-flowered heartleaf (*Hexastylis naniflora*) remains secure from the risk of extinction after it has been removed from the protections of the Act. The Service prepared a draft post-delisting monitoring plan, in coordination with our partners. This draft plan is designed to detect substantial declines in the dwarf-flowered heartleaf population with reasonable certainty and precision. It meets the minimum requirement set forth by the Act by effectively monitoring the status of dwarf-flowered heartleaf using annual sampling events.

Deleted: this
Deleted: (PDM)
Deleted: (Plan),
Deleted: different

****

The information below this line is for informational and outreach purposes only and has not been used as the basis for any potential Agency decision.

III. Positions of Interested Parties

The dwarf-flowered heartleaf occurs on public and private land, based on a long history of outreach and conservation projects, landowners would likely be neutral or favorable regarding a proposed delisting.

IV. Potential Issues/Conflicts

Potential issues and conflicts with this proposed delisting are not anticipated.

V. Communications and Outreach

Outreach Lead:	Phil Kloer
Affected States:	North/South Carolina
Media POC:	Phil Kloer 404-679-7299
Congressional:	Kristen Peters (EA) will send advance notification emails to Congressionals via email two days before rule publication.
State Contacts:	Raleigh Ecological Services Office Field Supervisor (Pete Benjamin) will ensure email notification sent to the following offices: North/South Carolina Governor's Office, Deputy Chief of Staff; NC Botanical Garden, Director of Conservation Programs; NC Forest Service, Regional Forester; NC Division of Parks and Recreation – State Parks, Director; NC Natural Heritage Program, Director; NC Plant Conservation Program, Administrator; NC Clean Water Management Trust Fund, Acquisition Program Manager.
Other Outreach:	Region 4 Facebook and Twitter Accounts – Katherine Taylor.

Fw: Dwarf flowered heartleaf info for HQ

Young, Kristi <kristi_young@fws.gov>
Tue 2/4/2020 10:25 AM

To: Hosler, Barbara <barbara_hosler@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>

Barb,

I believe you are acting for Don this month? Please see the attached, responding to Bridget's comments

Kristi

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Tuesday, February 4, 2020 8:17 AM
To: Morgan, Don <don_morgan@fws.gov>; Fahey, Bridget <bridget_fahey@fws.gov>; Glenne, Gina <gina_glenne@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>; Ketram, Natchanon N <natchanon_ketram@fws.gov>
Subject: Re: Dwarf-flowered heartleaf info for HQ

Hello All

Sorry for the delay addressing comments. Please see attachments for the dwarf-flowered heartleaf proposed rule, IM & BP. Let me know if you have additional comments.

Byron A. Hamilton, Sr.
U.S. Fish and Wildlife Service
South Atlantic-Gulf & Mississippi Basin Regions
Ecological Services Program
1875 Century Blvd NE
Atlanta, GA 30345

From: Morgan, Don <don_morgan@fws.gov>
Sent: Thursday, September 26, 2019 4:22 PM
To: Merritt, Timothy <timothy_merritt@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>; Young, Kristi <kristi_young@fws.gov>; Ketram, Natchanon N <natchanon_ketram@fws.gov>
Subject: Re: Dwarf-flowered heartleaf info for HQ

Hi Tim,

Attached are comments from Bridget on the Dwarf-flowered heartleaf proposed delisting package.

Please let me know if you have any questions.

Don

_____
Don R. Morgan

U.S. Fish and Wildlife Service
Chief, Branch Delisting and Foreign Species
5275 Leesburg Pike
Falls Church, VA 22041-3803
Phone (703) 358-2444
Fax (703) 358-1800

On Wed, Jul 31, 2019 at 2:34 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Dwarf-flowered heartleaf for your reading pleasure.
> Tim
>
> ---------- Forwarded message ---------
> From: **Hamilton, Byron** <byron_hamilton@fws.gov>
> Date: Wed, Jul 31, 2019 at 2:25 PM
> Subject: Dwarf-flowered heartleaf info for HQ
> To: Timothy Merritt <timothy_merritt@fws.gov>
>
> Tim,
>
> See attachments.
>
> --
> **Byron Hamilton, Sr.**
> **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> **U.S. Fish & Wildlife Service**
> **1875 Century Blvd.**
> **Atlanta, GA 30345**
> **Work - (404) 679-4119**
> **Cell - (803) 707-9518**
>
> --
> _____
> Timothy Merritt
> Chief, Division of Conservation and Classification
> U S Fish and Wildlife Service
> 1875 Century Blvd., NE, Suite 200
> Atlanta, GA 30345
> 404-679-7082 office
> 615 574 8812 cell
>
> ***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***

Briefing Paper for Departmental Clearance of *Federal Register* Documents

I. Subject: Proposed Delisting Rule for Dwarf-flowered heartleaf

II. RIN (for rulemaking documents): 1018-BD95

III. Docket or tracking number: FWS-R4-ES-2019-0081

IV. DCN (from DTS):

V. Summary: We are proposing to delist the dwarf-flowered heartleaf (*Hexastylis naniflora*). This recommendation is based on a thorough review of the best available scientific and commercial information, which indicates that this species does not meet the definition on an endangered species or threatened species.

VI. Is the action controversial? ☐ Yes. ☒ No.

If yes, please answer the following:

a. What are the controversial issues?

b. Who will care about these issues?.

c. How strongly will they care?

VII. Communications:

a. Has the bureau communications office coordinated with DOI communications staff?

☒ Yes. ☐ No.

If yes, please note whom you contacted and how (e.g., email, voicemail):

Brian Hires via email.

b. Does this document require a press release?

☒ Yes. ☐ No.

Press release title: Conservation Success Story: Threatened Plant Proposed for Removal from Endangered species List

Press release first paragraph: Tens of thousands of threatened dwarf-flowered heartleaf plants are conserved by Duke Energy along the Broad River. Another population is conserved at Cowpens National Battlefield, in upstate South Carolina. A third is part of the Broad River Greenway, a local park in North Carolina's Cleveland County. These are three of many conservation efforts for the heartleaf, leading the U.S. Fish and Wildlife Service (Service) to propose removing it from the federal threatened and endangered species list.

VIII. Is timing critical? ☒ Yes. ☐ No.

Target date to clear DOI: INSERT DATE, or as priorities allow.

No-later-than date to clear DOI (if applicable): INSERT DATE.

If you provided an NLT date, please answer the following:

a. What is the main driver of the timing? This action is on our National Delisting/ Downlisting Workplan for FY19

b. What happens if the deadline is missed?

IX. Background: The dwarf-flowered heartleaf is a low growing herbaceous plant in the birthwort family. On April 14, 1989, we listed the dwarf-flowered heartleaf as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing (FR 54 14964). A recovery plan for the species was never completed. Over the last 29 years, the Service has worked closely with partners to recover this species. When dwarf-flowered heartleaf listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two states. Therefore, we propose to delist the dwarf-flowered heartleaf due to recovery.

X. Is there an information collection associated with this document?

☐ Yes. ☒ No.

If yes, please answer the following:

a. Does the document have any approved OMB control number(s)? ☐ Yes. ☐ No.

If yes, provide the OMB control number(s) and expiration date(s):

b. Does the document require ☐ a new OMB control number or ☐ a renewal of an existing approval?

If a new number or a renewal is required, what is the current status?

XI. Approval is requested to send the document to:

☒ The Office of the Federal Register for publication, or

☐ OIRA for review.

XII. Primary contact:

Formatted: Highlight

Formatted: Highlight

Name: Gary Frazer, Assistant Director – Ecological Services
Phone: 202-208-4646
Email: gary_frazer@fws.gov

Information Memorandum for the Secretary/Director

Date: July 16, 2018

From: Gary Frazer, Assistant Director, Ecological Services

Telephone: 202-208-4646

Subject: Dwarf-flowered Heartleaf Proposed Delisting

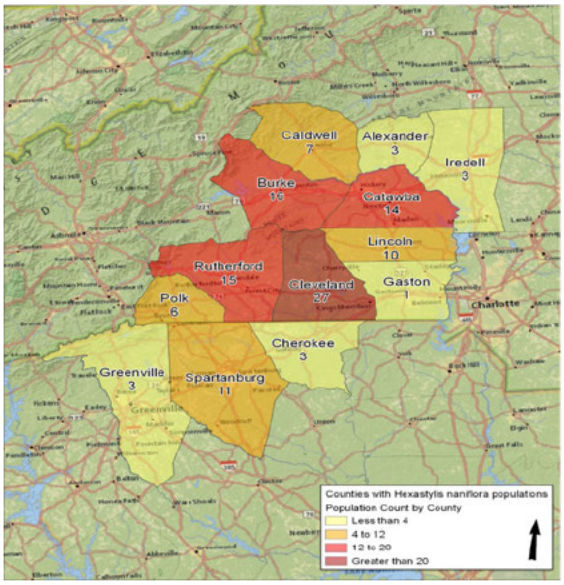
I. Introduction

We are proposing to delist the dwarf-flowered heartleaf (*Hexastylis naniflora*). This proposal is based on a thorough review of the best available scientific and commercial information, which indicates that this species does not meet the definition of an endangered species or threatened species.

Deleted:

II. Background

On April 14, 1989, we listed the dwarf-flowered heartleaf as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting and cattle grazing (FR 54 14964). A recovery plan for the species was never completed. Over the last 29 years, the Service has worked closely with partners to recover this species. The Service initiated a Species Status Assessment (SSA) to aid in determining the appropriateness of reclassifying the species in 2018.



Key Drivers of Species Status

CURRENT AND FUTURE CONDITIONS - The dwarf-flowered heartleaf is a low growing herbaceous plant in the birthwort family. When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include five additional counties in North Carolina. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is in Cherokee, Greenville, and Spartanburg Counties. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two states.

At the time of listing, the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. In addition, other documented threats include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of ponds, impacts from grazing cattle, off road vehicle damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or siltation. In the SSA, we assessed these same factors as well as climate change to determine the viability of the dwarf-flowered heartleaf currently and in the future. Climate change through changes in temperature and precipitation may exacerbate these risk factors to the species.

To determine current resiliency for populations, we used Element Occurrence (EO) viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed

(b)(5) DPP
(b)(5) DPP

to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focused monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have population estimates for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

Deleted: habitat-level information

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.
- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.
- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.
- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

Of the 78 populations assessed, 28 had very high resiliency, five had high, 26 had moderate, while 19 had low resiliency.

We assessed the future condition of the dwarf-flowered heartleaf under three scenarios projected out to the year 2040.

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Table 6.10. Viability summary for *Hexastylis naniflora* under 3 future scenarios (projected to year 2040) and compared to Current Condition.

	Current	Status Quo	High Development	Targeted Conservation
Very High	28	27	27	27
High	5	6	4	6
Moderate	26	23	25	23
Low	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total	**78**	**75**	**72**	**79**

Six EOs within currently delineated populations not included in our Current Conditions analysis are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. Thus, after considering the best available scientific and commercial information, we determine the dwarf-flowered heartleaf is not likely to become in danger of extinction in the foreseeable future.

Data Sources

The data set available for determining species abundance, distribution, and factors influencing the species viability predominantly relies on existing information from unpublished field survey results (1990-2015), research project reports, peer reviewed scientific publications, unpublished field observations by experienced biologists, personal communications, latest 5-year review, and the species status assessment report.

Conservation Efforts

The North Carolina Plant Conservation and Protection Act (NC State Code Article 19B, § 106-202.12) provides limited protection from unauthorized collection and trade of plants listed under that statute. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. Plant species are afforded even less protection in South Carolina, where they are protected only from disturbance where they occur on those properties owned by the state and specifically managed as South Carolina Heritage Preserves (SC State Code of Regulations Part 123 § 200-204). There are no other federal or state statutes that afford significant protections to *Hexastylis naniflora*.

The overwhelming majority of *Hexastylis naniflora* populations have been discovered as a direct result of surveys conducted to ensure compliance with the Endangered Species Act. Even more significantly, the majority of sites that have the potential to afford long-term protection to the species have been protected as a direct result of the provisions of Section 7 of the ESA. Through Section 7 and other voluntary conservation actions, approximately 24 of the 78 poulations are permanently protected, and another 18 populations are partiallyprotected, greatly minimizing the likelihood of impacts due to development.

(b)(5) DPP

Tens of thousands of threatened dwarf-flowered heartleaf plants are conserved by Duke Energy along the Broad River. Another population is conserved at Cowpens National Battlefield, in upstate South Carolina. A third is part of the Broad River Greenway, a local park in North Carolina's Cleveland County. These are three of many conservation efforts for the heartleaf, leading the USFWS to propose removing it from the federal threatened and endangered species list. Key to that conservation effort has been organizations acquiring and permanently protecting sites where the plant grows. Foothills Conservancy, Catawba Lands Conservancy, and The Nature Conservancy all protect sites. The North Carolina Department of Transportation is one of the greatest contributors to conservation, acquiring land and conserving multiple populations over the years, including land that became part of Cleveland County's Broad River Greenway.

(b)(5) DPP

Post-Delisting Monitoring

The purpose of post-delisting monitoring is to verify that the dwarf-flowered heartleaf (*Hexastylis naniflora*) remains secure from the risk of extinction after it has been removed from the protections of the Act. The Service prepared a draft post-delisting monitoring plan in coordination with our partners. This draft plan is designed to detect substantial declines in the dwarf-flowered heartleaf population with reasonable certainty and precision. It meets the minimum requirement set forth by the Act by effectively monitoring the status of dwarf-flowered heartleaf using annual sampling events.

****

The information below this line is for informational and outreach purposes only and has not been used as the basis for any potential Agency decision.

III. Positions of Interested Parties

The dwarf-flowered heartleaf occurs on public and private land, based on a long history of outreach and conservation projects, landowners would likely be neutral or favorable regarding a proposed delisting.

IV. Potential Issues/Conflicts

Potential issues and conflicts with this proposed delisting are not anticipated.

V. Communications and Outreach

Outreach Lead:	Phil Kloer
Affected States:	North/South Carolina
Media POC:	Phil Kloer 404-679-7299
Congressional:	Kristen Peters (EA) will send advance notification emails to Congressionals via email two days before rule publication.
State Contacts:	Raleigh Ecological Services Office Field Supervisor (Pete Benjamin) will ensure email notification sent to the following offices: North/South Carolina Governor's Office, Deputy Chief of Staff; NC Botanical Garden, Director of Conservation Programs; NC Forest Service, Regional Forester; NC Division of Parks and Recreation – State Parks, Director; NC Natural Heritage Program, Director; NC Plant Conservation Program, Administrator; NC Clean Water Management Trust Fund, Acquisition Program Manager.
Other Outreach:	Region 4 Facebook and Twitter Accounts – Katherine Taylor.

Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2019–0081; FXES11130900000-189-FF0932000]

RIN 1018-BD95

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicate that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened species, and does not meet the definition of an endangered species, under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

Formatted

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: *Written comments:* You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2019–0081, which is the docket number for this rulemaking. Then, click on the Search button. On the resulting page, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rule box to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2019–0081, U.S. Fish and Wildlife Service, MS: JAO/1N, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see **Information Requested**, below, for more information).

Document availability: The proposed rule, draft PDM plan, and supporting documents (including the species status assessment (SSA) report, references cited, and 5-year review) are available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and

Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC 28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from other concerned governmental agencies (including, but not limited to, State and Federal agencies and city or county governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information we receive during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

(1) Information concerning the biology and ecology of dwarf-flowered heartleaf;

(2) Relevant data concerning any threats (or lack thereof) to dwarf-flowered heartleaf, particularly any data on the possible effects of climate change as it relates to habitat, as well as the extent of State protection and management that would be provided to this plant as a delisted species;

(3) Current or planned activities within the geographic range of dwarf-flowered heartleaf that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All

(b)(5) DPP

Deleted:

Deleted: *Hexastylis naniflora*

Deleted:

Deleted: *Hexastylis naniflora*

Deleted: *Hexastylis naniflora*

comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment—including your personal identifying information—on *http://www.regulations.gov*. You may request, at the top of your document, that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee we will be able to do so.

Comments and materials we receive, as well as supporting documentation used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act (16 U.S.C. 1531 et seq.) directs that determinations as to whether any species is an endangered or threatened species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for a public hearing on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the *Federal Register* (see **DATES**, above). Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the *Federal Register* at least 15 days before the hearing.

Peer Review

In accordance with our joint policy on peer review published in the *Federal Register* on July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we sought the expert opinions of seven appropriate specialists regarding the SSA report, which informed this proposed rule. Out of the seven reviewers, we received no responses. The purpose of peer review is to ensure our determination is based on scientifically sound data, assumptions, and analyses.

Because we will consider all comments and information received during the comment period, our final determinations may differ from this proposal. Based on the new information we receive (and any comments on that new information), we may conclude that the species is still in danger of extinction, either now or in the foreseeable future. Such final decisions would be a logical outgrowth of this proposal, as long as we: (a) base the decisions on the best scientific and commercial data available after considering all of the relevant factors; (2) do not rely on factors Congress has not intended us to consider; and (3) articulate a rational connection between the facts found and the conclusions made, including why we changed our conclusion

Previous Federal Actions

On April 14, 1989, we listed dwarf-flowered heartleaf as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting, and cattle grazing (54 FR 14964). A recovery plan for the species was never completed. However, over the last 30 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf SSA report to aid in determining the appropriateness of reclassifying the species.

Background

Deleted: have

(b)(5) DPP

Deleted: species status assessment (

Deleted:)

Deleted: published a final rule in the *Federal Register*

Deleted: (54 FR 14964) listing

Deleted: *Hexastylis naniflora*

Deleted: species status assessment (

Deleted:)

Dwarf-flowered heartleaf is a plant species endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It is a low-growing herbaceous plant in the birthwort family (Aristolochiaceae). Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (Service 2010, p. 15; North Carolina Natural Heritage Program (NCNHP) 2016, p. 4). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant populations (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two States. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Dwarf-flowered heartleaf is historically known to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of any population.

Dwarf-flowered heartleaf occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, p. 114; Weakley 2015, p. 129; Service 2015, entire), or in moist soils adjacent to creeks or streamheads, or along lakes and rivers. Plants grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). A habitat suitability study was conducted to quantify the

Deleted: *Hexastylis naniflora*
Deleted: species of
Deleted: Upper
Deleted: rare,
Deleted: *Hexastylis naniflora*

(b)(5) DPP

Deleted: NCNHP
Deleted: *Hexastylis naniflora*
Deleted: Upper
Deleted:

Deleted: *Hexastylis naniflora*
Deleted: appears to have

(b)(5) DPP
(b)(5) DPP

Deleted: *Hexastylis naniflora*
Deleted: *Hexastylis naniflora*

Deleted: have been observed to

Deleted: Wagner (2013, pp 30–32) conducted a

habitat requirements for dwarf-flowered heartleaf, which may be used to help identify the species when not in flower (relative to other *Hexastylis* species' habitat preferences), find new populations, or identify suitable sites for transplants (Wagner 2013, pp. 30-32). The unit of measurement for population size in this species is a "clump" (rosette).

A thorough review of the taxonomy, life history, ecology, and overall viability of the dwarf-flowered heartleaf is presented in the SSA report (Service 2018, entire; available at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081).

Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an "endangered species" or a "threatened species." The Act defines an endangered species as a species that is "in danger of extinction throughout all or a significant portion of its range," and a threatened species is a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether any species is an "endangered species" or a "threatened species" because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

Deleted: *Hexastylis naniflora*

Deleted: for

Deleted: ing

Deleted: ing

Deleted: ing

Deleted: *Hexastylis naniflora*

Formatted: Font: (Default) Times New Roman, 12 pt

Deleted: as

Formatted: Font: (Default) Times New Roman, 12 pt

We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future. These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term "threat" to refer, in general, to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term "threat" includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term "threat" may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the

(b)(5) DPP

Formatted: Font: (Default) Times New Roman, 12 pt

Formatted: Font: (Default) Times New Roman, 12 pt

Formatted: Font: (Default) Times New Roman, 12 pt

species—such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term "foreseeable future," which appears in the statutory definition of "threatened species." Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term foreseeable future extends only so far into the future as the Services can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. "Reliable" does not mean "certain"; it means sufficient to provide a reasonable degree of confidence in the prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework

The SSA report documents the results of our comprehensive biological status review for dwarf-flowered heartleaf, including an assessment of the potential stressors to the species. The SSA report does not represent a decision by the Service on whether the species should be

Formatted: Font: (Default) Times New Roman, 12 pt, Font color: Auto

Formatted: Font color: Auto

(b)(5) DPP

(b)(5) DPP

Deleted: *Hexastylis naniflora*

proposed for removal from the List of Endangered and Threatened Plants (i.e., "delisting"). It does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate the species' individual life-history needs. In the next stage, we assessed the historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize the species' viability (i.e., its ability to sustain populations in the wild over time). We used this information to inform this proposed rule.

Deleted: utilized

Summary of Biological Status and Threats

Formatted: Font: Bold, Italic

Formatted: Space After: 8 pt, Widow/Orphan control, Don't keep with next

Current Condition

Resiliency

For dwarf-flowered heartleaf to maintain viability, its populations, or some portion thereof, must be resilient. Resiliency is assessed at the level of populations and reflects a species' ability to withstand stochastic events (events arising from random factors). Resilient populations

Deleted: *Hexastylis naniflora*

are better able to withstand disturbances such as random fluctuations in reproductive rates and fecundity (demographic stochasticity), variations in rainfall (environmental stochasticity), and the effects of anthropogenic activities. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include habitat impacts, climate change, and exotic, invasive species. Factors influencing the resiliency of dwarf-flowered heartleaf populations include population size, available habitat, and elements of dwarf-flowered heartleaf ecology that determine whether populations can maximize habitat occupancy.

The Natural Heritage Programs (NHP) collect information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member NHPs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2004, n.p.). We regard the NHP database as the best repository for known locations of the dwarf-flowered heartleaf (Service 2010, p. 41). Based on recent reports using the data sources described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple sub-EOs and stand-alone EO records. For the purpose of assessing resiliency, 78 populations observed since 2005 were assessed due to the high confidence in their persistence.

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability

Deleted: *Hexastylis naniflora*

Deleted: particularly human development pressures, but also …

Deleted: *Hexastylis naniflora*

Deleted: *Hexastylis naniflora*

Deleted: s

Deleted: Since the Service does not maintain its own database of known locations of *Hexastylis naniflora*, it

Deleted: s

Deleted: s

Deleted: this information

(b)(5) DPP
(b)(5) DPP

Deleted: only the

ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

Deleted:

- Very high—populations with more than 1,000 individuals; very high probability of persistence for 20–30 years at or above the current population size.
- High—populations with 500 to 1,000 individuals; moderately high probability of persistence for 20–30 years at or above the current population size.
- Moderate—populations with 100 to 500 individuals; low probability of persistence for 20–30 years at or above the current population size.
- Low—populations with fewer than 100 individuals; low probability of persistence for 20–30 years at or above the current population size, and moderately high probability of extirpation.

Of the 78 populations assessed, 28 have very high resiliency, 5 have high resiliency, 26 have moderate resiliency, and 19 have low resiliency.

Redundancy

Redundancy is also assessed at the species level and reflects a species' ability to withstand catastrophic events (such as a rare destructive natural event or episode involving many populations) by spreading the risk of such an event across multiple, resilient populations. We

measured redundancy for dwarf-flowered heartleaf by the number and distribution of resilient populations across the range of the species. It is important to note that dwarf-flowered heartleaf has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area. Redundancy for dwarf-flowered heartleaf is the total number and resiliency of population segments and their distribution across the species' range.

We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with devastating effects; however, they can occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbances. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long-term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions such as temperature and precipitation changes (DeWan et al. 2010, pp. 7–10). There are 119 populations of dwarf-flowered heartleaf spread across 13 counties. This is an increase from 24 populations across eight counties at the time of listing. There is adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press disturbances.

Representation

Deleted: *Hexastylis naniflora*

Deleted: *Hexastylis naniflora*

Deleted: *Hexastylis naniflora*

Deleted: can also

Deleted: *Hexastylis naniflora*

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Deleted: Hexastylis naniflora

Deleted: ,

Deleted: appears to be

Deleted: *Hexastylis naniflora*

Because we lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf, we decided delineating representative units was not appropriate for this species. However, in the absence of species-specific genetic and ecological diversity information, we evaluated representation based on the extent and variability of habitat characteristics across the geographical range. Dwarf-flowered heartleaf occurs in two types of habitat throughout the range. Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (Padgett 2004, Weakley 2015, USFWS 2015), or moist soils adjacent to creeks, streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats, demonstrating the species' ability to withstand the impact of disturbances.

Summary of Threats and Conservation Measures that Affect the Species

The NCNHP assessed threats in the populations they monitored from 2012 through 2016 (Robinson and Padgett 2016, pp. 7–8, 17–20). Threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on field observations of severity, scope, and immediacy. The rank (A through G) for each threat factor determined an overall value for each threat observed at each population. Threats observed during these years included development; incompatible forestry practices; agriculture; trampling; invasive, exotic species; sedimentation; erosion; and road construction. In this rule, we discuss the major threats affecting the species, which include development, climate change and invasive, exotic species.

Development

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Moved up [2]

Deleted: ¶

(b)(5) DPP

Deleted: North Carolina (

Deleted:)

Deleted: on their

Deleted: from field observations

Deleted: only

Deleted: are

(b)(5) DPP

Deleted:

Dwarf-flowered heartleaf populations occur in rapidly growing urban areas within numerous counties in North and South Carolina. At the time of listing, the species was determined to be most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

The most recent 5-year review for the species identified the most recurrent source of habitat destruction as road and bridge improvement projects which is the most common trigger for consultations under section 7 of the Act involving dwarf-flowered heartleaf. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of section 7 consultations. Collectively, these projects have adversely impacted or were expected to impact approximately 22,135 rosettes (Service 2018, p. 31). In most cases, the section 7 process resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection. Significant portions of other populations have been purchased by the North Carolina Department of Transportation (NCDOT) as off-site conservation measures in association with these consultations. Other forms of economic development have also resulted in the destruction or modification of habitats occupied by dwarf-flowered heartleaf; in many cases, these activities have also required section 7 consultations with the Service. Examples include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities at a regional airport. Collectively, these activities involved the loss or relocation of several thousand rosettes.

Deleted: *Hexastylis naniflora*

(b)(5) DPP

Deleted:

Deleted: it was determined that

(b)(5) DPP

Deleted: , and certainly

(b)(5) DPP

Deleted: *Hexastylis naniflora*

Deleted: , as road and bridge improvement projects

Deleted: *Hexastylis naniflora*

Development was identified as a threat at five of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17–19). The five populations include two stand-alone EOs and three parent EOs with 18 sub-EOs. Of the two stand-alone EOs, one has a development threat rank of A (moderate to severe, imminent threat for most (more than 60 percent) of population, occurrences, or area) and one has a rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area). Of the 18 sub-EOs, nine have development identified as a threat. Of the nine sub-EOs, one has a development threat rank of A, one has a rank of B, one has a rank of E (moderate to severe threat for a small proportion of population, occurrences, or area), and six have a rank of F (low severity threat for most or a significant proportion of population, occurrences, or area). The two stand-alone EOs and two sub-EOs with the highest threat ranks (A and B) are located in four populations. Based on the most recent monitoring data, one is increasing, two are stable, and one is decreasing (Robinson and Padgett 2016, p. 11). Even where development is ranked as a high threat, impacts to dwarf-flowered heartleaf are not a certain outcome.

Development was identified as a threat at one of three South Carolina populations monitored by NCNHP, and the population has a development threat rank of E (Robinson and Padgett 2016, p. 20). Based on the most recent monitoring data, the population is stable (Robinson and Padgett 2016, p. 11).

The data indicate that dwarf-flowered heartleaf populations can persist and increase in the presence of development. From 2012 to 2016, there were insignificant changes in the severity of the threat observed in the field from development (NCNHP 2016, p. 8).

Deleted: Thus, e

Deleted: it does not mean that the

Deleted: is being impacted

Deleted: (moderate to severe threat for small proportion of population, occurrences, or area)

Deleted: In short, t

Deleted: and despite the threat of development,

Deleted: f

Deleted: no

Deleted: significant enough to elevate the threat ranks of dwarf-flowered heartleaf populations evaluated

The North Carolina Plant Protection and Conservation Act (North Carolina General Statutes, sections 106-202.12 et seq.) lists native plants as threatened, endangered, or species of concern, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. In NC, the NCNHP designates "natural areas", which are sites with biological diversity significance due to the presence of rare species or unique natural communities. The NCNHP works with many conservation partners (state and federal agencies, conservation organization, land trusts, etc.) to implement voluntary protection. Through partnerships, the most important natural areas are purchased for permanent conservation. If a natural area is not available for purchase, ecological significance can be recognized by a voluntary registry agreement. Registry agreements consist of Registered Heritage Areas (RHAs), which are voluntary conservation agreements between the landowner and NCNHP to preserve the natural area and biological diversity of the property. The NCNHP has four registry agreements that include dwarf-flowered heartleaf. In South Carolina, plants are protected only from disturbance where they occur on those properties owned by the State and specifically managed as South Carolina Heritage Preserves (South Carolina Code of State Regulations, chapter 123, sections 123-200 through 123-204). Heritage Preserves are protected areas that play a critical role in conserving rare species and natural habitats. There is one Heritage Preserve in South Carolina, which protects one population of the dwarf-flowered heartleaf.

The overwhelming majority of dwarf-flowered heartleaf populations have been discovered as a direct result of surveys conducted to ensure compliance with the Act. The majority of sites that have the potential to afford long-term protection to the species have been

Deleted:
Deleted: special
Deleted:
Deleted:
Deleted:
(b)(5) DPP
Deleted: ing
Deleted:
(b)(5) DPP
(b)(5) DPP
Deleted: Preserve which
Deleted: ??
Deleted: with
(b)(5) DPP
Deleted: However,
Deleted: T
Deleted: t
Deleted: *Hexastylis naniflora*
Deleted: Even more significantly,
Deleted: t
(b)(5) DPP
(b)(5) DPP

protected as a direct result of the provisions of section 7 of the Act, which directs federal agencies to avoid and minimize adverse effects to federally listed species. Through section 7 and other voluntary conservation actions, approximately 24 (31%) of the 78 current populations are permanently protected, and another 18 populations (23%) are partially protected, greatly minimizing the likelihood of impacts due to development.

Invasive, Exotic Species

Invasive, exotic plant species occur across the range of this species. Plants such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and Japanese stiltgrass (*Microstegium vimineum*) are known at several sites that contain dwarf-flowered heartleaf (Service 2011, p. 15). Invasive, exotic species were identified as a threat at eight of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17–19). The eight populations include four stand-alone EOs and four parent EOs with 19 sub-EOs. Of the four stand-alone EOs, one has an invasive threat rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area), two have a rank of F (low severity threat for most or a significant proportion of population, occurrences, or area), and one has a rank of G (low severity threat for a small proportion of population, occurrences, or area). Of the 19 sub-EOs, 9 have invasive, exotic species identified as a threat. Of the nine sub-EOs, one has an invasive threat rank of A (moderate to severe, imminent threat for most (more than 60 percent) of population, occurrences, or area), four have a rank of B, two have a rank of E (moderate to severe threat for a small proportion of population, occurrences, or area), and two have a rank of G. The one stand-alone EO and five sub-EOs with the highest threat ranks (A and B) are located in three populations. Based on the most recent monitoring data, one is increasing, one is stable, and one is decreasing

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Deleted: consulting

Deleted: through conservation measures pledged as a part of the project description

Deleted: percent

Deleted: ly known

Deleted: ??

Deleted: 23

Deleted:

Deleted: or so percent

Deleted: somewhat

Deleted: (through voluntary agreements or another type of protection) While development on privately owned land is not regulated by the Service, the

Deleted: is greatly reduced at these populations, as protection status is not removed if the ESA is no longer applicable to the species

Deleted: *Hexastylis naniflora*

Deleted: 8

Deleted: (moderate to severe

Deleted: , imminent threat for a significant portion (20–6...

Deleted: (low severity threat for a small proportion of ...

(Robinson and Padgett 2016, p. 11). Even where nonnative species are ranked as a high threat, impact to dwarf-flowered heartleaf is not a certain outcome.

Invasive, exotic species were identified as a threat at all (three) South Carolina populations monitored by NCNHP, and all sites had an invasive threat rank of F (Robinson and Padgett 2016, p. 20). Based on the most recent monitoring data, all populations are stable (Robinson and Padgett 2016, p. 11).

In short, the data indicate that dwarf-flowered heartleaf populations can persist and increase in the presence of invasive, exotic species. Despite the long-term presence of invasive, exotic plants, from 2012 to 2016, there were no changes in the severity of threats observed in the field enough to elevate the threat ranks of dwarf-flowered heartleaf populations evaluated (NCNHP 2016, p. 8).

Climate Change

There is concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Increased frequency of severe storms could lead to impacts if flooding duration or intensity increase as a result. Increased flooding could decrease habitat suitability through scouring and changes in soil moisture or wash plants away. Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.), which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p. 7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages, resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p. 7). Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat

(b)(5) DPP

Deleted:

Deleted: Thus, even

(b)(5) DPP

Deleted: from these species significant

Deleted: *Hexastylis naniflora*

(b)(5) DPP

(b)(5) DPP

Deleted:

(b)(5) DPP

Deleted: i

Deleted: in floodplains

Deleted: for the landscape

Deleted:

from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. In recent years, the Southeast has experienced moderate to severe droughts, which many observers have implicated in population declines and poor transplant survivorship (NCNHP 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County, NC; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, entire). Although climate change is likely to affect terrestrial habitats in the Southeast, there is uncertainty about the specific effects of climate change on dwarf-flowered heartleaf because studies have not been done to assess population responses as a result of different climate change scenarios. However, the Future Conditions section below, addresses some of the potential effects of climate change and outcomes.

Future Condition

Our analysis of the past, current, and future influences on dwarf-flowered heartleaf revealed that there are several influences that may pose risks to the future viability of the species. These risks are primarily related to invasive species, climate change, and habitat changes from development. We consider "foreseeable future" as that period of time within which a reliable prediction can be made about the future status of a species, as described in the Solicitor's opinion dated January 16, 2009. We consider 20 years to be a reasonable period of time within which reliable predictions can be made for dwarf-flowered heartleaf. This period of time aligns with the timeframes for predictions regarding development and growth (see *Development* below), and

Deleted: as a resultbecause

Deleted: of

Deleted: difference

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Deleted: on what

Deleted: *Hexastylis naniflora*

Deleted: needs for long-term viability

Deleted: reasonably relied upon in making a determination

Formatted: Font: Italic

climate change (see *Climate Change* below). We discuss in greater detail how we define "foreseeable future" for this species below, under ***Determination.***

Invasive, Exotic Species

As discussed above, invasive, exotic plants were identified as a threat at the time of listing; however, the threat may not be as significant as once thought. The NCNHP monitored 13 populations of dwarf-flowered heartleaf and assessed threats at each population. Of monitored sites, only 9 percent of populations (one of 11) where invasive, exotic species are present are also in decline, indicating the species has at least some capacity to withstand the presence of invasive, exotic species. The number of populations has increased dramatically since listing and the invasive, exotic plant threat posed at many of the largest populations is low (NCNHP 2016, pp. 8, 17–20). Additionally, and as noted above, the number of populations managed under conservation ownership has increased. Therefore, we do not believe that competition from invasive, exotic species will be a significant threat in the foreseeable future.

Climate Change

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14,

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Formatted: Font: Italic

(b)(5) DPP

(b)(5) DPP

Deleted: *Hexastylis naniflora*

Deleted: Their results show that, o

Deleted: ; the

Deleted: ; and

(b)(5) DPP

Deleted:

(b)(5) DPP

Deleted: ¶

Deleted: (about 20 years from now: 2040)

(b)(5) DPP

18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

According to IPCC, "most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change on most landscapes" (IPCC 2014, p. 13). Plant species with restricted ranges may experience population declines as a result of the effects of climate change. The concept of changing climate can be meaningfully assessed both by looking into the future and reviewing past changes.

As part of the current, worldwide collaboration in climate modelling under the IPCC, climate assessments of the full dataset of 30 climate models for historical and 21st century comparisons provide predictions at scales ranging from global to county level in the United States (U.S. Geological Survey (USGS) National Climate Change Viewer (NCCV) 2019). This global climate information has been recently downscaled by the National Aeronautics and Space Administration to scales relevant to our region of interest, and projected into the future under two different scenarios of possible emissions of greenhouse gases (Alder and Hostetler 2017, p. 3). Using the NCCV and assuming the more extreme "representative concentration pathways" (RCP) greenhouse gas emission scenario (RCP 8.5), we calculated projected annual mean changes from 1981–2010 to those projected for 2025–2049 for maximum temperature (+2.9–3.1 degrees Fahrenheit (°F) in NC and +2.9 °F in SC), precipitation (+0.2 inches per month for NC and SC), soil storage (-0.1 - -0.2 inch for NC and -0.1 inch SC), and evaporative deficit (no change for NC or SC) in all counties where dwarf-flowered heartleaf occurs (Adler and Hostetler 2017, entire). We also calculated projected annual mean changes for the more conservative greenhouse gas emission scenario (RCP 4.5) using the same timeframes for maximum temperature (+2.5–2.7 °F in NC and SC), precipitation (+0.01 inch per month for NC and SC),

soil storage (-0.1 - -.02 inch for NC and -0.1 inch for SC), and evaporative deficit (no change for NC or SC) in all counties where dwarf-flowered heartleaf occurs (Adler and Hostetler 2017, entire). Based on these results, all 13 counties within the range of dwarf-flowered heartleaf will be subjected to higher temperatures (annual mean increase of 2.6 °F (RCP 4.5) or 2.9 °F (RCP 8.5)) and slightly higher precipitation (annual mean increase of 0.1 inch per month (RCP 4.5) or 0.2 inch per month (RCP 8.5)) relative to the period of 1981–2010. Because the average annual increase in precipitation is predicted to be only slight, the loss in soil storage is likely primarily the result of higher predicted temperatures. While the predictions of a changing climate could negatively impact dwarf-flowered heartleaf, the species possesses other biological traits to provide resiliency against this threat.

Dwarf-flowered heartleaf is a long-lived perennial species. Several populations have been revisited after decades and the species was still stable. For example, one population in Rutherford County was first observed in 1957, and was still extant when next observed in 2001 (NCNHP 2018, n.p.). In their analyses of life-history traits in relation to potential vulnerability to variability in demographic vital rates caused by increased variability in climatic patterns, researchers concluded that longer-lived species should be less influenced by climate-driven increases in demographic variability (Morris *et al.* 2008, p. 22; Dalgleish *et al.* 2010, p. 216).

Within the family Aristolochiaeae, more than 50 percent of the plant lineage is myrmecochorous (seed dispersal by ants) (Lengyel et al. 2010, p. 49). Likewise, dwarf-flowered heartleaf employs myrmecochory as a method for seed dispersal (Gaddy1986, entire). While species with ant-dispersed seeds have slower migration rates than species with seeds that are adhesive or ingested (Brunet and Von Oheimb 1998, p. 429), myrmecochory provides for multiple adaptive advantages for plants. Ants can disperse seeds to sites that might be nutrient-

Deleted: to

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Deleted: *Hexastylis naniflora*

Deleted: present

Deleted:

(b)(5) DPP

Deleted: Morris et al (2008, p 22) and Dalgleish et al (2010, p 216)

(b)(5) DPP

Deleted: *Hexastylis naniflora*

Deleted: ,

Deleted: been shown to have

Deleted: the multiple benefits

Deleted: the

Deleted: is evidence for the adaptive advantages of this strategy…

enhanced or where plant fitness will be higher. Additionally, ants bury seeds, which may protect them from fire and drought (Boyd 2001, p. 235), two conditions exacerbated by climate change.

Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, p. 111). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations of dwarf-flowered heartleaf in 2009 (Golder and Associates 2009). However, anecdotal observation suggests that the species was not appreciably harmed by this fire (Service 2011, p. 14). Additionally, the National Park Service (NPS) uses prescribed fire as a vegetation management tool at Cowpens National Battlefield. The NPS's prescribed burning activity includes the majority of the dwarf-flowered heartleaf population on site and burning appears to have had no adverse effects upon growth or flowering (Walker et al. 2009, p. 14).

Populations are located within various ecological settings within the species' range. Dwarf-flowered heartleaf occurs on Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (Padgett 2004, p. 114; Weakley 2015, p. 129), or moist soils adjacent to creeks or streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats, demonstrating the species' ability to adapt to different environmental conditions that could be brought on by climate change.

Based on USGS projection models, IPCC data, and taking into account uncertainties with respect to the effects of climate change, it is almost certain that climate change is affecting the dwarf-flowered heartleaf habitats in North and South Carolina. However, based on the

Deleted: are known to

Deleted: and some studies show burying seeds

Deleted: *Hexastylis naniflora*

Deleted: scope of

Deleted: *Hexastylis naniflora*

Deleted: ;

Deleted:

Deleted: Monitoring data suggest that b

Deleted: has

(b)(5) DPP

Deleted: *Hexastylis naniflora*

Deleted: known

Deleted: but,

(b)(5) DPP

(b)(5) DPP

biological traits of the species discussed above, we do not believe that climate change is a threat to the plant now or within the foreseeable future (Service 2018, p. 33).

Development

As discussed above, development was identified as a threat at the time of listing; however, the threat may not be as significant as once thought. The NCNHP monitored 13 populations of dwarf-flowered heartleaf and assessed threats at each population. Of monitored sites, only 12 percent of populations (one of eight) where development is identified as a threat are also in decline, indicating the species has at least some capacity to withstand the threat of development. The number of populations has increased dramatically since listing and the development threat posed at many of the largest populations is low (NCNHP 2016, pp. 8, 17–20).

In addition, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status quo, targeted conservation, and high development. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

Commented [HB108R107]: Added citation

Deleted: (about 20 years from now: 2040)

Deleted:

(b)(5) DPP

Deleted: Because the actual impacts of urbanization are unknown, Ww
w

Deleted: W

Deleted: w

Moved up [1]

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) model to determine areas predicted to be urbanized by 2040, a time period for which the models provide reliable data. The SLEUTH model has been successfully applied worldwide over the last 15 years to simulate land use change, including urbanization (Clarke 1995, entire). The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0 to 100 percent. We chose 80 percent probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- Percent increase in projected development within current populations; and
- Percent increase in projected development within areas delineated as potential habitat by the Maxent habitat model.

We know that dwarf-flowered heartleaf populations have been extirpated as the result of urban development in the past through loss of habitat. However, there are no data available on the relationships between urbanization and indirect? impacts to dwarf-flowered heartleaf. Because of this unknown, we attempted to capture potential impacts in two ways. First, our scenarios reflect a range of potential impacts from nearby urban development. Also, we used two thresholds for percent increase in urban development to capture potential deleterious effects: 25 percent and 50 percent. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25 percent of the area of current populations was likely to have some negative impacts; and development increase of at least 50 percent was likely to have significant impacts to populations.

Deleted: s
Deleted: would
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
Deleted:
Deleted: (SLEUTH probability of urbanization less than 80 percent)
Deleted:
(b)(5) DPP(b)(5) DPP
Deleted: also
Deleted: that …rban development has led to extirpation …
Deleted: has
Deleted: led to extirpation of
Deleted: extirpated dwarf-flowered heartleaf populations
Deleted: T
(b)(5) DPP
Moved up [3]
Deleted: exact
Deleted: the
Deleted: *Hexastylis naniflora*
Deleted: ,
Deleted: although
Deleted: We do know that
Deleted: several current populations are located in areas …
Deleted: Becau
Deleted: se
Deleted: certainty
Deleted: unknowns

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios (targeted conservation and status quo). This is appropriate for several reasons. First, discovery of new EOs is common; many of the populations we consider under **Current Conditions**, above, include detections that have occurred within the last few years. Second, we did not include many older detections (i.e., we only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years, and the species was still present. For example, one such EO was first observed in 1957, and next observed still extant in 2001. It seems as long as suitable habitat is still present, it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e., we define current populations as those observed between 2005 and present day). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005–current day) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005 to today. If these older EOs within current

Deleted: location

Deleted: *Hexastylis naniflora*

Deleted: *Hexastylis naniflora*

populations that were not included in our **Current Conditions** discussion, above, are found to be likely to persist, then it is possible we underestimated the resiliency of that population.

(b)(5) DPP

Once these older EOs were identified, we created a 1,000-meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20–25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed under **Current Conditions**, above (i.e., low = fewer than 100 individuals; moderate = 100–500 individuals; high = 500–1,000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and percent Maxent classified as 0.8–1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000-meter buffer. The percent Maxent classified as 0.8–1.0 represents the percentage of all potential habitat within the 1,000-meter buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000-meter buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-flowered heartleaf is likely to persist.

Deleted: *Hexastylis naniflora*

(b)(5) DPP

(b)(5) DPP

Status Quo Scenario

Under the status quo scenario, we estimate that 75 populations will persist throughout the range, and that there will be a range of impacts from urbanization that are related to the

Deleted: assume

Deleted: be identified as

Deleted: ing

percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
  - Protected areas:
    - Protected in perpetuity—no negative impacts from urbanization; and
    - Voluntary protection/non-perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold.
  - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

High Development Scenario

Under the high development scenario, we estimate no additional populations will persist throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

Deleted: assume

Deleted: be identified as

Deleted: ing

(b)(5) DPP

- No additional populations are identified as persisting.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:

- Protected areas:
  - Protected in perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold; and
  - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.
- Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold; extirpation of populations if percent increase in urbanization exceeds 90 percent threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we estimate it is likely that several additional populations (i.e., more than in the status quo scenario) will persist throughout the range. The range of impacts from urbanization are the same as in the status quo scenario. We assessed population resiliency under the following assumptions:

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Deleted: assume

Deleted: be identified as persisting

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
  - Protected areas:
    - Protected in perpetuity—no impacts from urbanization; and

- Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 50 percent threshold.
  - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

Future Resiliency

Status Quo Scenario

In the status quo scenario, we predict 75 populations of dwarf-flowered heartleaf will be extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

(b)(5) DPP

(b)(5) DPP

Deleted: there are

Deleted: ed

Deleted: to be

Deleted:

Deleted: *Hexastylis naniflora*

Deleted: on the landscape

High Development Scenario

In the high development scenario, we predict 72 populations of dwarf-flowered heartleaf will remain extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition, a few

Deleted: there are

Deleted: ed

Deleted: to be

Deleted:

Deleted: *Hexastylis naniflora*

Deleted: on the landscape

populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the targeted conservation scenario, we predicted 79 populations of dwarf-flowered heartleaf will be extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Deleted: there are

Deleted: to be

Deleted: *Hexastylis naniflora*

Deleted: on the landscape

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few populations is offset in the status quo and targeted conservation scenarios by the persistence of several additional populations. In the high development scenario, there is a predicted loss of six populations, with loss of resiliency in several additional populations. However, in all three

scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances; however, the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change, over the next 20 to 30 years.

Based on the assumption that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (status quo and targeted conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. There are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Deleted: *Hexastylis naniflora*

(b)(5) DPP

Deleted: *Hexastylis naniflora*

Deleted: H

Table of viability summary for dwarf-flowered heartleaf under three future scenarios (projected to year 2040) and compared to current condition.

Deleted: *Hexastylis naniflora*

	Current Condition	Status Quo Scenario	High Development Scenario	Targeted Conservation Scenario
Very High Resiliency	28	27	27	27
High Resiliency	5	6	4	6
Moderate Resiliency	26	23	25	23
Low Resiliency	19	17	16	17
Extirpated	n/a	5	6	5

Persisting	n/a	2	0	6
Total Populations	**78**	**75**	**72**	**79**

Determination of Dwarf-flowered Heartleaf Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." For a more detailed discussion on the factors considered when determining whether a species meets the definition of "endangered species" or "threatened species" and our analysis on how we determine the foreseeable future in making these decisions, please see the *Regulatory Framework* section above.

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to dwarf-flowered heartleaf. Currently, there are a total of 119 known populations in 13 counties, 78 of which have been documented since 2005. This is a significant increase from 24 known populations in eight counties at the time of listing. Of the 78 populations, 75 percent are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend.

When dwarf-flowered heartleaf was listed (54 FR 14964; April 14, 1989), the two prominent threats identified were invasive, exotic plants and habitat loss or destruction. As discussed above, invasive, exotic species are not as significant a threat to dwarf-flowered heartleaf as originally thought. Only one of the 11 monitored populations where invasive, exotic

Formatted: Font color: Auto

Deleted:

(b)(5) DPP

Deleted: *Hexastylis naniflora*

Deleted: *Hexastylis naniflora*

Deleted: placed on the Federal List of Endangered and Threatened Plants

Deleted: *Hexastylis naniflora*

species occur was identified as declining. Additionally, dwarf-flowered heartleaf has the capacity to withstand habitat loss and destruction due to development. The species currently has significant redundancy (119 populations), resilient populations (33 of 78 evaluated populations with high or very high viability), and representation in two different ecological settings. Even under our high development scenario, only two high or very high viability populations are predicted to have lower viability as a result of development. Therefore, we do not believe that competition from invasive, exotic species or habitat loss and destruction are significant threats to the species. Additionally, since listing, there has been a nearly four-fold increase in the number of known populations. Of the 78 populations evaluated in the SSA, 24 (31%) have permanent protection and 18 (23%) have partial protection through voluntary agreements or other commitments of management (e.g., N.C. Department of Transportation). We conclude that the species is currently not in danger of extinction throughout its range.

In order to more closely examine the future threat posed by habitat loss or destruction, the Service analyzed three different development scenarios into the future to 2040. Under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (five or six) of currently low resilient populations are predicted to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Of the 78 populations evaluated in the SSA, 24 (31%) have permanent protection and 18 (23%) have partial protection through voluntary agreements or other commitments of management (e.g., N.C. Department of Transportation), reducing the likelihood of development impacting those populations. Recent

Deleted: i

Deleted: analysis in the SSA report indicates

Deleted: *Hexastylis naniflora*

Deleted: lost to a lower

Deleted: rank

Deleted:

Deleted: f

Deleted: , and several

Deleted: populations have entered into conservation ownership by organizations with management staff (e g , Broad River Greenway) or have

Deleted: projected

(b)(5) DPP

Deleted: another type of protection

Deleted:)

examination of the species also identified climate change and invasive species as potential future threats. The broadened range (8 counties to 13) and significantly increased population numbers (24 to 119) since listing in 1989 indicate that the species benefits from sufficient redundancy and resiliency to withstand perturbations from climate change as well as from invasive species. Based on this analysis, we conclude that the species is neither currently in danger of extinction, nor likely to become so within the foreseeable future.

Determination of Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range (SPR). Where the best available information allows the Services to determine a status for the species rangewide, that determination should be given conclusive weight because a rangewide determination of status more accurately reflects the species' degree of imperilment and better promotes the purposes of the Act. Under this reading, we should first consider whether the species warrants listing "throughout all" of its range and proceed to conduct a "significant portion of its range" analysis if, and only if, a species does not qualify for listing as either an endangered or a threatened species according to the "throughout all" language.

Having determined that dwarf-flowered heartleaf is not in danger of extinction nor likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in an SPR. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do the "screening" analysis, we ask whether there are portions

Deleted: *Hexastylis naniflora*

of the species' range for which there is substantial information indicating that: (1) The portion may be significant; and (2) the species may be, in that portion, either in danger of extinction or likely to become so in the foreseeable future. For a particular portion, if we cannot answer both questions in the affirmative, then that portion does not warrant further consideration and the species does not warrant listing because of its status in that portion of its range. We emphasize that answering these questions in the affirmative is not a determination that the species is in danger of extinction or likely to become so in the foreseeable future throughout a significant portion of its range—rather, it is a step in determining whether a more detailed analysis of the issue is required.

If we answer these questions in the affirmative, we then conduct a more thorough analysis to determine whether the portion does indeed meet both of the SPR prongs: (1) The portion is significant; and (2) the species is, in that portion, either in danger of extinction or likely to become so in the foreseeable future. Confirmation that a portion does indeed meet one of these prongs does not create a presumption, prejudgment, or other determination as to whether the species is an endangered species or threatened species. Rather, we must then undertake a more detailed analysis of the other prong to make that determination. Only if the portion does indeed meet both SPR prongs would the species warrant listing because of its status in a significant portion of its range.

At both stages in this process—the stage of screening potential portions to identify any portions that warrant further consideration and the stage of undertaking the more detailed analysis of any portions that do warrant further consideration—it might be more efficient for us to address the "significance" question or the "status" question first. Our selection of which question to address first for a particular portion depends on the biology of the species, its range,

and the threats it faces. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range.

For dwarf-flowered heartleaf we chose to evaluate the status question (i.e., identifying portions where dwarf-flowered heartleaf may be in danger of extinction or likely to become so in the foreseeable future) first. To conduct this screening, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. We examined the following threats: development; exotic, invasive; and climate change, including cumulative effects.

The NCNHP monitored 13 populations of dwarf-flowered heartleaf throughout the species' range. Eleven of the 13 populations had invasive, exotic species identified as a threat, indicating that invasive, exotic species are found throughout the range and not concentrated in any specific location. Climate change effects, as discussed previously, are very uniform throughout the range. The opportunity for habitat loss and destruction due to development is higher on privately owned lands that could be sold for future development. Of the 78 populations evaluated, we determined that 31 percent are permanently protected and another 23 percent are partially protected (i.e., voluntary landowner agreements). The unprotected populations are spread throughout the species' range and not geographically clustered together. While there is some variability in the habitats occupied by dwarf-flowered heartleaf across its range, the basic ecological components required for the species to complete its life cycle are present throughout the habitats occupied by the 119 populations of the species. Thus, we found no concentration of threats in any portion of the dwarf-flowered heartleaf range at a biologically meaningful scale.

(b)(5) DPP

Deleted: *Hexastylis naniflora*

Deleted: ,

Formatted: Indent: First line: 0.5

Deleted: *Hexastylis naniflora*

Deleted:

Deleted: projects

Deleted: or other causes of habitat loss such as trash disposal, expansion of residential lawns, cattle,

Deleted: andon invasive exotics

Deleted: LIST THREATS HERE

Deleted: ,

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Deleted: *Hexastylis naniflora*

Deleted: *Hexastylis naniflora*

Formatted: Font: (Default) Times New Roman, 12 pt

Deleted:

Formatted: Font: (Default) Times New Roman, 12 pt

Formatted: Font:

If both (1) a species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range and (2) the threats to the species are essentially uniform throughout its range, then the species could not be in danger of extinction or likely to become so in the foreseeable future in any biologically meaningful portion of its range. For the dwarf-flowered heartleaf, we found both: the species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, and there is no geographical concentration of threats so the threats to the species are essentially uniform throughout its range. Therefore, no portions warrant further consideration through a more detailed analysis, and the species is not in danger of extinction or likely to become so in the foreseeable future in any significant portion of its range. Our approach to analyzing SPR in this determination is consistent with the court's holding in *Desert Survivors v. Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018).

Dwarf-flowered Heartleaf Determination of Status

Our review of the best available scientific and commercial information indicates that the dwarf-flowered heartleaf does not meet the definition of an endangered species or a threatened species in accordance with sections 3(6) and 3(20) of the Act. On the basis of this evaluation, we propose to remove dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Plants (50 CFR 17.12(h)).

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Plants. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Deleted: *Hexastylis naniflora*

Formatted: Not Highlight

Deleted: *Hexastylis naniflora*

Formatted: Font: Italic

Formatted: Font: Italic

Formatted: Font: (Default) Times New Roman, 12 pt

Formatted: Font: (Default) Times New Roman, 12 pt

Deleted: , we believe *Hexastylis naniflora* no longer requires the protection of the Act, and

Deleted: *Hexastylis naniflora*

Deleted: throughout its range

Deleted: *Hexastylis naniflora*

longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect dwarf-flowered heartleaf.

Deleted: *Hexastylis naniflora*

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a delisted species remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as an endangered or threatened species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Deleted: species

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2019–0081. Copies can also be obtained from the Service's Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**). We seek information,

data, and comments from the public regarding dwarf-flowered heartleaf and the PDM plan. We are also seeking peer review of the draft PDM plan concurrently with this comment period. We anticipate finalizing the PDM plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Deleted: *Hexastylis naniflora*

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are not clearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act

We have determined that we do not need to prepare an environmental assessment or environmental impact statement, as defined in the National Environmental Policy Act (42 U.S.C. 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered

Species Act. We published a notice outlining our reasons for this determination in the *Federal Register* on October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands affected by this proposed rule.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081 and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

§ 17.12 [Amended]

2. Amend § 17.12(h) by removing the entry for "dwarf-flowered heartleaf" under "FLOWERING PLANTS" from the List of Endangered and Threatened Plants.

Deleted: *Hexastylis naniflora*

Dated: _____

_____

Aurelia Skipwith
Director,
U.S. Fish and Wildlife Service,

Deleted: Margaret E. Everson,¶
Principal Deputy

Formatted: Indent: Left: 0.5 , First line: 0.5

Deleted: Exercising the Authority of the Director,¶
U S Fish and Wildlife Service ¶

~~[Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants]~~

Re: PRB review of the Nashville crayfish reopener

Eanett, Jillian H <jillian_eanett@fws.gov>

Thu 3/19/2020 10:59 AM

To: Craghead, Anissa <anissa_craghead@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Prigan, Sara <sara_prigan@fws.gov>; Wilkinson, Susan <susan_wilkinson@fws.gov>; Baucum, Madonna L <madonna_baucum@fws.gov>

Good morning, All,
Yes that docket ID is correct for the Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife.

From: Craghead, Anissa <anissa_craghead@fws.gov>
Sent: Thursday, March 19, 2020 10:55 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Prigan, Sara <sara_prigan@fws.gov>; Wilkinson, Susan <susan_wilkinson@fws.gov>; Baucum, Madonna L <madonna_baucum@fws.gov>; Eanett, Jillian H <jillian_eanett@fws.gov>
Subject: Re: PRB review of the Nashville crayfish reopener

Byron, if you mean the number that starts FXES, you need to talk to your admin asst or someone else in ES to check to see if it's the correct activity/cost code for the account to which the cost of Federal Register publication of your document should be charged. My staff (PRB) doesn't have that information.

If you want to confirm you have the correct docket number, Jill can check on that. (Jill, would you please do that?)

Thanks,
Anissa

Anissa Craghead
Senior Regulatory Analyst
Division of Policy, Economics, Risk Management, and Analytics (PERMA)
Policy and Regulations Branch
JOINT ADMINISTRATIVE OPERATIONS | U.S. Fish & Wildlife Service
anissa_craghead@fws.gov | office (703) 358-2445

JAO mission: To deliver innovative administrative services that advance the mission of the U.S. Fish & Wildlife Service.

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Thursday, March 19, 2020 10:49 AM
To: Craghead, Anissa <anissa_craghead@fws.gov>
Cc: Prigan, Sara <sara_prigan@fws.gov>; Wilkinson, Susan <susan_wilkinson@fws.gov>; Baucum, Madonna L <madonna_baucum@fws.gov>; Eanett, Jillian H <jillian_eanett@fws.gov>
Subject: Re: PRB review of the Nashville crayfish reopener

Good morning!

Can anyone please verify if this is the correct code for the dwarf-flowered heartleaf?

[Docket No. FWS–R4–ES–2019–0081; FXES11130900000-189-FF0932000[FC1] **]**

[FC1]Need to verify – I don't think this code is correct.

Byron A. Hamilton, Sr.
U.S. Fish and Wildlife Service
South Atlantic-Gulf & Mississippi Basin Regions
Ecological Services Program
1875 Century Blvd NE
Atlanta, GA 30345

From: Craghead, Anissa <anissa_craghead@fws.gov>
Sent: Wednesday, March 11, 2020 9:48 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Prigan, Sara <sara_prigan@fws.gov>; Wilkinson, Susan <susan_wilkinson@fws.gov>; Baucum, Madonna L <madonna_baucum@fws.gov>; Eanett, Jillian H <jillian_eanett@fws.gov>
Subject: Fw: PRB review of the Nashville crayfish reopener

Hi, Byron. When you send a document to PRB for review, please remember to copy all of us (Susan, Sara, Madonna, Jill, and me)
on your email.

What's your preferred date for PRB to complete this review?

Anissa Craghead
Senior Regulatory Analyst
Division of Policy, Economics, Risk Management, and Analytics (PERMA)
Policy and Regulations Branch
JOINT ADMINISTRATIVE OPERATIONS | U.S. Fish & Wildlife Service
anissa_craghead@fws.gov | office (703) 358-2445

JAO mission: To deliver innovative administrative services that advance the mission of the U.S. Fish & Wildlife Service.

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, March 11, 2020 9:46 AM
To: Craghead, Anissa <anissa_craghead@fws.gov>
Subject: PRB review of the Nashville crayfish reopener

Good morning Anissa,

Please see the attachment for the Nashville crayfish reopener. Your review of this document would be greatly appreciated. Thanks!

Byron A. Hamilton, Sr.

U.S. Fish and Wildlife Service
South Atlantic-Gulf & Mississippi Basin Regions
Ecological Services Program
1875 Century Blvd NE
Atlanta, GA 30345

Fw: Dwarf flowered Heartleaf: Additional Comments

Hamilton, Byron <byron_hamilton@fws.gov>

Fri 5/1/2020 9:25 AM

To: Morgan, Don <don_morgan@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>

Good morning Don,

This is the latest version of the Dwarf-flowered heartleaf rule. I apologize for the confusion.

Byron A. Hamilton, Sr.
U S Fish and Wildlife Service
South Atlantic-Gulf & Mississippi Basin Regions
Ecological Services Program
1875 Century Blvd NE
Atlanta, GA 30 45

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Thursday, March 19, 2020 2:18 PM
To: Ketram, Natchanon N <natchanon_ketram@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>
Subject: Re: Dwarf-flowered Heartleaf: Additional Comments

Good afternoon,

See attachment for the dwarf-flowered heartleaf rule with comments addressed. Please let me know if you have additional comments.

Byron A. Hamilton, Sr.
U.S. Fish and Wildlife Service
South Atlantic-Gulf & Mississippi Basin Regions
Ecological Services Program
1875 Century Blvd NE
Atlanta, GA 30345

From: Young, Kristi <kristi_young@fws.gov>
Sent: Monday, March 2, 2020 3:56 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Evans, Brian <brian_evans@fws.gov>
Subject: Fw: Dwarf-flowered Heartleaf: Additional Comments

Byron,

Please see Natchanon's note, below. Looks like there were additional comments on the rule. Let me know if you need assistance.

-Kristi

From: Ketram, Natchanon N <natchanon_ketram@fws.gov>
Sent: Monday, March 2, 2020 1:46 PM
To: Young, Kristi <kristi_young@fws.gov>
Cc: Morgan, Don <don_morgan@fws.gov>
Subject: Dwarf-flowered Heartleaf: Additional Comments

Good afternoon Kristi,

I am acting for Don today so I am forwarding this to you. HQ has additional comments on the rule. Please see attachment. Thank you.

Natchanon Ketram
Biologist
Branch of Delisting and Foreign Species
Ecological Services
U S Fish and Wildlife Service
Falls Church, VA, USA
(703) 358-2499

Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2019–0081; FXES11130900000-189-FF0932000]

RIN 1018-BD95

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicate that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened species, and does not meet the definition of an endangered species, under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2019–0081, which is the docket number for this rulemaking. Then, click on the Search button. On the resulting page, in the Search panel on the left side of the screen, under the Document Type heading, check the Proposed Rule box to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2019–0081, U.S. Fish and Wildlife Service, MS: JAO/1N, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see **Information Requested**, below, for more information).

Document availability: The proposed rule, draft PDM plan, and supporting documents (including the species status assessment (SSA) report, references cited, and 5-year review) are available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and

Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC 28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from other concerned governmental agencies (including, but not limited to, State and Federal agencies and city or county governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. We particularly seek comments on:

(1) Information concerning the biology and ecology of dwarf-flowered heartleaf;

(b)(5) DPP

(2) Relevant data concerning any threats (or lack thereof) to dwarf-flowered heartleaf, particularly any data on the possible effects of climate change as it relates to habitat, as well as the extent of State protection and management that would be provided to this plant as a delisted species;

(3) Current or planned activities within the geographic range of dwarf-flowered heartleaf that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

Please note that submissions merely stating support for, or opposition to, the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or a threatened species must be made "solely on the basis of the best scientific and commercial data available."

You may submit your comments and materials concerning this proposed rule by one of the methods listed in **ADDRESSES**. We request that you send comments only by the methods described in **ADDRESSES**.

If you submit information via *http://www.regulations.gov*, your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on *http://www.regulations.gov*.

Comments and materials we receive, as well as supporting documentation used in preparing this proposed rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Public Hearing

Section 4(b)(5)(E) of the Act provides for a public hearing on this proposal, if requested. Requests must be received by the date specified in **DATES**. Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public

hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the *Federal Register* at least 15 days before the hearing.

Peer Review

In accordance with our joint policy on peer review published in the *Federal Register* on July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we sought the expert opinions of seven appropriate specialists regarding the species status assessment (SSA) report, which informed this proposed rule. Out of the seven reviews requested, we received no responses. The purpose of peer review is to ensure our determination is based on scientifically sound data, assumptions, and analyses.

(b)(5) DPP

Because we will consider all comments and information received during the comment period, our final determinations may differ from this proposal. Based on the new information we receive (and any comments on that new information), we may conclude that the species is still in danger of extinction, either now or in the foreseeable future. Such final decisions would be a logical outgrowth of this proposal, as long as we: (a) base the decisions on the best scientific and commercial data available after considering all of the relevant factors; (2) do not rely on factors Congress has not intended us to consider; and (3) articulate a rational connection between the facts found and the conclusions made, including why we changed our conclusion.

Previous Federal Actions

On April 14, 1989, we listed dwarf-flowered heartleaf as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting, and cattle grazing (54 FR 14964). A recovery plan for the species was never completed. However,

over the last 30 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf SSA report to aid in determining the appropriateness of reclassifying the species.

Supporting Documents

A species status assessment team prepared an SSA report for the dwarf-flowered heartleaf. The SSA team was composed of Service biologists, in consultation with other species experts. The SSA report represents a compilation of the best scientific and commercial data available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the species.

Proposed Delisting Determination

Background

Dwarf-flowered heartleaf is a plant species endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It is a low-growing herbaceous plant in the birthwort family (Aristolochiaceae). Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (Service 2010, p. 15; North Carolina Natural Heritage Program (NCNHP) 2016, p. 4). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant populations (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two States. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

(b)(5) DPP

Dwarf-flowered heartleaf is historically known to have a restricted range due to its

habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of any population.

(b)(5) DPP
(b)(5) DPP

Dwarf-flowered heartleaf occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, p. 114; Weakley 2015, p. 129; Service 2015, entire), or in moist soils adjacent to creeks or streamheads, or along lakes and rivers. Plants grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). A habitat suitability study was conducted to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used to help identify the species when not in flower (relative to other *Hexastylis* species' habitat preferences), find new populations, or identify suitable sites for transplants (Wagner 2013, pp. 30-32). The unit of measurement for population size in this species is a "clump" (rosette).

A thorough review of the taxonomy, life history, ecology, and overall viability of the dwarf-flowered heartleaf is presented in the SSA report (Service 2018, entire; available at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081).

Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an "endangered species" or a

"threatened species." The Act defines an endangered species as a species that is "in danger of extinction throughout all or a significant portion of its range," and a threatened species as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether any species is an "endangered species" or a "threatened species" because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future. These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term "threat" to refer, in general, to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term "threat" includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those

that affect individuals through alteration of their habitat or required resources (stressors). The term "threat" may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species, such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term "foreseeable future," which appears in the statutory definition of "threatened species." Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term "foreseeable future" extends only so far into the future as the Services can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. "Reliable" does not mean "certain"; it means sufficient to provide a reasonable degree of confidence in the

prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework

The SSA report documents the results of our comprehensive biological status review for dwarf-flowered heartleaf, including an assessment of the potential threats to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for removal from the List of Endangered and Threatened Plants (i.e., "delisting"). It does, however, provide the scientific basis that informs our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

Summary of SSA Analysis

To assess dwarf-flowered heartleaf viability, we used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 306–310). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years), redundancy supports

the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation supports the ability of the species to adapt over time to long-term changes in the environment (for example, climate changes). In general, the more resilient and redundant a species is and the more representation it has, the more likely it is to sustain populations over time, even under changing environmental conditions. Using these principles, we identified the species' ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species' viability.

The SSA process can be categorized into three sequential stages. During the first stage, we evaluated the individual species' life-history needs. In the next stage, we assessed the historical and current condition of the species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize the species' viability (i.e., its ability to sustain populations in the wild over time). We used this information to inform this proposed rule.

Summary of Biological Status and Threats

In this discussion, we review the biological condition of the species and its resources, and the threats that influence the species' current and future condition, in order to assess the species' overall viability and the risks to that viability.

Current Condition

Resiliency

For dwarf-flowered heartleaf to maintain viability, its populations, or some portion thereof, must be resilient. Resiliency is assessed at the level of populations and reflects a species' ability to withstand stochastic events (events arising from random factors). Resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates and fecundity (demographic stochasticity), variations in rainfall (environmental stochasticity), and the effects of anthropogenic activities. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include habitat impacts, climate change, and exotic, invasive species. Factors influencing the resiliency of dwarf-flowered heartleaf populations include population size, available habitat, and elements of dwarf-flowered heartleaf ecology that determine whether populations can maximize habitat occupancy.

The Natural Heritage Programs (NHP) collect information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member NHPs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2004, n.p.). We regard the NHP database as the best repository for known locations of the dwarf-flowered heartleaf (Service 2010, p. 41). Based on recent reports using the data sources described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple sub-EOs and stand-alone EO records. For the purpose

of assessing resiliency, 78 populations observed since 2005 were assessed due to the high confidence in their persistence. These new populations are results of additional survey efforts.

(b)(5) DPP

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

- Very high—populations with more than 1,000 individuals; very high probability of persistence for 20–30 years at or above the current population size.
- High—populations with 500 to 1,000 individuals; moderately high probability of persistence for 20–30 years at or above the current population size.
- Moderate—populations with 100 to 500 individuals; low probability of persistence for 20–30 years at or above the current population size.
- Low—populations with fewer than 100 individuals; low probability of persistence for 20–30 years at or above the current population size, and moderately high probability of extirpation.

Of the 78 populations assessed, 28 have very high resiliency, 5 have high resiliency, 26 have moderate resiliency, and 19 have low resiliency.

Redundancy

Redundancy is also assessed at the species level and reflects a species' ability to withstand catastrophic events (such as a rare destructive natural event or episode involving many populations) by spreading the risk of such an event across multiple, resilient populations. We measured redundancy for dwarf-flowered heartleaf by the number and distribution of resilient populations across the range of the species. It is important to note that dwarf-flowered heartleaf has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area. Redundancy for dwarf-flowered heartleaf is the total number and resiliency of population segments and their distribution across the species' range.

We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with devastating effects; however, they can occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbances. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long-term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions such as temperature and precipitation changes (DeWan et al. 2010, pp. 7–10). There are 119 populations of dwarf-flowered heartleaf spread across 13 counties. This is an increase from 24 populations across eight counties at the

time of listing. There is adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press disturbances.

Representation

Because we lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf, we decided delineating representative units was not appropriate for this species. However, in the absence of species-specific genetic and ecological diversity information, we evaluated representation based on the extent and variability of habitat characteristics across the geographical range. Dwarf-flowered heartleaf occurs in two types of habitat throughout the range. Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (Padgett 2004, entire; Weakley 2015, entire; USFWS 2015, entire), or moist soils adjacent to creeks, streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats, demonstrating the species' ability to adapt to changing environmental conditions.

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

We note that, by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have not only analyzed individual effects on the species, but we have also analyzed their potential cumulative effects. We incorporate the cumulative effects into our SSA analysis when we characterize the current and future condition of the species. Our assessment of the current and future conditions encompasses and incorporates the threats individually and cumulatively. Our current and future condition assessment is iterative because it accumulates and evaluates the effects of all the factors that may be influencing the species, including threats and conservation efforts. Because the SSA framework considers not just the presence of the factors, but to what degree they collectively influence risk

to the entire species, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative effects analysis.

Summary of Threats and Conservation Measures that Affect the Species

The NCNHP assessed threats in the populations they monitored from 2012 through 2016 (Robinson and Padgett 2016, pp. 7–8, 17–20). Threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on field observations of severity, scope, and immediacy. The rank (A through G) for each threat factor determined an overall value for each threat observed at each population. Threats observed during these years included development; incompatible forestry practices; agriculture; trampling; invasive, exotic species; sedimentation; erosion; and road construction. In this rule, we discuss the major threats affecting the species, which include development, climate change and invasive, exotic species.

Development

Dwarf-flowered heartleaf populations occur in rapidly growing urban areas within numerous counties in North and South Carolina. At the time of listing, the species was determined to be most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5).

The most recent 5-year review for the species identified the most recurrent source of habitat destruction as road and bridge improvement projects which is the most common trigger for consultations under section 7 of the Act involving dwarf-flowered heartleaf. Ten of the 27

(b)(5) DPP

largest populations (containing more than 1,000 rosettes) have been the subject of section 7 consultations. Collectively, these projects have adversely impacted or were expected to impact approximately 22,135 rosettes (Service 2018, p. 31). In most cases, the section 7 process resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection. Significant portions of other populations have been purchased by the North Carolina Department of Transportation (NCDOT) as off-site conservation measures in association with these consultations. The sole purpose of this purchase is to give additional right of way th protect the dwarf-flowered heartleaf. Other forms of economic development have also resulted in the destruction or modification of habitats occupied by dwarf-flowered heartleaf; in many cases, these activities have also required section 7 consultations with the Service. Examples include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities at a regional airport. Collectively, these activities involved the loss or relocation of several thousand rosettes.

Development was identified as a threat at five of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17–19). The five populations include two stand-alone EOs and three parent EOs with 18 sub-EOs. Of the two stand-alone EOs, one has a development threat rank of A (moderate to severe, imminent threat for most (more than 60 percent) of population, occurrences, or area) and one has a rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area). Of the 18 sub-EOs, nine have development identified as a threat. Of the nine sub-EOs, one has a development threat rank of A, one has a rank of B, one has a rank of E (moderate to severe threat for a small proportion of population, occurrences, or area), and six have a rank of F (low severity threat for most or a significant proportion of population, occurrences, or area). The two stand-

alone EOs and two sub-EOs with the highest threat ranks (A and B) are located in four populations. Based on the most recent monitoring data, one is increasing, two are stable, and one is decreasing (Robinson and Padgett 2016, p. 11). Even where development is ranked as a high threat, impacts to dwarf-flowered heartleaf are not a certain outcome.

Development was identified as a threat at one of three South Carolina populations monitored by NCNHP, and the population has a development threat rank of E (Robinson and Padgett 2016, p. 20). Based on the most recent monitoring data, the population is stable (Robinson and Padgett 2016, p. 11).

The data indicate that dwarf-flowered heartleaf populations can persist and increase in the presence of development. From 2012 to 2016, there were insignificant changes in the severity of the threat observed in the field from development (NCNHP 2016, p. 8).

The North Carolina Plant Protection and Conservation Act (North Carolina General Statutes, sections 106-202.12 et seq.) lists native plants as threatened, endangered, or species of concern, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. In North Carolina, the NCNHP designates "natural areas", which are sites with biological diversity significance due to the presence of rare species or unique natural communities. The NCNHP works with many conservation partners (state and federal agencies, conservation organization, land trusts, etc.) to implement voluntary protection. Through partnerships, the most important natural areas are purchased for permanent conservation. If a natural area is not available for purchase, ecological significance can be recognized by a voluntary registry agreement. Registry agreements consist of Registered Heritage Areas (RHAs), which are voluntary conservation agreements between the landowner

and NCNHP to preserve the natural area and biological diversity of the property. The NCNHP has four registry agreements that include dwarf-flowered heartleaf. In South Carolina, plants are protected only from disturbance where they occur on those properties owned by the State and specifically managed as South Carolina Heritage Preserves (South Carolina Code of State Regulations, chapter 123, sections 123-200 through 123-204). Heritage Preserves are protected areas that play a critical role in conserving rare species and natural habitats. There is one Heritage Preserve in South Carolina, which protects one population of the dwarf-flowered heartleaf.

The overwhelming majority of dwarf-flowered heartleaf populations have been discovered as a direct result of surveys conducted to ensure compliance with the Act. The majority of sites that have the potential to afford long-term protection to the species have been protected as a direct result of the provisions of section 7 of the Act, which directs federal agencies to avoid and minimize adverse effects to federally listed species. Through section 7 and other voluntary conservation actions, approximately 24 (31%) of the 78 current populations are permanently protected, and another 18 populations (23%) are partially protected, greatly minimizing the likelihood of impacts due to development. Together, these two groups of populations make up over 50% of the areas under some form of protective mechanism in the absence of the ESA propections.

Invasive, Exotic Species

Invasive, exotic plant species occur across the range of this species. Plants such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and Japanese stiltgrass (*Microstegium vimineum*) are known at several sites that contain dwarf-flowered heartleaf (Service 2011, p. 15). Invasive, exotic species were identified

as a threat at eight of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17–19). The eight populations include four stand-alone EOs and four parent EOs with 19 sub-EOs. Of the four stand-alone EOs, one has an invasive threat rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area), two have a rank of F (low severity threat for most or a significant proportion of population, occurrences, or area), and one has a rank of G (low severity threat for a small proportion of population, occurrences, or area). Of the 19 sub-EOs, 9 have invasive, exotic species identified as a threat. Of the nine sub-EOs, one has an invasive threat rank of A (moderate to severe, imminent threat for most (more than 60 percent) of population, occurrences, or area), four have a rank of B, two have a rank of E (moderate to severe threat for a small proportion of population, occurrences, or area), and two have a rank of G. The one stand-alone EO and five sub-EOs with the highest threat ranks (A and B) are located in three populations. Based on the most recent monitoring data, one is increasing, one is stable, and one is decreasing (Robinson and Padgett 2016, p. 11). Even where nonnative species are ranked as a high threat, impact to dwarf-flowered heartleaf is not a certain outcome.

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Invasive, exotic species were identified as a threat at all (three) South Carolina populations monitored by NCNHP, and all sites had an invasive threat rank of F (Robinson and Padgett 2016, p. 20). Based on the most recent monitoring data, all populations are stable (Robinson and Padgett 2016, p. 11).

In short, the data indicate that dwarf-flowered heartleaf populations can persist and increase in the presence of invasive, exotic species. Despite the long-term presence of invasive, exotic plants, from 2012 to 2016, there were no changes in the severity of threats observed in the

field enough to elevate the threat ranks of dwarf-flowered heartleaf populations evaluated (NCNHP 2016, p. 8).

Climate Change

Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, entire). Increased frequency of severe storms could lead to impacts if flooding duration or intensity increase as a result. Increased flooding could decrease habitat suitability through scouring and changes in soil moisture or wash plants away. Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.), which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p. 7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages, resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p. 7). Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. In recent years, the Southeast has experienced moderate to severe droughts, which many observers have implicated in population declines and poor transplant survivorship (NCNHP 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County, NC; Golder and Associates, 2009).

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Future Condition

Our analysis of the past, current, and future influences on dwarf-flowered heartleaf revealed that there are several influences that may pose risks to the future viability of the species. These risks are primarily related to invasive species, climate change, and habitat changes from development. We consider "foreseeable future" as that period of time within which a reliable prediction can be made about the future status of a species. We consider 20 years to be a reasonable period of time within which reliable predictions can be made for dwarf-flowered heartleaf. This period of time aligns with the timeframes for predictions regarding development and growth (see *Development* below) and climate change (see *Climate Change* below). We discuss in greater detail how we define "foreseeable future" for this species below, under ***Determination***.

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Invasive, Exotic Species

As discussed above, invasive, exotic plants were identified as a threat at the time of listing; however, the threat may not be as significant as once thought. The NCNHP monitored 13 populations of dwarf-flowered heartleaf and assessed threats at each population. Of monitored sites, only 9 percent of populations (one of 11) where invasive, exotic species are present are also in decline, indicating the species has at least some capacity to withstand the presence of invasive, exotic species. The number of populations has increased dramatically since listing and the invasive, exotic plant threat posed at many of the largest populations is low (NCNHP 2016, pp. 8, 17–20). Additionally, and as noted above, the number of populations managed under conservation ownership has increased. Therefore, we do not believe that competition from invasive, exotic species will be a significant threat in the foreseeable future.

(b)(5) DPP

Climate Change

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2014, entire). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2014, entire). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

(b)(5) DPP

Deleted: 07

Deleted: p 78

Deleted: 07

Deleted: pp 8–14, 18–19

According to IPCC, "most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change on most landscapes" (IPCC 2014, p. 13). Plant species with restricted ranges may experience population declines as a result of the effects of climate change. The concept of changing climate can be meaningfully assessed both by looking into the future and reviewing past changes.

As part of the current, worldwide collaboration in climate modelling under the IPCC, climate assessments of the full dataset of 30 climate models for historical and 21st century comparisons provide predictions at scales ranging from global to county level in the United States (U.S. Geological Survey (USGS) National Climate Change Viewer (NCCV) 2019). This global climate information has been recently downscaled by the National Aeronautics and Space Administration to scales relevant to our region of interest, and projected into the future under two different scenarios of possible emissions of greenhouse gases (Alder and Hostetler 2017, p. 3).

Using the NCCV and assuming the more extreme "representative concentration pathways" (RCP) greenhouse gas emission scenario (RCP 8.5), we calculated projected annual mean changes from 1981–2010 to those projected for 2025–2049 for maximum temperature (+2.9–3.1 degrees Fahrenheit (°F) in NC and +2.9 °F in SC), precipitation (+0.2 inches per month for NC and SC), soil storage (-0.1 - -0.2 inch for NC and -0.1 inch SC), and evaporative deficit (no change for NC or SC) in all counties where dwarf-flowered heartleaf occurs (Adler and Hostetler 2017, entire). We also calculated projected annual mean changes for the more conservative greenhouse gas emission scenario (RCP 4.5) using the same timeframes for maximum temperature (+2.5–2.7 °F in NC and SC), precipitation (+0.01 inch per month for NC and SC), soil storage (-0.1 - -.02 inch for NC and -0.1 inch for SC), and evaporative deficit (no change for NC or SC) in all counties where dwarf-flowered heartleaf occurs (Adler and Hostetler 2017, entire). Based on these results, all 13 counties within the range of dwarf-flowered heartleaf will be subjected to higher temperatures (annual mean increase of 2.6 °F (RCP 4.5) or 2.9 °F (RCP 8.5)) and slightly higher precipitation (annual mean increase of 0.1 inch per month (RCP 4.5) or 0.2 inch per month (RCP 8.5)) relative to the period of 1981–2010. Because the average annual increase in precipitation is predicted to be only slight, the loss in soil storage is likely primarily the result of higher predicted temperatures. While the predictions of a changing climate could negatively impact dwarf-flowered heartleaf, the species possesses other biological traits to provide resiliency against this threat.

Dwarf-flowered heartleaf is a long-lived perennial species. Several populations have been revisited after decades and the species was still stable. For example, one population in Rutherford County was first observed in 1957, and was still extant when next observed in 2001 (NCNHP 2018, n.p.). In their analyses of life-history traits in relation to potential vulnerability

to variability in demographic vital rates caused by increased variability in climatic patterns, researchers concluded that longer-lived species should be less influenced by climate-driven increases in demographic variability (Morris *et al.* 2008, p. 22; Dalgleish *et al.* 2010, p. 216).

Within the family Aristolochiaeae, more than 50 percent of the plant lineage is myrmecochorous (seed dispersal by ants) (Lengyel et al. 2010, p. 49). Likewise, dwarf-flowered heartleaf employs myrmecochory as a method for seed dispersal (Gaddy1986, entire). While species with ant-dispersed seeds have slower migration rates than species with seeds that are adhesive or ingested (Brunet and Von Oheimb 1998, p. 429), myrmecochory provides for multiple adaptive advantages for plants. Ants can disperse seeds to sites that might be nutrient-enhanced or where plant fitness will be higher. Additionally, ants bury seeds, which may protect them from fire and drought (Boyd 2001, p. 235), two conditions exacerbated by climate change.

Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, p. 111). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations of dwarf-flowered heartleaf in 2009 (Golder and Associates 2009). However, anecdotal observation suggests that the species was not appreciably harmed by this fire (Service 2011, p. 14). Additionally, the National Park Service (NPS) uses prescribed fire as a vegetation management tool at Cowpens National Battlefield. The NPS's prescribed burning activity includes the majority of the dwarf-flowered heartleaf population on site and burning appears to have had no adverse effects upon growth or flowering (Walker et al. 2009, p. 14).

Populations are located within various ecological settings within the species' range. Dwarf-flowered heartleaf occurs on Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats

(b)(5) DPP

for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (Padgett 2004, p. 114; Weakley 2015, p. 129), or moist soils adjacent to creeks or streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats, demonstrating the species' ability to adapt to different environmental conditions that could be brought on by climate change.

Based on USGS projection models, IPCC data, and taking into account uncertainties with respect to the effects of climate change, it is almost certain that climate change is affecting the dwarf-flowered heartleaf habitats in North and South Carolina. However, b.

Development

As discussed above, development was identified as a threat at the time of listing; however, the threat may not be as significant as once thought. The NCNHP monitored 13 populations of dwarf-flowered heartleaf and assessed threats at each population. Of monitored sites, only 12 percent of populations (one of eight) where development is identified as a threat are also in decline, indicating the species has at least some capacity to withstand the threat of development. The number of populations has increased dramatically since listing and the development threat posed at many of the largest populations is low (NCNHP 2016, pp. 8, 17–20).

(b)(5) DPP

In addition, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status quo, targeted conservation, and high development. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) model to determine areas predicted to be urbanized by 2040, a time period for which the models provide reliable data. The SLEUTH model has been successfully applied worldwide over the last 15 years to simulate land use change, including urbanization (Clarke 1995, entire). The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0 to 100 percent. We chose 80 percent probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- Percent increase in projected development within current populations; and
- Percent increase in projected development within areas delineated as potential habitat by the Maxent habitat model.

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

We know that dwarf-flowered heartleaf populations have been extirpated as the result of urban development in the past through loss of habitat. However, there are no data available on the relationships between urbanization and indirect? impacts to dwarf-flowered heartleaf. Because of this unknown, we attempted to capture potential impacts in two ways. First, our scenarios reflect a range of potential impacts from nearby urban development. Also, we used

two thresholds for percent increase in urban development to capture potential deleterious effects: 25 percent and 50 percent. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25 percent of the area of current populations was likely to have some negative impacts; and development increase of at least 50 percent was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios (targeted conservation and status quo). This is appropriate for several reasons. First, discovery of new EOs is common; many of the populations we consider under **Current Conditions**, above, include detections that have occurred within the last few years. Second, we did not include many older detections (i.e., we only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years, and the species was still present. For example, one such EO was first observed in 1957, and next observed still extant in 2001. It seems as long as suitable habitat is still present, it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e., we define current populations as those observed between 2005 and present day). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005–current day) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by

including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate.

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Once these older EOs were identified, we created a 1,000-meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20–25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed under **Current Conditions**, above (i.e., low = fewer than 100 individuals; moderate = 100–500 individuals; high = 500–1,000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and percent Maxent classified as 0.8–1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000-meter buffer. The percent Maxent classified as 0.8–1.0 represents the percentage of all potential habitat within the 1,000-meter buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000-meter buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-flowered heartleaf is likely to persist.

(b)(5) DPP
(b)(5) DPP

Status Quo Scenario

Under the status quo scenario, we estimate that 75 populations will persist throughout the range, and that there will be a range of impacts from urbanization that are related to the

percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
  - Protected areas:
    - Protected in perpetuity—no negative impacts from urbanization; and
    - Voluntary protection/non-perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold.
  - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

High Development Scenario

Under the high development scenario, we estimate no additional populations will persist throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

- No additional populations are identified as persisting.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:

- Protected areas:
  - Protected in perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold; and
  - Voluntary protection/non-perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.
- Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold; extirpation of populations if percent increase in urbanization exceeds 90 percent threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we estimate it is likely that several additional populations (i.e., more than in the status quo scenario) will persist throughout the range. This scenario accounts for resilience (which is linked to abundance), habitat suitability (as predicted by the model), projected urban development (from SLEUTH), and protection status. Conservation is happening through various partners – State, land trusts or other non-profits, private individuals, etc. The range of impacts from urbanization are the same as in the status quo scenario. We assessed population resiliency under the following assumptions:

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.

- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—no impacts from urbanization; and
        - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 50 percent threshold.
    - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

Future Resiliency

Status Quo Scenario

In the status quo scenario, we predict 75 of the 78 populations of dwarf-flowered heartleaf will be extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

High Development Scenario

In the high development scenario, we predict 72 of the 78 populations of dwarf-flowered heartleaf will remain extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the targeted conservation scenario, we predicted 79 populations of dwarf-flowered heartleaf will be extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few populations is offset in the status quo and targeted conservation scenarios by the persistence of several additional populations. In the high development scenario, there is a predicted loss of six populations, with loss of resiliency in several additional populations. However, in all three scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances; however, the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as oil spills over the next 20 to 30 years.

(b)(5) DPP

Deleted: climate change

Deleted: ,

Based on the assumption that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (status quo and targeted conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. There are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Table of viability summary for dwarf-flowered heartleaf under three future scenarios (projected to year 2040) and compared to current condition.

	Current Condition	Status Quo Scenario	High Development Scenario	Targeted Conservation Scenario

Very High Resiliency	28	27	27	27
High Resiliency	5	6	4	6
Moderate Resiliency	26	23	25	23
Low Resiliency	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total Populations	**78**	**75**	**72**	**79**

Determination of Dwarf-flowered Heartleaf Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." For a more detailed discussion on the factors considered when determining whether a species meets the definition of "endangered species" or "threatened species" and our analysis on how we determine the foreseeable future in making these decisions, see *Regulatory Framework*, above.

Status Throughout All of Its Range

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to dwarf-flowered heartleaf. Currently, there are a total of 119 known populations in 13 counties, 78 of which have been documented since 2005. This is a significant increase from 24 known populations in eight counties at the time of listing. Of the 78

populations, 75 percent are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend.

When dwarf-flowered heartleaf was listed (54 FR 14964; April 14, 1989), the two prominent threats identified were invasive, exotic plants and habitat loss or destruction. As discussed above, invasive, exotic species are not as significant a threat to dwarf-flowered heartleaf as originally thought. Only one of the 11 monitored populations where invasive, exotic species occur was identified as declining. Additionally, dwarf-flowered heartleaf has the capacity to withstand habitat loss and destruction due to development. The species currently has significant redundancy (119 populations), resilient populations (33 of 78 evaluated populations with high or very high viability), and representation in two different ecological settings. Even under our high development scenario, only two high or very high viability populations are predicted to have lower viability as a result of development. Therefore, we do not believe that competition from invasive, exotic species or habitat loss and destruction are significant threats to the species. Additionally, since listing, there has been a nearly four-fold increase in the number of known populations. Of the 78 populations evaluated in the SSA, 24 (31%) have permanent protection and 18 (23%) have partial protection through voluntary agreements or other commitments of management (e.g., N.C. Department of Transportation). We conclude that the species is currently not in danger of extinction throughout its range.

In order to more closely examine the future threat posed by habitat loss or destruction, the Service analyzed three different development scenarios into the future to 2040. Under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (five or six) of currently low resilient populations are predicted to become

extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Of the 78 populations evaluated in the SSA, 24 (31%) have permanent protection and 18 (23%) have partial protection through voluntary agreements or other commitments of management (e.g., N.C. Department of Transportation), reducing the likelihood of development impacting those populations. Recent examination of the species also identified climate change and invasive species as potential future threats. The broadened range (8 counties to 13) and significantly increased population numbers (24 to 119) since listing in 1989 indicate that the species benefits from sufficient redundancy and resiliency to withstand perturbations from climate change as well as from invasive species. Based on this analysis, we conclude that the species is neither currently in danger of extinction, nor likely to become so within the foreseeable future.

(b)(5) DPP

Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so within the foreseeable future throughout all or a significant portion of its range.

Having determined that dwarf-flowered heartleaf is not in danger of extinction nor likely to become so within the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so within the foreseeable future in a significant portion of its range. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do the "screening" analysis, we ask whether there are portions of the species' range for which there is substantial

information indicating that: (1) The portion may be significant; and (2) the species may be, in that portion, either in danger of extinction or likely to become so within the foreseeable future. For a particular portion, if we cannot answer both questions in the affirmative, then that portion does not warrant further consideration and the species does not warrant listing because of its status in that portion of its range. We emphasize that answering these questions in the affirmative is not a determination that the species is in danger of extinction or likely to become so within the foreseeable future throughout a significant portion of its range—rather, it is a step in determining whether a more detailed analysis of the issue is required.

If we answer these questions in the affirmative, we then conduct a more thorough analysis to determine whether the portion does indeed meet both of the "significant portion of the range" prongs: (1) The portion is significant; and (2) the species is, in that portion, either in danger of extinction or likely to become so in the foreseeable future. Confirmation that a portion does indeed meet one of these prongs does not create a presumption, prejudgment, or other determination as to whether the species is an endangered species or threatened species. Rather, we must then undertake a more detailed analysis of the other prong to make that determination. Only if the portion does indeed meet both prongs would the species warrant listing because of its status in a significant portion of its range.

At both stages in this process—the stage of screening potential portions to identify any portions that warrant further consideration and the stage of undertaking the more detailed analysis of any portions that do warrant further consideration—it might be more efficient for us to address the "significance" question or the "status" question first. Our selection of which question to address first for a particular portion depends on the biology of the species, its range, and the threats it faces. Regardless of which question we address first, if we reach a negative

answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range.

For dwarf-flowered heartleaf we chose to evaluate the status question (i.e., identifying portions where dwarf-flowered heartleaf may be in danger of extinction or likely to become so in the foreseeable future) first. To conduct this screening, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. We examined the following threats: development; invasive, exotic species; and climate change, including cumulative effects.

(b)(5) DPP

The NCNHP monitored 13 populations of dwarf-flowered heartleaf throughout the species' range. Eleven of the 13 populations had invasive, exotic species identified as a threat, indicating that invasive, exotic species are found throughout the range and not concentrated in any specific location. Climate change effects, as discussed previously, are very uniform throughout the range. The opportunity for habitat loss and destruction due to development is higher on privately owned lands that could be sold for future development. Of the 78 populations evaluated, we determined that 31 percent are permanently protected and another 23 percent are partially protected (i.e., voluntary landowner agreements). The unprotected populations are spread throughout the species' range and not geographically clustered together. While there is some variability in the habitats occupied by dwarf-flowered heartleaf across its range, the basic ecological components required for the species to complete its life cycle are present throughout the habitats occupied by the 119 populations of the species. Thus, we found no concentration of threats in any portion of the dwarf-flowered heartleaf range at a biologically meaningful scale.

If both (1) a species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range and (2) the threats to the species are essentially

(b)(5) DPP

uniform throughout its range, then the species could not be in danger of extinction or likely to become so in the foreseeable future in any biologically meaningful portion of its range. For the dwarf-flowered heartleaf, we found both: the species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, and there is no geographical concentration of threats so the threats to the species are essentially uniform throughout its range. Therefore, we conclude, based on this screening analysis, that no portions warrant further consideration through a more detailed analysis, and the species is not in danger of extinction or likely to become so in the foreseeable future in any significant portion of its range. Our approach to analyzing significant portions of the range in this determination is consistent with the courts' holdings in *Desert Survivors v. Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018); *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d , 946, 959 (D. Ariz. 2017); and *Center for Biological Diversity v. Everson*, 2020 WL 437289 (D.D.C. Jan. 28, 2020).

Determination of Status

Our review of the best available scientific and commercial information indicates that the dwarf-flowered heartleaf does not meet the definition of an endangered species or a threatened species in accordance with sections 3(6) and 3(20) of the Act. Therefore, we propose to remove dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Plants (50 CFR 17.12(h)).

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Plants. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no

longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect dwarf-flowered heartleaf.

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a delisted species remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as an endangered or threatened species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2019–0081. Copies can also be obtained from the Service's Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**). We seek information,

data, and comments from the public regarding dwarf-flowered heartleaf and the PDM plan. We are also seeking peer review of the draft PDM plan concurrently with this comment period. We anticipate finalizing the PDM plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are not clearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act

We have determined that we do not need to prepare an environmental assessment or environmental impact statement, as defined in the National Environmental Policy Act (42 U.S.C. 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered

Species Act. We published a notice outlining our reasons for this determination in the *Federal Register* on October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands affected by this proposed rule.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081 and upon request from the Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

§ 17.12 [Amended]

2. Amend § 17.12(h) by removing the entry for "dwarf-flowered heartleaf" under "FLOWERING PLANTS" from the List of Endangered and Threatened Plants.

Dated: _____.

_____

Aurelia Skipwith
Director,
U.S. Fish and Wildlife Service.

Re: Dwarf flowered heartleaf ready for SOL 3 day review

Hamilton, Byron <byron_hamilton@fws.gov>
Mon 8/10/2020 2:16 PM
To: Young, Kristi <kristi_young@fws.gov>; Weller, Emily <emily_weller@fws.gov>

Hey Kristi.

Please see attachments for the 3 versions (Em's, Mike's and the version from HQ with track changes) of the heartleaf proposed rule. Let me know if the track changes version is ok. Thanks!

Byron A Hamilton, Sr
U.S. Fish and Wildlife Service
South Atlantic-Gulf & Mississippi Basin Regions
Ecological Services Program
1875 Century Blvd NE
Atlanta, GA 30345

From: Young, Kristi kristi young@fws gov
Sent: Monday, August 10, 2020 1 18 PM
To: Weller, Emily emily weller@fws gov ; Hamilton, Byron byron hamilton@fws gov
Subject: Re Dwarf flowered heartleaf ready for SOL 3 day review

OK. (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP
(b)(5) DPP

Byron, please take the version Emily sent you, run a compare docs with the version surnamed by the solicitor, and send all three versions to me (clearly labeled which is which). I will forward to Shannon and ask for a resurname

Kristi Young
Acting Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic Gulf and Mi i ippi Ba in
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<

From: Weller, Emily <emily_weller@fws.gov>
Sent: Monday, August 10, 2020 10:51 AM
To: Young, Kristi <kristi_young@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Dwarf-flowered heartleaf ready for SOL 3-day review

Go ahead and get SOL resurname. If the SOL is going to have edits it would be better to do it now than after it has gone through Gary, the Dir, and FWP.

Em

Emily Bizwell Weller
U.S. Fi h and Wildlife Service
ACTING Chief, Branch Delisting and Foreign Species
00 Dulle Drive
Lafayette, LA 70506
337 91 3090
337-291-3139 (Fax)
emily_weller@fw .gov

From: Young, Kristi <kristi_young@fws.gov>
Sent: Monday, August 10, 2020 11:33 AM
To: Weller, Emily <emily_weller@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Dwarf-flowered heartleaf ready for SOL 3-day review

Emily,

(b)(5) DPP

-Kristi

>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<
Kri ti Young
Acting Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi Basin
Unified Region
Kristi_Young@FWS.gov
(404) 679-7119

From: Weller, Emily <emily_weller@fws.gov>
Sent: Thursday, August 6, 2020 9:32 AM
To: Young, Kristi <kristi_young@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Dwarf-flowered heartleaf ready for SOL 3-day review

Good morning! Dwarf-flowered heartleaf is ready for the SOL 3-day review. (b)(5) DPP (b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP(b)(5) DPP (b)(5) DPP(b)(5) DPP he RSOL has 3 days to take a look at the edits that have been made and provide a surname (can be via email). I'm attaching the latest clean version. I wasn't sure which version of the document I should do a doc compare with, but I think it would probably be helpful to provide that so they can easily see the changes made.

Please let me know if you have any questions or concerns, particularly if the RSOL believes they cannot, or don't, provide a response in 3 days.

Thanks,
Em

Emily Bizwell Weller
U.S. Fish and Wildlife Service
ACTING Chief, Branch Delisting and Foreign Species
200 Dulles Drive
Lafayette, LA 70506
337-291-3090
337-291-3139 (Fax)
emily_weller@fws.gov

Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2019–0081; FF09E22000 FXES11130900000 201

RIN 1018-BD95

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicate that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened species, and does not meet the definition of an endangered species, under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2019–0081, which is the docket number for this rulemaking. Then, click on the Search button. On the resulting page, in the Search panel on the left side of the screen, under the Document Type heading, check the Proposed Rule box to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail to: Public Comments Processing, Attn: FWS–R4–ES–2019–0081, U.S. Fish and Wildlife Service, MS: JAO/1N, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

Deleted: or hand-delivery

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see **Information Requested**, below, for more information).

Document availability: The proposed rule, draft PDM plan, and supporting documents (including the species status assessment (SSA) report, references cited, and 5-year review) are available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and

Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC 28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from other concerned governmental agencies (including, but not limited to, State and Federal agencies and city or county governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. We particularly seek comments on:

(1) Information concerning the biology and ecology of dwarf-flowered heartleaf;

(2) Relevant data concerning any threats (or lack thereof) to dwarf-flowered heartleaf, particularly any data on the possible effects of climate change as it relates to habitat, as well as the extent of State protection and management that would be provided to this plant as a delisted species;

(3) Current or planned activities within the geographic range of dwarf-flowered heartleaf that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

(b)(5) DPP

Please note that submissions merely stating support for, or opposition to, the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or a threatened species must be made "solely on the basis of the best scientific and commercial data available."

You may submit your comments and materials concerning this proposed rule by one of the methods listed in **ADDRESSES**. We request that you send comments only by the methods described in **ADDRESSES**.

If you submit information via *http://www.regulations.gov*, your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on *http://www.regulations.gov*.

Comments and materials we receive, as well as supporting documentation used in preparing this proposed rule, will be available for public inspection on *http://www.regulations.gov*,

Deleted: , or by appointment, during normal business hours, at the U S Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**)…

Public Hearing

Section 4(b)(5)(E) of the Act provides for a public hearing on this proposal, if requested. Requests must be received by the date specified in **DATES**. Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the *Federal Register* at least 15 days

before the hearing. For the immediate future, we will provide these public hearings using webinars that will be announced on the Service's website, in addition to the *Federal Register*. The use of these virtual public hearings is consistent with our regulation at 50 CFR 424.16(c)(3).

Formatted: Font: (Default) Times New Roman, 12 pt

Peer Review

In accordance with our joint policy on peer review published in the *Federal Register* on July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we sought the expert opinions of seven appropriate specialists regarding the species status assessment (SSA) report, which informed this proposed rule. Out of the seven reviews requested, we received no responses. The purpose of peer review is to ensure our determination is based on scientifically sound data, assumptions, and analyses.

(b)(5) DPP

Because we will consider all comments and information received during the comment period, our final determinations may differ from this proposal. Based on the new information we receive (and any comments on that new information), we may conclude that the species is still in danger of extinction, either now or in the foreseeable future. Such final decisions would be a logical outgrowth of this proposal, as long as we: (a) base the decisions on the best scientific and commercial data available after considering all of the relevant factors; (2) do not rely on factors Congress has not intended us to consider; and (3) articulate a rational connection between the facts found and the conclusions made, including why we changed our conclusion.

Previous Federal Actions

On April 14, 1989, we listed dwarf-flowered heartleaf as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting, and cattle grazing (54 FR 14964). A recovery plan for the species was never completed. However,

over the last 30 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf SSA report to aid in determining the appropriateness of reclassifying the species.

Supporting Documents

A species status assessment team prepared an SSA report for the dwarf-flowered heartleaf. The SSA team was composed of Service biologists, in consultation with other species experts. The SSA report represents a compilation of the best scientific and commercial data available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the species.

Proposed Delisting Determination

Background

Dwarf-flowered heartleaf is a plant species endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It is a low-growing herbaceous plant in the birthwort family (Aristolochiaceae). Although dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (Service 2010, p. 15; North Carolina Natural Heritage Program (NCNHP) 2016, p. 4). When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant populations (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two States. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

(b)(5) DPP

Dwarf-flowered heartleaf is historically known to have a restricted range due to its

habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of dwarf-flowered heartleaf, but also the size of any population.

Dwarf-flowered heartleaf occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, p. 114; Weakley 2015, p. 129; Service 2015, entire), or in moist soils adjacent to creeks or streamheads, or along lakes and rivers. Plants grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). A habitat suitability study was conducted to quantify the habitat requirements for dwarf-flowered heartleaf, which may be used to help identify the species when not in flower (relative to other *Hexastylis* species' habitat preferences), find new populations, or identify suitable sites for transplants (Wagner 2013, pp. 30-32). The unit of measurement for population size in this species is a "clump" (rosette).

A thorough review of the taxonomy, life history, ecology, and overall viability of the dwarf-flowered heartleaf is presented in the SSA report (Service 2018, entire; available at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081).

Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an "endangered species" or a

"threatened species." The Act defines an endangered species as a species that is "in danger of extinction throughout all or a significant portion of its range," and a threatened species as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether any species is an "endangered species" or a "threatened species" because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future. These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term "threat" to refer, in general, to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term "threat" includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those

that affect individuals through alteration of their habitat or required resources (stressors). The term "threat" may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species, such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term "foreseeable future," which appears in the statutory definition of "threatened species." Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term "foreseeable future" extends only so far into the future as the Services can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. "Reliable" does not mean "certain"; it means sufficient to provide a reasonable degree of confidence in the

prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework

The SSA report documents the results of our comprehensive biological status review for dwarf-flowered heartleaf, including an assessment of the potential threats to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for removal from the List of Endangered and Threatened Plants (i.e., "delisting"). It does, however, provide the scientific basis that informs our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

Summary of SSA Analysis

To assess dwarf-flowered heartleaf viability, we used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 306–310). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years), redundancy supports

the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation supports the ability of the species to adapt over time to long-term changes in the environment (for example, climate changes). In general, the more resilient and redundant a species is and the more representation it has, the more likely it is to sustain populations over time, even under changing environmental conditions. Using these principles, we identified the species' ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species' viability.

The SSA process can be categorized into three sequential stages. During the first stage, we evaluated the individual species' life-history needs. In the next stage, we assessed the historical and current condition of the species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize the species' viability (i.e., its ability to sustain populations in the wild over time). We used this information to inform this proposed rule.

Summary of Biological Status and Threats

In this discussion, we review the biological condition of the species and its resources, and the threats that influence the species' current and future condition, in order to assess the species' overall viability and the risks to that viability.

Current Condition

Resiliency

For dwarf-flowered heartleaf to maintain viability, its populations, or some portion thereof, must be resilient. Resiliency is assessed at the level of populations and reflects a species' ability to withstand stochastic events (events arising from random factors). Resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates and fecundity (demographic stochasticity), variations in rainfall (environmental stochasticity), and the effects of anthropogenic activities. Stochastic factors that have the potential to affect dwarf-flowered heartleaf include habitat impacts, climate change, and exotic, invasive species. Factors influencing the resiliency of dwarf-flowered heartleaf populations include population size, available habitat, and elements of dwarf-flowered heartleaf ecology that determine whether populations can maximize habitat occupancy.

The Natural Heritage Programs (NHP) collect information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member NHPs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2004, n.p.). We regard the NHP database as the best repository for known locations of the dwarf-flowered heartleaf (Service 2010, p. 41). Based on recent reports using the data sources described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple sub-EOs and stand-alone EO records. For the purpose

of assessing resiliency, 78 populations observed since 2005 were assessed due to the high confidence in their persistence. These new populations are results of additional survey efforts.

(b)(5) DPP

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

- Very high—populations with more than 1,000 individuals; very high probability of persistence for 20–30 years at or above the current population size.
- High—populations with 500 to 1,000 individuals; moderately high probability of persistence for 20–30 years at or above the current population size.
- Moderate—populations with 100 to 500 individuals; low probability of persistence for 20–30 years at or above the current population size.
- Low—populations with fewer than 100 individuals; low probability of persistence for 20–30 years at or above the current population size, and moderately high probability of extirpation.

Of the 78 populations assessed, 28 have very high resiliency, 5 have high resiliency, 26 have moderate resiliency, and 19 have low resiliency.

Redundancy

Redundancy is also assessed at the species level and reflects a species' ability to withstand catastrophic events (such as a rare destructive natural event or episode involving many populations) by spreading the risk of such an event across multiple, resilient populations. We measured redundancy for dwarf-flowered heartleaf by the number and distribution of resilient populations across the range of the species. It is important to note that dwarf-flowered heartleaf has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area. Redundancy for dwarf-flowered heartleaf is the total number and resiliency of population segments and their distribution across the species' range.

We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with devastating effects; however, they can occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbances. Both types of disturbances are part of the natural variability of dwarf-flowered heartleaf ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long-term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions such as temperature and precipitation changes (DeWan et al. 2010, pp. 7–10). There are 119 populations of dwarf-flowered heartleaf spread across 13 counties. This is an increase from 24 populations across eight counties at the

time of listing. There is adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press disturbances.

Representation

Because we lack genetic and ecological diversity data to characterize representation for dwarf-flowered heartleaf, we decided delineating representative units was not appropriate for this species. However, in the absence of species-specific genetic and ecological diversity information, we evaluated representation based on the extent and variability of habitat characteristics across the geographical range. Dwarf-flowered heartleaf occurs in two types of habitat throughout the range. Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (Padgett 2004, entire; Weakley 2015, entire; USFWS 2015, entire), or moist soils adjacent to creeks, streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats, demonstrating the species' ability to adapt to changing environmental conditions.

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

We note that, by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have not only analyzed individual effects on the species, but we have also analyzed their potential cumulative effects. We incorporate the cumulative effects into our SSA analysis when we characterize the current and future condition of the species. Our assessment of the current and future conditions encompasses and incorporates the threats individually and cumulatively. Our current and future condition assessment is iterative because it accumulates and evaluates the effects of all the factors that may be influencing the species, including threats and conservation efforts. Because the SSA framework considers not just the presence of the factors, but to what degree they collectively influence risk

to the entire species, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative effects analysis.

Summary of Threats and Conservation Measures that Affect the Species

The NCNHP assessed threats in the populations they monitored from 2012 through 2016 (Robinson and Padgett 2016, pp. 7–8, 17–20). Threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on field observations of severity, scope, and immediacy. The rank (A through G) for each threat factor determined an overall value for each threat observed at each population. Threats observed during these years included development; incompatible forestry practices; agriculture; trampling; invasive, exotic species; sedimentation; erosion; and road construction. In this rule, we discuss the major threats affecting the species, which include development, climate change and invasive, exotic species.

Development

Dwarf-flowered heartleaf populations occur in rapidly growing urban areas within numerous counties in North and South Carolina. At the time of listing, the species was determined to be most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5).

The most recent 5-year review for the species identified the most recurrent source of habitat destruction as road and bridge improvement projects which is the most common trigger for consultations under section 7 of the Act involving dwarf-flowered heartleaf. Ten of the 27

largest populations (containing more than 1,000 rosettes) have been the subject of section 7 consultations. Collectively, these projects have adversely impacted or were expected to impact approximately 22,135 rosettes (Service 2018, p. 31). In most cases, the section 7 process resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection. Significant portions of other populations have been purchased by the North Carolina Department of Transportation (NCDOT) as off-site conservation measures in association with these consultations. The purpose of this purchase is to protect the dwarf-flowered heartleaf. Other forms of economic development have also resulted in the destruction or modification of habitats occupied by dwarf-flowered heartleaf; in many cases, these activities have also required section 7 consultations with the Service. Examples include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities at a regional airport. Collectively, these activities involved the loss or relocation of several thousand rosettes.

(b)(5) DPP

Deleted: sole

Deleted: give additional right of way th

Deleted:

Development was identified as a threat at five of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17–19). The five populations include two stand-alone EOs and three parent EOs with 18 sub-EOs. Of the two stand-alone EOs, one has a development threat rank of A (moderate to severe, imminent threat for most (more than 60 percent) of population, occurrences, or area) and one has a rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area). Of the 18 sub-EOs, nine have development identified as a threat. Of the nine sub-EOs, one has a development threat rank of A, one has a rank of B, one has a rank of E (moderate to severe threat for a small proportion of population, occurrences, or area), and six have a rank of F (low severity threat for most or a significant proportion of population, occurrences, or area). The two stand-

alone EOs and two sub-EOs with the highest threat ranks (A and B) are located in four populations. Based on the most recent monitoring data, one is increasing, two are stable, and one is decreasing (Robinson and Padgett 2016, p. 11). Even where development is ranked as a high threat, impacts to dwarf-flowered heartleaf are not a certain outcome.

Development was identified as a threat at one of three South Carolina populations monitored by NCNHP, and the population has a development threat rank of E (Robinson and Padgett 2016, p. 20). Based on the most recent monitoring data, the population is stable (Robinson and Padgett 2016, p. 11).

The data indicate that dwarf-flowered heartleaf populations can persist and increase in the presence of development. From 2012 to 2016, there were insignificant changes in the severity of the threat observed in the field from development (NCNHP 2016, p. 8).

The North Carolina Plant Protection and Conservation Act (North Carolina General Statutes, sections 106-202.12 et seq.) lists native plants as threatened, endangered, or species of concern, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. In North Carolina, the NCNHP designates "natural areas", which are sites with biological diversity significance due to the presence of rare species or unique natural communities. The NCNHP works with many conservation partners (state and federal agencies, conservation organization, land trusts, etc.) to implement voluntary protection. Through partnerships, the most important natural areas are purchased for permanent conservation. If a natural area is not available for purchase, ecological significance can be recognized by a voluntary registry agreement. Registry agreements consist of Registered Heritage Areas (RHAs), which are voluntary conservation agreements between the landowner

and NCNHP to preserve the natural area and biological diversity of the property. The NCNHP has four registry agreements that include dwarf-flowered heartleaf. In South Carolina, plants are protected only from disturbance where they occur on those properties owned by the State and specifically managed as South Carolina Heritage Preserves (South Carolina Code of State Regulations, chapter 123, sections 123-200 through 123-204). Heritage Preserves are protected areas that play a critical role in conserving rare species and natural habitats. There is one Heritage Preserve in South Carolina, which protects one population of the dwarf-flowered heartleaf.

The overwhelming majority of dwarf-flowered heartleaf populations have been discovered as a direct result of surveys conducted to ensure compliance with the Act. The majority of sites that have the potential to afford long-term protection to the species have been protected as a result of consultations under section 7 of the Act, which directs federal agencies to avoid and minimize adverse effects to federally listed species. Through section 7 and other voluntary conservation actions, approximately 24 (31%) of the 78 current populations are permanently protected, and another 18 populations (23%) are partially protected, greatly minimizing the likelihood of impacts due to development. Together, these two groups of populations make up over 50% of the areas under some form of protective mechanism in the absence of the ESA protections.

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Deleted: direct

Deleted: the provisions of

(b)(5) DPP
(b)(5) DPP

Deleted: propections

Invasive, Exotic Species

Invasive, exotic plant species occur across the range of this species. Plants such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and Japanese stiltgrass (*Microstegium vimineum*) are known at several sites that contain dwarf-flowered heartleaf (Service 2011, p. 15). Invasive, exotic species were identified

as a threat at eight of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17–19). The eight populations include four stand-alone EOs and four parent EOs with 19 sub-EOs. Of the four stand-alone EOs, one has an invasive threat rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area), two have a rank of F (low severity threat for most or a significant proportion of population, occurrences, or area), and one has a rank of G (low severity threat for a small proportion of population, occurrences, or area). Of the 19 sub-EOs, 9 have invasive, exotic species identified as a threat. Of the nine sub-EOs, one has an invasive threat rank of A (moderate to severe, imminent threat for most (more than 60 percent) of population, occurrences, or area), four have a rank of B, two have a rank of E (moderate to severe threat for a small proportion of population, occurrences, or area), and two have a rank of G. The one stand-alone EO and five sub-EOs with the highest threat ranks (A and B) are located in three populations. Based on the most recent monitoring data, one is increasing, one is stable, and one is decreasing (Robinson and Padgett 2016, p. 11). Even where nonnative species are ranked as a high threat, impact to dwarf-flowered heartleaf is not a certain outcome.

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Invasive, exotic species were identified as a threat at all (three) South Carolina populations monitored by NCNHP, and all sites had an invasive threat rank of F (Robinson and Padgett 2016, p. 20). Based on the most recent monitoring data, all populations are stable (Robinson and Padgett 2016, p. 11).

In short, the data indicate that dwarf-flowered heartleaf populations can persist and increase in the presence of invasive, exotic species. Despite the long-term presence of invasive, exotic plants, from 2012 to 2016, there were no changes in the severity of threats observed in the

field enough to elevate the threat ranks of dwarf-flowered heartleaf populations evaluated (NCNHP 2016, p. 8).

Climate Change

Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, entire). Increased frequency of severe storms could lead to impacts if flooding duration or intensity increase as a result. Increased flooding could decrease habitat suitability through scouring and changes in soil moisture or wash plants away. Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.), which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p. 7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages, resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p. 7). Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. In recent years, the Southeast has experienced moderate to severe droughts, which many observers have implicated in population declines and poor transplant survivorship (NCNHP 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County, NC; Golder and Associates, 2009).

Moved (insertion) [1]

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Future Condition

Our analysis of the past, current, and future influences on dwarf-flowered heartleaf revealed that there are several influences that may pose risks to the future viability of the species. These risks are primarily related to invasive species, climate change, and habitat changes from development. We consider "foreseeable future" as that period of time within which a reliable prediction can be made about the future status of a species. We consider 20 years to be a reasonable period of time within which reliable predictions can be made for dwarf-flowered heartleaf. This period of time aligns with the timeframes for predictions regarding development and growth (see *Development* below) and climate change (see *Climate Change* below). We discuss in greater detail how we define "foreseeable future" for this species below, under ***Determination***.

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Invasive, Exotic Species

As discussed above, invasive, exotic plants were identified as a threat at the time of listing; however, the threat may not be as significant as once thought. The NCNHP monitored 13 populations of dwarf-flowered heartleaf and assessed threats at each population. Of monitored sites, only 9 percent of populations (one of 11) where invasive, exotic species are present are also in decline, indicating the species has at least some capacity to withstand the presence of invasive, exotic species. The number of populations has increased dramatically since listing and the invasive, exotic plant threat posed at many of the largest populations is low (NCNHP 2016, pp. 8, 17–20). Additionally, and as noted above, the number of populations managed under conservation ownership has increased. Therefore, we do not believe that competition from invasive, exotic species will be a significant threat in the foreseeable future.

(b)(5) DPP

Climate Change

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2014, entire). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2014, entire). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

(b)(5) DPP

Deleted: 07

Deleted: p 78

Deleted: 07

Deleted: pp 8–14, 18–19

According to IPCC, "most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change on most landscapes" (IPCC 2014, p. 13). Plant species with restricted ranges may experience population declines as a result of the effects of climate change. The concept of changing climate can be meaningfully assessed both by looking into the future and reviewing past changes.

As part of the current, worldwide collaboration in climate modelling under the IPCC, climate assessments of the full dataset of 30 climate models for historical and 21st century comparisons provide predictions at scales ranging from global to county level in the United States (U.S. Geological Survey (USGS) National Climate Change Viewer (NCCV) 2019). This global climate information has been recently downscaled by the National Aeronautics and Space Administration to scales relevant to our region of interest, and projected into the future under two different scenarios of possible emissions of greenhouse gases (Alder and Hostetler 2017, p. 3).

Using the NCCV and assuming the more extreme "representative concentration pathways" (RCP) greenhouse gas emission scenario (RCP 8.5), we calculated projected annual mean changes from 1981–2010 to those projected for 2025–2049 for maximum temperature (+2.9–3.1 degrees Fahrenheit (°F) in NC and +2.9 °F in SC), precipitation (+0.2 inches per month for NC and SC), soil storage (-0.1 - -0.2 inch for NC and -0.1 inch SC), and evaporative deficit (no change for NC or SC) in all counties where dwarf-flowered heartleaf occurs (Adler and Hostetler 2017, entire). We also calculated projected annual mean changes for the more conservative greenhouse gas emission scenario (RCP 4.5) using the same timeframes for maximum temperature (+2.5–2.7 °F in NC and SC), precipitation (+0.01 inch per month for NC and SC), soil storage (-0.1 - -.02 inch for NC and -0.1 inch for SC), and evaporative deficit (no change for NC or SC) in all counties where dwarf-flowered heartleaf occurs (Adler and Hostetler 2017, entire). Based on these results, all 13 counties within the range of dwarf-flowered heartleaf will be subjected to higher temperatures (annual mean increase of 2.6 °F (RCP 4.5) or 2.9 °F (RCP 8.5)) and slightly higher precipitation (annual mean increase of 0.1 inch per month (RCP 4.5) or 0.2 inch per month (RCP 8.5)) relative to the period of 1981–2010. Because the average annual increase in precipitation is predicted to be only slight, the loss in soil storage is likely primarily the result of higher predicted temperatures. While the predictions of a changing climate could negatively impact dwarf-flowered heartleaf, the species possesses other biological traits to provide resiliency against this threat.

Dwarf-flowered heartleaf is a long-lived perennial species. Several populations have been revisited after decades and the species was still stable. For example, one population in Rutherford County was first observed in 1957, and was still extant when next observed in 2001 (NCNHP 2018, n.p.). In their analyses of life-history traits in relation to potential vulnerability

to variability in demographic vital rates caused by increased variability in climatic patterns, researchers concluded that longer-lived species should be less influenced by climate-driven increases in demographic variability (Morris *et al.* 2008, p. 22; Dalgleish *et al.* 2010, p. 216).

Within the family Aristolochiaeae, more than 50 percent of the plant lineage is myrmecochorous (seed dispersal by ants) (Lengyel et al. 2010, p. 49). Likewise, dwarf-flowered heartleaf employs myrmecochory as a method for seed dispersal (Gaddy1986, entire). While species with ant-dispersed seeds have slower migration rates than species with seeds that are adhesive or ingested (Brunet and Von Oheimb 1998, p. 429), myrmecochory provides for multiple adaptive advantages for plants. Ants can disperse seeds to sites that might be nutrient-enhanced or where plant fitness will be higher. Additionally, ants bury seeds, which may protect them from fire and drought (Boyd 2001, p. 235), two conditions exacerbated by climate change.

Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, p. 111). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations of dwarf-flowered heartleaf in 2009 (Golder and Associates 2009). However, anecdotal observation suggests that the species was not appreciably harmed by this fire (Service 2011, p. 14). Additionally, the National Park Service (NPS) uses prescribed fire as a vegetation management tool at Cowpens National Battlefield. The NPS's prescribed burning activity includes the majority of the dwarf-flowered heartleaf population on site and burning appears to have had no adverse effects upon growth or flowering (Walker et al. 2009, p. 14).

Populations are located within various ecological settings within the species' range. Dwarf-flowered heartleaf occurs on Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats

(b)(5) DPP

for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (Padgett 2004, p. 114; Weakley 2015, p. 129), or moist soils adjacent to creeks or streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats, demonstrating the species' ability to adapt to different environmental conditions that could be brought on by climate change.

Based on USGS projection models, IPCC data, and taking into account uncertainties with respect to the effects of climate change, it is almost certain that climate change is affecting the dwarf-flowered heartleaf habitats in North and South Carolina. However, b.

Development

As discussed above, development was identified as a threat at the time of listing; however, the threat is not be as significant as once thought. The NCNHP monitored 13 populations of dwarf-flowered heartleaf and assessed threats at each population. Of monitored sites, only 12 percent of populations (one of eight) where development is identified as a threat are also in decline, indicating the species has at least some capacity to withstand the threat of development. The number of populations has increased dramatically since listing and the development threat posed at many of the largest populations is low (NCNHP 2016, pp. 8, 17–20).

Deleted: may

(b)(5) DPP

In addition, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status quo, targeted conservation, and high development. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) model to determine areas predicted to be urbanized by 2040, a time period for which the models provide reliable data. The SLEUTH model has been successfully applied worldwide over the last 15 years to simulate land use change, including urbanization (Clarke 1995, entire). The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0 to 100 percent. We chose 80 percent probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- Percent increase in projected development within current populations; and
- Percent increase in projected development within areas delineated as potential habitat by the Maxent habitat model.

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

We know that dwarf-flowered heartleaf populations have been extirpated as the result of urban development in the past through loss of habitat. However, there are no data available on the relationships between urbanization and indirect? impacts to dwarf-flowered heartleaf. Because of this unknown, we attempted to capture potential impacts in two ways. First, our scenarios reflect a range of potential impacts from nearby urban development. Also, we used

two thresholds for percent increase in urban development to capture potential deleterious effects: 25 percent and 50 percent. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25 percent of the area of current populations was likely to have some negative impacts; and development increase of at least 50 percent was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios (targeted conservation and status quo). This is appropriate for several reasons. First, discovery of new EOs is common; many of the populations we consider under **Current Conditions**, above, include detections that have occurred within the last few years. Second, we did not include many older detections (i.e., we only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years, and the species was still present. For example, one such EO was first observed in 1957, and next observed still extant in 2001. It seems as long as suitable habitat is still present, it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where dwarf-flowered heartleaf is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e., we define current populations as those observed between 2005 and present day). Although our focus is on older EOs, where dwarf-flowered heartleaf is likely to persist into the future, we also included current EOs (2005–current day) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by

including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate.

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Once these older EOs were identified, we created a 1,000-meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20–25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed under **Current Conditions**, above (i.e., low = fewer than 100 individuals; moderate = 100–500 individuals; high = 500–1,000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and percent Maxent classified as 0.8–1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000-meter buffer. The percent Maxent classified as 0.8–1.0 represents the percentage of all potential habitat within the 1,000-meter buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000-meter buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where dwarf-flowered heartleaf is likely to persist.

Status Quo Scenario

(b)(5) DPP
(b)(5) DPP

Under the status quo scenario, we estimate that 75 populations will persist throughout the range, and that there will be a range of impacts from urbanization that are related to the

percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
  - Protected areas:
    - Protected in perpetuity—no negative impacts from urbanization; and
    - Voluntary protection/non-perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold.
  - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

High Development Scenario

Under the high development scenario, we estimate no additional populations will persist throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

(b)(5) DPP

- No additional populations are identified as persisting.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:

- Protected areas:
  - Protected in perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold; and
  - Voluntary protection/non-perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.
- Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold; extirpation of populations if percent increase in urbanization exceeds 90 percent threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we estimate it is likely that several additional populations (i.e., more than in the status quo scenario) will persist throughout the range. This scenario accounts for resilience (which is linked to abundance), habitat suitability (as predicted by the model), projected urban development (from SLEUTH), and protection status. Conservation is happening through various partners – State, land trusts or other non-profits, private individuals, etc. The range of impacts from urbanization are the same as in the status quo scenario. We assessed population resiliency under the following assumptions:

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.

- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—no impacts from urbanization; and
        - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 50 percent threshold.
    - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

Future Resiliency

Status Quo Scenario

In the status quo scenario, we predict 75 of the 78 populations of dwarf-flowered heartleaf will be extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

High Development Scenario

In the high development scenario, we predict 72 of the 78 populations of dwarf-flowered heartleaf will remain extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the targeted conservation scenario, we predicted 79 populations of dwarf-flowered heartleaf will be extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few populations is offset in the status quo and targeted conservation scenarios by the persistence of several additional populations. In the high development scenario, there is a predicted loss of six populations, with loss of resiliency in several additional populations. However, in all three scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances; however, the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as oil spills over the next 20 to 30 years.

(b)(5) DPP

Deleted: climate change

Deleted: ,

Based on the assumption that dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (status quo and targeted conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. There are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Table of viability summary for dwarf-flowered heartleaf under three future scenarios (projected to year 2040) and compared to current condition.

	Current Condition	Status Quo Scenario	High Development Scenario	Targeted Conservation Scenario

Very High Resiliency	28	27	27	27
High Resiliency	5	6	4	6
Moderate Resiliency	26	23	25	23
Low Resiliency	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total Populations	**78**	**75**	**72**	**79**

Determination of Dwarf-flowered Heartleaf Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." For a more detailed discussion on the factors considered when determining whether a species meets the definition of "endangered species" or "threatened species" and our analysis on how we determine the foreseeable future in making these decisions, see *Regulatory Framework*, above.

Status Throughout All of Its Range

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to dwarf-flowered heartleaf. Currently, there are a total of 119 known populations in 13 counties, 78 of which have been documented since 2005. This is a significant increase from 24 known populations in eight counties at the time of listing. Of the 78

populations, 75 percent are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend.

When dwarf-flowered heartleaf was listed (54 FR 14964; April 14, 1989), the two prominent threats identified were invasive, exotic plants and habitat loss or destruction. As discussed above, invasive, exotic species are not as significant a threat to dwarf-flowered heartleaf as originally thought. Only one of the 11 monitored populations where invasive, exotic species occur was identified as declining. Additionally, dwarf-flowered heartleaf has the capacity to withstand habitat loss and destruction due to development. The species currently has significant redundancy (119 populations), resilient populations (33 of 78 evaluated populations with high or very high viability), and representation in two different ecological settings. Even under our high development scenario, only two high or very high viability populations are predicted to have lower viability as a result of development. Therefore, we do not believe that competition from invasive, exotic species or habitat loss and destruction are significant threats to the species. Additionally, since listing, there has been a nearly four-fold increase in the number of known populations. Of the 78 populations evaluated in the SSA, 24 (31%) have permanent protection and 18 (23%) have partial protection through voluntary agreements or other commitments of management (e.g., N.C. Department of Transportation). We conclude that the species is currently not in danger of extinction throughout its range.

In order to more closely examine the future threat posed by habitat loss or destruction, the Service analyzed three different development scenarios into the future to 2040. Under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (five or six) of currently low resilient populations are predicted to become

extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Of the 78 populations evaluated in the SSA, 24 (31%) have permanent protection and 18 (23%) have partial protection through voluntary agreements or other commitments of management (e.g., N.C. Department of Transportation), reducing the likelihood of development impacting those populations. Recent examination of the species also identified climate change and invasive species as potential future threats. The broadened range (8 counties to 13) and significantly increased population numbers (24 to 119) since listing in 1989 indicate that the species benefits from sufficient redundancy and resiliency to withstand perturbations from climate change as well as from invasive species. Based on this analysis, we conclude that the species is neither currently in danger of extinction, nor likely to become so within the foreseeable future.

(b)(5) DPP

Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so within the foreseeable future throughout all or a significant portion of its range.

Having determined that dwarf-flowered heartleaf is not in danger of extinction nor likely to become so within the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so within the foreseeable future in a significant portion of its range. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do the "screening" analysis, we ask whether there are portions of the species' range for which there is substantial

information indicating that: (1) The portion may be significant; and (2) the species may be, in that portion, either in danger of extinction or likely to become so within the foreseeable future. For a particular portion, if we cannot answer both questions in the affirmative, then that portion does not warrant further consideration and the species does not warrant listing because of its status in that portion of its range. We emphasize that answering these questions in the affirmative is not a determination that the species is in danger of extinction or likely to become so within the foreseeable future throughout a significant portion of its range—rather, it is a step in determining whether a more detailed analysis of the issue is required.

If we answer these questions in the affirmative, we then conduct a more thorough analysis to determine whether the portion does indeed meet both of the "significant portion of the range" prongs: (1) The portion is significant; and (2) the species is, in that portion, either in danger of extinction or likely to become so in the foreseeable future. Confirmation that a portion does indeed meet one of these prongs does not create a presumption, prejudgment, or other determination as to whether the species is an endangered species or threatened species. Rather, we must then undertake a more detailed analysis of the other prong to make that determination. Only if the portion does indeed meet both prongs would the species warrant listing because of its status in a significant portion of its range.

At both stages in this process—the stage of screening potential portions to identify any portions that warrant further consideration and the stage of undertaking the more detailed analysis of any portions that do warrant further consideration—it might be more efficient for us to address the "significance" question or the "status" question first. Our selection of which question to address first for a particular portion depends on the biology of the species, its range, and the threats it faces. Regardless of which question we address first, if we reach a negative

answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range.

For dwarf-flowered heartleaf we chose to evaluate the status question (i.e., identifying portions where dwarf-flowered heartleaf may be in danger of extinction or likely to become so in the foreseeable future) first. To conduct this screening, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. We examined the following threats: development; invasive, exotic species; and climate change, including cumulative effects.

(b)(5) DPP

The NCNHP monitored 13 populations of dwarf-flowered heartleaf throughout the species' range. Eleven of the 13 populations had invasive, exotic species identified as a threat, indicating that invasive, exotic species are found throughout the range and not concentrated in any specific location. Climate change effects, as discussed previously, are very uniform throughout the range. The opportunity for habitat loss and destruction due to development is higher on privately owned lands that could be sold for future development. Of the 78 populations evaluated, we determined that 31 percent are permanently protected and another 23 percent are partially protected (i.e., voluntary landowner agreements). The unprotected populations are spread throughout the species' range and not geographically clustered together. While there is some variability in the habitats occupied by dwarf-flowered heartleaf across its range, the basic ecological components required for the species to complete its life cycle are present throughout the habitats occupied by the 119 populations of the species. Thus, we found no concentration of threats in any portion of the dwarf-flowered heartleaf range at a biologically meaningful scale.

If both (1) a species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range and (2) the threats to the species are essentially

Commented [KNN98]: Template language inserted

Commented [HB99R98]: Affirmative

uniform throughout its range, then the species could not be in danger of extinction or likely to become so in the foreseeable future in any biologically meaningful portion of its range. For the dwarf-flowered heartleaf, we found both: the species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, and there is no geographical concentration of threats so the threats to the species are essentially uniform throughout its range. Therefore, we conclude, based on this screening analysis, that no portions warrant further consideration through a more detailed analysis, and the species is not in danger of extinction or likely to become so in the foreseeable future in any significant portion of its range. Our approach to analyzing significant portions of the range in this determination is consistent with the courts' holdings in *Desert Survivors v. Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018); *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d , 946, 959 (D. Ariz. 2017); and *Center for Biological Diversity v. Everson*, 2020 WL 437289 (D.D.C. Jan. 28, 2020).

Determination of Status

Our review of the best available scientific and commercial information indicates that the dwarf-flowered heartleaf does not meet the definition of an endangered species or a threatened species in accordance with sections 3(6) and 3(20) of the Act. Therefore, we propose to remove dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Plants (50 CFR 17.12(h)).

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Plants. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no

longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect dwarf-flowered heartleaf.

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a delisted species remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as an endangered or threatened species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2019–0081. Copies can also be obtained from the Service's Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**). We seek information,

data, and comments from the public regarding dwarf-flowered heartleaf and the PDM plan. We are also seeking peer review of the draft PDM plan concurrently with this comment period. We anticipate finalizing the PDM plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are not clearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act

We have determined that we do not need to prepare an environmental assessment or environmental impact statement, as defined in the National Environmental Policy Act (42 U.S.C. 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered

Species Act. We published a notice outlining our reasons for this determination in the *Federal Register* on October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands affected by this proposed rule.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081 and upon request from the Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

§ 17.12 [Amended]

2. Amend § 17.12(h) by removing the entry for "dwarf-flowered heartleaf" under "FLOWERING PLANTS" from the List of Endangered and Threatened Plants.

Dated: _____.

_____

Aurelia Skipwith
Director,
U.S. Fish and Wildlife Service.

Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2019–0081; FXES11130900000-189-FF0932000]

RIN 1018-BD95

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; availability of draft post-delisting monitoring plan.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicate that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened species, and does not meet the definition of an endangered species, under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: *Written comments:* You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2019–0081, which is the docket number for this rulemaking. Then, click on the Search button. On the resulting page, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rule box to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2019–0081, U.S. Fish and Wildlife Service, MS: JAO/1N, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see **Information Requested**, below, for more information).

Document availability: The proposed rule, draft PDM plan, and supporting documents (including the species status assessment (SSA) report, references cited, and 5-year review) are available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and

Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC 28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from other concerned governmental agencies (including, but not limited to, State and Federal agencies and city or county governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information we receive during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

(1) Information concerning the biology and ecology of *Hexastylis naniflora*;

(2) Relevant data concerning any threats (or lack thereof) to *Hexastylis naniflora*, particularly any data on the possible effects of climate change as it relates to habitat, as well as the extent of State protection and management that would be provided to this plant as a delisted species;

(3) Current or planned activities within the geographic range of *Hexastylis naniflora* that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All

comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment—including your personal identifying information—on *http://www.regulations.gov*. You may request, at the top of your document, that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee we will be able to do so.

Comments and materials we receive, as well as supporting documentation used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act (16 U.S.C. 1531 et seq.) directs that determinations as to whether any species is an endangered or threatened species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for a public hearing on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the *Federal Register* (see **DATES**, above). Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the *Federal Register* at least 15 days before the hearing.

Peer Review

In accordance with our joint policy on peer review published in the *Federal Register* on July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we have sought the expert opinions of seven appropriate specialists regarding the species status assessment (SSA) report, which informed this proposed rule. The purpose of peer review is to ensure our determination is based on scientifically sound data, assumptions, and analyses.

Previous Federal Actions

On April 14, 1989, we published a final rule in the *Federal Register* (54 FR 14964) listing *Hexastylis naniflora* as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting, and cattle grazing. A recovery plan for the species was never completed. However, over the last 30 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf species status assessment (SSA) to aid in determining the appropriateness of reclassifying the species.

Background

Hexastylis naniflora is a species of plant endemic to the Upper Piedmont region of western North Carolina and upstate South Carolina. It is a rare, low-growing herbaceous plant in the birthwort family (Aristolochiaceae). Although *Hexastylis naniflora* is restricted in range, it is not as rare as once thought (Service 2010, p. 15; NCNHP 2016, p. 4). When *Hexastylis naniflora* was federally listed in 1989, the listing rule described 24 extant populations (and one extirpated population) distributed across eight counties in the Upper Piedmont of North and South Carolina. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two States. In North Carolina, it is found in Alexander, Burke, Caldwell,

Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Hexastylis naniflora appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of *Hexastylis naniflora*, but also the size of any population.

Hexastylis naniflora occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, p. 114; Weakley 2015, p. 129; Service 2015, entire), or in moist soils adjacent to creeks or streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). Wagner (2013, pp. 30–32) conducted a habitat suitability study to quantify the habitat requirements for *Hexastylis naniflora*, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species' habitat preferences), finding new populations, or identifying suitable sites for transplants. The unit of measurement for population size in this species is a "clump" (rosette).

A thorough review of the taxonomy, life history, ecology, and overall viability of the *Hexastylis naniflora* is presented in the SSA report (Service 2018, entire; available at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081).

Summary of Biological Status and Threats

Section 4(a)(1) of the Act directs us to determine whether any species is an endangered or a threatened species because of any of the following factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The SSA report documents the results of our comprehensive biological status review for *Hexastylis naniflora*, including an assessment of the potential stressors to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for removal from the List of Endangered and Threatened Plants (i.e., "delisting"). It does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate the species' individual life-history needs. In the next stage, we assessed the historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize the

species' viability (i.e., its ability to sustain populations in the wild over time). We utilized this information to inform this proposed rule.

Current Condition

Resiliency

For *Hexastylis naniflora* to maintain viability, its populations, or some portion thereof, must be resilient. Resiliency is assessed at the level of populations and reflects a species' ability to withstand stochastic events (events arising from random factors). Resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates and fecundity (demographic stochasticity), variations in rainfall (environmental stochasticity), and the effects of anthropogenic activities. Stochastic factors that have the potential to affect *Hexastylis naniflora* include habitat impacts, particularly human development pressures, but also climate change, and exotic, invasive species. Factors influencing the resiliency of *Hexastylis naniflora* populations include population size, available habitat, and elements of *Hexastylis naniflora* ecology that determine whether populations can maximize habitat occupancy.

The Natural Heritage Program (NHP) collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member NHPs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2004, n.p.). Since the Service does not maintain its own database of known locations of *Hexastylis naniflora*, it regards the NHP databases as the best repository for this

information (Service 2010, p. 41). Based on recent reports using the data sources described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple sub-EOs and stand-alone EO records. For the purpose of assessing resiliency, only the 78 populations observed since 2005 were assessed due to the high confidence in their persistence.

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

- Very high—populations with more than 1,000 individuals; very high probability of persistence for 20–30 years at or above the current population size.
- High—populations with 500 to 1,000 individuals; moderately high probability of persistence for 20–30 years at or above the current population size.
- Moderate—populations with 100 to 500 individuals; low probability of persistence for 20–30 years at or above the current population size.

- Low—populations with fewer than 100 individuals; low probability of persistence for 20–30 years at or above the current population size, and moderately high probability of extirpation.

Of the 78 populations assessed, 28 have very high resiliency, 5 have high resiliency, 26 have moderate resiliency, and 19 have low resiliency.

Redundancy

Redundancy is also assessed at the species level and reflects a species' ability to withstand catastrophic events (such as a rare destructive natural event or episode involving many populations) by spreading the risk of such an event across multiple, resilient populations. We measured redundancy for *Hexastylis naniflora* by the number and distribution of resilient populations across the range of the species. It is important to note that *Hexastylis naniflora* has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area. Redundancy for *Hexastylis naniflora* is the total number and resiliency of population segments and their distribution across the species' range.

We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with devastating effects; however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of *Hexastylis naniflora* ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way

construction), the primary potential catastrophic disturbances are press disturbances from long-term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions (DeWan et al. 2010, pp. 7–10). There are 119 populations of *Hexastylis naniflora*, spread across 13 counties. This is an increase from 24 populations across eight counties at the time of listing. There appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press disturbances.

Representation

We lack genetic and ecological diversity data to characterize representation for *Hexastylis naniflora*. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. Instead, we used the EO data standard, which provides a default separation distance of 1 kilometer (km) (0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several *Hexastylis naniflora* populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Summary of Threats and Conservation Measures that Affect the Species

As stated earlier in this document, section 4(a)(1) of the Act directs us to determine whether any species is an endangered species or a threatened species because of any factors

affecting its continued existence due to one or more of the five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future. In the SSA report (Service 2018, entire), we discuss the threats affecting *Hexastylis naniflora*.

The North Carolina (NC) NHP assessed threats in populations they monitored from 2012 through 2016 (Robinson and Padgett 2016, pp. 7–8, 17–20). Threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank (A through G) for each threat factor determined an overall value for each threat observed at each population. Threats observed during these years included development; incompatible forestry practices; agriculture; trampling; invasive, exotic species; sedimentation; erosion; and road construction. In this rule, we only discuss development, climate change and invasive, exotic species. Despite threats observed in many of the populations surveyed, several of the populations appear to be stable during the 5-year survey, and no significant changes in threats within populations were noted between 2012 and 2016.

Development

Hexastylis naniflora populations occur in rapidly growing urban areas within expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, South Carolina (SC), to the south. At the time of listing, it was determined that the species was most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

The most recent 5-year review for the species identified the most recurrent source of habitat destruction, and certainly the most common trigger for consultations under section 7 of the Act involving *Hexastylis naniflora*, *a*s road and bridge improvement projects. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of section 7 consultations. Collectively, these projects have adversely impacted or were expected to impact approximately 22,135 rosettes. In most cases, the section 7 process resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection. Significant portions of other populations have been purchased by the NC Department of Transportation (NCDOT) as off-site conservation measures in association with these consultations. Other forms of economic development have also resulted in the destruction or modification of habitats occupied by *Hexastylis naniflora*; in many cases, these activities have also required section 7 consultations with the Service. Examples include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities at a regional airport. Collectively, these activities involved the loss or relocation of several thousand rosettes.

The North Carolina Plant Protection and Conservation Act (North Carolina General Statutes, sections 106-202.12 et seq.) lists native plants as threatened, endangered, or species of concern, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. In South Carolina, plants are protected only from disturbance where they occur on those properties owned by the State and specifically managed as South Carolina Heritage Preserves (South Carolina Code of State Regulations, chapter 123, sections 123-200 through 123-204).

The overwhelming majority of *Hexastylis naniflora* populations have been discovered as a direct result of surveys conducted to ensure compliance with the Act. Even more significantly, the majority of sites that have the potential to afford long-term protection to the species have been protected as a direct result of the provisions of section 7 of the Act, which directs consulting agencies to minimize adverse effects to federally listed species through conservation measures pledged as a part of the project description.

Invasive, Exotic Species

Invasive, exotic plant species occur across the range of this species. Plants such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and Japanese stiltgrass (*Microstegium vimineum*)are known at several sites that contain *Hexastylis naniflora* (Service 2011, p. 15). Invasive, exotic species were identified as a threat at 8 of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17–19). The eight populations include four stand-alone EOs and four parent EOs with 19 sub-EOs. Of the four stand-alone EOs, one has an invasive threat rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area),

two have a rank of F (low severity threat for most or a significant proportion of population, occurrences, or area), and one has a rank of G (low severity threat for a small proportion of population, occurrences, or area). Of the 19 sub-EOs, 9 have invasive, exotic species identified as a threat. Of the nine sub-EOs, one has an invasive threat rank of A (moderate to severe, imminent threat for most (more than 60 percent) of population, occurrences, or area), four have a rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area), two have a rank of E (moderate to severe threat for a small proportion of population, occurrences, or area), and two have a rank of G (low severity threat for a small proportion of population, occurrences, or area). The one stand-alone EO and five sub-EOs with the highest threat ranks (A and B) are located in three populations. Based on the most recent monitoring data, one is increasing, one is stable, and one is decreasing (Robinson and Padgett 2016, p. 11).

Invasive, exotic species were identified as a threat at all (three) South Carolina populations monitored by NCNHP, and all sites had an invasive threat rank of F (low severity threat for most or a significant proportion of population, occurrences, or area) (Robinson and Padgett 2016, p. 20). Based on the most recent monitoring data, all populations are stable (Robinson and Padgett 2016, p. 11).

In short, the data indicate that *Hexastylis naniflora* populations can persist and increase in the presence of invasive, exotic species. Despite the long-term presence of invasive, exotic plants, from 2012 to 2016, there were no changes in the severity of threats observed in the field from these species significant enough to elevate the threat ranks of *Hexastylis naniflora* populations evaluated (NCNHP 2016, p. 8).

Climate Change

There is concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Because typical habitats for this species include moist soils adjacent to creeks or streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams, specific effects of climate change to *Hexastylis naniflora* are likely related to changes in soil moisture associated with potential increases in drought. Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.), which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p. 7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages, resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p. 7). Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. In recent years, the Southeast has experienced moderate to severe droughts, which many observers have implicated in population declines and poor transplant survivorship (NCNHP 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County, NC; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, entire). Although climate change is likely to affect terrestrial habitats in the Southeast, there is uncertainty about the specific effects of climate change on *Hexastylis naniflora*. Currently, we have no evidence that climate change

effects observed to date have had any adverse impact on the species or its habitats; however *Hexastylis naniflora* is found in 13 counties, up from 8 at listing, and is known from 119 populations, up from 24 at listing.

Future Condition

Our analysis of the past, current, and future influences on what *Hexastylis naniflora* needs for long-term viability revealed that there are several influences that may pose risks to the future viability of the species. These risks are primarily related to invasive species, climate change, and habitat changes from development. We discuss how we define "foreseeable future" for this species below, under ***Determination.***

Invasive, Exotic Species

As discussed above, invasive, exotic plants were identified as a threat at the time of listing; however, the threat may not be as significant as once thought. The NCNHP monitored 13 populations of *Hexastylis naniflora* and assessed threats at each population. Their results show that, of monitored sites, only 9 percent of populations (one of 11) where invasive, exotic species are present are also in decline, indicating the species has at least some capacity to withstand the presence of invasive, exotic species. The number of populations has increased dramatically since listing; the invasive, exotic plant threat posed at many of the largest populations is low (NCNHP 2016, pp. 8, 17–20); and the number of populations under conservation ownership with management has increased.

Therefore, we do not believe that competition from invasive, exotic species will be a significant threat in the foreseeable future (about 20 years from now: 2040).

Climate Change

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

According to IPCC, "most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change on most landscapes" (IPCC 2014, p. 13). Plant species with restricted ranges may experience population declines as a result of the effects of climate change. The concept of changing climate can be meaningfully assessed both by looking into the future and reviewing past changes.

As part of the current, worldwide collaboration in climate modelling under the IPCC, climate assessments of the full dataset of 30 climate models for historical and 21st century comparisons provide predictions at scales ranging from global to county level in the United States (U.S. Geological Survey (USGS) National Climate Change Viewer (NCCV) 2019;

https://www2.usgs.gov/landresources/lcs/nccv.asp). This global climate information has been recently downscaled by the National Aeronautics and Space Administration to scales relevant to our region of interest, and projected into the future under two different scenarios of possible emissions of greenhouse gases (Alder and Hostetler 2017, p. 3). Using the NCCV and assuming the more extreme "representative concentration pathways" (RCP) greenhouse gas emission scenario (RCP 8.5), in which greenhouse gas emissions continue to rise unchecked through the end of the century leading to an equivalent radiative forcing of 8.5 watts per square meter (m^2), we calculated projected annual mean changes comparing 1981–2010 to 2025–2049 for maximum temperature (+2.9–3.1 degrees Fahrenheit (°F) in NC and +2.9 °F in SC), precipitation (+0.02 inches per month for NC and SC), soil storage (-0.1 inch for NC and SC), and evaporative deficit (no change for NC or SC) in all counties where *Hexastylis naniflora* occurs (Adler and Hostetler 2017, entire). Based on these results, all 13 counties within the range of *Hexastylis naniflora* will be subjected to higher temperatures (annual mean increase of 2.9 °F) and slightly higher precipitation (annual mean increase of 0.2 inches per month) relative to the period of 1981–2010. Because the average annual increase in precipitation is predicted to be only slight, the loss in soil storage is likely primarily the result of higher predicted temperatures. While the predictions of a changing climate could negatively impact *Hexastylis naniflora*, the species possesses other biological traits to provide resiliency to this threat.

Hexastylis naniflora is a long-lived perennial species. Several populations have been revisited after decades and the species was still present. For example, one population in Rutherford County was first observed in 1957, and was next observed in 2001 (NCNHP 2018, n.p.). In their analyses of life-history traits in relation to potential vulnerability to variability in demographic vital rates caused by increased variability in climatic patterns, Morris et al. (2008,

p. 22) and Dalgleish et al. (2010, p. 216) concluded that longer-lived species should be less influenced by climate-driven increases in demographic variability.

Within the family Aristolochiaeae, more than 50 percent of the plant lineage is myrmecochorous (seed dispersal by ants) (Lengyel et al. 2010, p. 49). This supports Gaddy's work (1986, entire), which found three species of *Hexastylis,* including *Hexastylis naniflora,* employ myrmecochory as a method for seed dispersal. While species with ant-dispersed seeds have been shown to have slower migration rates than species with seeds that are adhesive or ingested (Brunet and Von Oheimb 1998, p. 429), the multiple benefits myrmecochory provides for plants is evidence for the adaptive advantages of this strategy. Ants can disperse seeds to sites that might be nutrient-enhanced or where plant fitness will be higher. Additionally, ants are known to bury seeds, and some studies show burying seeds may protect them from fire and drought (Boyd 2001, p. 235), two conditions exacerbated by climate change.

Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, p. 111). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations of *Hexastylis naniflora* in 2009 (Golder and Associates 2009). However, anecdotal observation suggests that the species was not appreciably harmed by this fire (Service 2011, p. 14). Additionally, the National Park Service (NPS) uses prescribed fire as a vegetation management tool at Cowpens National Battlefield. The scope of NPS's prescribed burning activity includes the majority of the *Hexastylis naniflora* population on site. Monitoring data suggest that burning has had no adverse effects upon growth or flowering (Walker et al. 2009, p. 14).

Populations are located within various ecological settings within the species' range. *Hexastylis naniflora* occurs on Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (Padgett 2004, p. 114; Weakley 2015, p. 129), or moist soils adjacent to creeks or streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats, demonstrating the species' ability to adapt to different environmental conditions that could be brought on by climate change.

Although climate change is almost certain to affect *Hexastylis naniflora* habitats in North and South Carolina (USGS NCCV 2019; *https://www2.usgs.gov/landresources/lcs/nccv.asp*), there is uncertainty about the specific effects of climate change on the plant. As discussed above, we have no direct evidence that climate change has had any adverse impact on *Hexastylis naniflora* or its habitat, and we are uncertain of how projected changes in temperature, precipitation, and soil moisture will influence the species in the future. However, based on the biological traits discussed above, we do not believe that climate change is a threat to the plant now or within the foreseeable future (about 20 years from now: 2040).

Development

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status quo, targeted conservation, and high development. We have identified 2040 as our foreseeable future based on the lifespan of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape (see SSA report,

available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081, for further explanation). Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040, a time period for which the models would provide reliable data. SLEUTH is a cellular automata model that applies transition rules to the states of a gridded series of cells, and in this case the transition is that from undeveloped to developed land cover, otherwise known as urbanization, and has been successfully applied worldwide over the last 15 years to simulate land use change (Clarke 1995, entire). The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0 to 100 percent. We chose 80 percent probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- Percent increase in projected development (SLEUTH probability of urbanization less than 80 percent) within current populations; and

- Percent increase in projected development (SLEUTH probability of urbanization less than 80 percent) within areas delineated as potential habitat by the Maxent habitat model.

There are no data available on the exact relationships between urbanization and the impacts to *Hexastylis naniflora*. We do know that several current populations are located in areas with surrounding urban landscapes. We also know that urban development has led to extirpation of populations in the past through loss of habitat. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from urban development. Also, we used two thresholds for percent increase in urban development to capture potential deleterious effects: 25 percent and 50 percent. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25 percent of the area of current populations was likely to have some negative impacts; and development increase of at least 50 percent was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios (targeted conservation and status quo). This is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider under **Current Conditions**, above, include detections that have occurred within the last few years. Second, we did not include many older detections (i.e., we only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years, and the species was present. For example, one such EO was first observed in 1957, and next observed in 2001. It seems as long as suitable habitat is still present, it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the

Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where *Hexastylis naniflora* is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e., we define current populations as those observed between 2005 and present day). Although our focus is on older EOs, where *Hexastylis naniflora* is likely to persist into the future, we also included current EOs (2005–current day) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005 to today. If these older EOs within current populations that were not included in our **Current Conditions** discussion, above, are found to be likely to persist, then it is possible we underestimated the resiliency of that population.

Once these older EOs were identified, we created a 1,000-meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH model to further refine a list of potential sites where the species would likely be found to persist within our 20–25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed under **Current Conditions**, above (i.e., low = fewer than 100 individuals; moderate = 100–500 individuals; high = 500–1,000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and percent Maxent classified as 0.8–1.0 score. Average Maxent

score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000-meter buffer. The percent Maxent classified as 0.8–1.0 represents the percentage of all potential habitat within the 1,000-meter buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000-meter buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where *Hexastylis naniflora* is likely to persist.

Status Quo Scenario

Under the status quo scenario, we assume 75 populations will be identified as persisting throughout the range, and that there will be a range of impacts from urbanization that are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—no negative impacts from urbanization; and
        - Voluntary protection/non-perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold.

- Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

High Development Scenario

Under the high development scenario, we assume no additional populations will be identified as persisting throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

- No additional populations are identified as persisting.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
  - Protected areas:
    - Protected in perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold; and
    - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.
  - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold; extirpation of populations if percent increase in urbanization exceeds 90 percent threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we assume it is likely several additional populations (i.e., more than in the status quo scenario) will be identified as persisting throughout the range. The range of impacts from urbanization are the same as in the status quo scenario. We assessed population resiliency under the following assumptions:

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—no impacts from urbanization; and
        - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 50 percent threshold.
    - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

Future Resiliency

Status Quo Scenario

In the status quo scenario, there are predicted to be 75 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under

Current Conditions, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

High Development Scenario

In the high development scenario, there are predicted to be 72 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Targeted Conservation Scenario

In the targeted conservation scenario, there are predicted to be 79 populations of *Hexastylis naniflora* on the landscape in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but

resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few populations is offset in the status quo and targeted conservation scenarios by the persistence of several additional populations. In the high development scenario, there is a predicted loss of six populations, with loss of resiliency in several additional populations. However, in all three scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press catastrophic disturbances; however, the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change, over the next 20 to 30 years.

Based on the assumption that *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (status quo and targeted conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current

populations. Here are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Table of viability summary for *Hexastylis naniflora* under three future scenarios (projected to year 2040) and compared to current condition.

	Current Condition	Status Quo Scenario	High Development Scenario	Targeted Conservation Scenario
Very High Resiliency	28	27	27	27
High Resiliency	5	6	4	6
Moderate Resiliency	26	23	25	23
Low Resiliency	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total Populations	**78**	**75**	**72**	**79**

Determination

Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to *Hexastylis naniflora*. Currently, there are a total of 119 known populations in 13 counties, 78 of which have been documented since 2005. This is a

significant increase from 24 known populations in eight counties at the time of listing. Of the 78 populations, 75 percent are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend.

When *Hexastylis naniflora* was placed on the Federal List of Endangered and Threatened Plants (54 FR 14964; April 14, 1989), the two prominent threats identified were invasive, exotic plants and habitat loss or destruction. As discussed above, invasive, exotic species are not as significant a threat to *Hexastylis naniflora* as originally thought. Only one of the 11 monitored populations where invasive, exotic species occur was identified is declining. Additionally, analysis in the SSA report indicates *Hexastylis naniflora* has the capacity to withstand habitat loss and destruction due to development. The species currently has significant redundancy (119 populations), resilient populations (33 of 78 evaluated populations with high or very high viability), and representation in two different ecological settings. Even under our high development scenario, only two high or very high viability populations are lost to a lower viability rank. Therefore, we do not believe that competition from invasive, exotic species or habitat loss and destruction are significant threats to the species. Additionally, since listing, there has been a nearly four-fold increase in the number of known populations, and several populations have entered into conservation ownership by organizations with management staff (e.g., Broad River Greenway) or have commitments of management (e.g., N.C. Department of Transportation). We conclude that the species is currently not in danger of extinction throughout its range.

In order to more closely examine the future threat posed by habitat loss or destruction, the Service analyzed three different development scenarios into the future to 2040. Under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very

highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (five or six) of currently low resilient populations are projected to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Approximately 31 percent of the 78 currently known populations are permanently protected, and another 23 or so percent are somewhat protected (through voluntary agreements or another type of protection), reducing the likelihood of development impacting those populations. Recent examination of the species also identified climate change and invasive species as potential future threats. The broadened range (8 counties to 13) and significantly increased population numbers (24 to 119) since listing in 1989 indicate that the species benefits from sufficient redundancy and resiliency to withstand perturbations from climate change as well as from invasive species. Based on this analysis, we conclude that the species is neither currently in danger of extinction, nor likely to become so within the foreseeable future.

Determination of Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range (SPR). Where the best available information allows the Services to determine a status for the species rangewide, that determination should be given conclusive weight because a rangewide determination of status more accurately reflects the species' degree of imperilment and better promotes the purposes of the Act. Under this reading, we should first consider whether the species warrants listing "throughout all" of its range and proceed to conduct

a "significant portion of its range" analysis if, and only if, a species does not qualify for listing as either an endangered or a threatened species according to the "throughout all" language.

Having determined that *Hexastylis naniflora* is not in danger of extinction nor likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in an SPR. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do the "screening" analysis, we ask whether there are portions of the species' range for which there is substantial information indicating that: (1) The portion may be significant; and (2) the species may be, in that portion, either in danger of extinction or likely to become so in the foreseeable future. For a particular portion, if we cannot answer both questions in the affirmative, then that portion does not warrant further consideration and the species does not warrant listing because of its status in that portion of its range. We emphasize that answering these questions in the affirmative is not a determination that the species is in danger of extinction or likely to become so in the foreseeable future throughout a significant portion of its range—rather, it is a step in determining whether a more detailed analysis of the issue is required.

If we answer these questions in the affirmative, we then conduct a more thorough analysis to determine whether the portion does indeed meet both of the SPR prongs: (1) The portion is significant; and (2) the species is, in that portion, either in danger of extinction or likely to become so in the foreseeable future. Confirmation that a portion does indeed meet one of these prongs does not create a presumption, prejudgment, or other determination as to whether the species is an endangered species or threatened species. Rather, we must then undertake a

more detailed analysis of the other prong to make that determination. Only if the portion does indeed meet both SPR prongs would the species warrant listing because of its status in a significant portion of its range.

At both stages in this process—the stage of screening potential portions to identify any portions that warrant further consideration and the stage of undertaking the more detailed analysis of any portions that do warrant further consideration—it might be more efficient for us to address the "significance" question or the "status" question first. Our selection of which question to address first for a particular portion depends on the biology of the species, its range, and the threats it faces. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range.

For *Hexastylis naniflora*, we chose to evaluate the status question (i.e., identifying portions where *Hexastylis naniflora* may be in danger of extinction or likely to become so in the foreseeable future) first. To conduct this screening, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. If a species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range and the threats to the species are essentially uniform throughout its range, then the species would not have a greater level of imperilment in any portion of its range than it does throughout all of its range, and, therefore, no portions would qualify as an SPR.

Analysis

Applying the process described above, we first determine if any portion of the range of *Hexastylis naniflora* warrants further consideration. As discussed above, a portion of a species' range is significant if it is part of the current range of the species and is important to the

conservation of the species because it contributes meaningfully to the representation, resiliency, or redundancy of the species. The contribution must be at a level such that its loss would result in a decrease in the ability to conserve the species. While there is some variability in the habitats occupied by *Hexastylis naniflora* across its range, the basic ecological components required for the species to complete its life cycle are present throughout the habitats occupied by the 119 populations of the species. No specific location within the current range of the species provides a unique or biologically significant function that is not found in other portions of the range, and no specific locations are likely to be of greater biological or conservation importance than any other locations.

We next examined whether any threats are geographically concentrated in some way that could indicate the species could be in danger of extinction, or likely to become so, in a specific area. The NCNHP monitored 13 populations of *Hexastylis naniflora* throughout the species' range. Eleven of the 13 populations had invasive, exotic species identified as a threat, indicating that invasive, exotic species are found throughout the range and not concentrated in any specific location. Climate change effects, as discussed previously, are very uniform throughout the range. The opportunity for habitat loss and destruction due to development is higher on privately owned lands that could be sold for future development. Of the 78 populations evaluated, we determined that 31 percent are permanently protected and another 23 percent are partially protected (i.e., voluntary landowner agreements). The unprotected populations are spread throughout the species' range and not geographically clustered together.

As we found no portions of the species' range where threats are significantly concentrated or substantially greater than in other portions of its range, we did not identify any portions where the species may be in danger of extinction or likely to become so in the

foreseeable future. Therefore, no portions warrant further consideration through a more detailed analysis.

Our review of the best available scientific and commercial information indicates that *Hexastylis naniflora* is not in danger of extinction or likely to become so in the foreseeable future in any significant portion of its range. Our approach to analyzing SPR in this determination is consistent with the court's holding in *Desert Survivors* v. *Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018).

On the basis of this evaluation, we believe *Hexastylis naniflora* no longer requires the protection of the Act, and we propose to remove *Hexastylis naniflora* throughout its range from the Federal List of Endangered and Threatened Plants (50 CFR 17.12(h)).

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove *Hexastylis naniflora* from the Federal List of Endangered and Threatened Plants. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect *Hexastylis naniflora*.

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that

proposing it as an endangered or threatened species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2019–0081. Copies can also be obtained from the Service's Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**). We seek information, data, and comments from the public regarding *Hexastylis naniflora* and the PDM plan. We are also seeking peer review of the draft PDM plan concurrently with this comment period. We anticipate finalizing the PDM plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are not clearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act

We have determined that we do not need to prepare an environmental assessment or environmental impact statement, as defined in the National Environmental Policy Act (42 U.S.C. 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act. We published a notice outlining our reasons for this determination in the *Federal Register* on October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered

Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands affected by this proposed rule.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081 and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

§ 17.12 [Amended]

2. Amend § 17.12(h) by removing the entry for "*Hexastylis naniflora*" under "FLOWERING PLANTS" from the List of Endangered and Threatened Plants.

Dated: _____

_____

Margaret E. Everson,
Principal Deputy Director,
U.S. Fish and Wildlife Service,
Exercising the Authority of the Director,
U.S. Fish and Wildlife Service.

~~**[Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants]**~~

Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2019–0081; FXES11130900000-189-FF0932000]

RIN 1018-BD95

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicate that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened species, and does not meet the definition of an endangered species, under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: *Written comments:* You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2019–0081, which is the docket number for this rulemaking. Then, click on the Search button. On the resulting page, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rule box to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2019–0081, U.S. Fish and Wildlife Service, MS: JAO/1N, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see **Information Requested**, below, for more information).

Document availability: The proposed rule, draft PDM plan, and supporting documents (including the species status assessment (SSA) report, references cited, and 5-year review) are available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and

Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC 28801; telephone 828-258-3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from other concerned governmental agencies (including, but not limited to, State and Federal agencies and city or county governments), Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule. Because we will consider all comments and information we receive during the comment period, our final determination may differ from this proposal. We particularly seek comments on:

(1) Information concerning the biology and ecology of *Hexastylis naniflora*;

(b)(5) DPP

(2) Relevant data concerning any threats (or lack thereof) to *Hexastylis naniflora*, particularly any data on the possible effects of climate change as it relates to habitat, as well as the extent of State protection and management that would be provided to this plant as a delisted species;

(3) Current or planned activities within the geographic range of *Hexastylis naniflora* that may negatively impact or benefit the species; and

(4) The draft PDM plan and the methods and approach detailed in it.

Please include sufficient information (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include. All

comments submitted electronically via *http://www.regulations.gov* will be presented on the website in their entirety as submitted. For comments submitted via hard copy, we will post your entire comment—including your personal identifying information—on *http://www.regulations.gov*. You may request, at the top of your document, that we withhold personal information such as your street address, phone number, or e-mail address from public review; however, we cannot guarantee we will be able to do so.

Comments and materials we receive, as well as supporting documentation used in preparing the rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Please note that submissions merely stating support for or opposition to the listing action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act (16 U.S.C. 1531 et seq.) directs that determinations as to whether any species is an endangered or threatened species must be made "solely on the basis of the best scientific and commercial data available."

Public Hearing

Section 4(b)(5)(E) of the Act provides for a public hearing on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the *Federal Register* (see **DATES**, above). Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the *Federal Register* at least 15 days before the hearing.

Peer Review

In accordance with our joint policy on peer review published in the *Federal Register* on July 1, 1994 (59 FR 34270) and our August 22, 2016, memorandum updating and clarifying the role of peer review of classification actions under the Act, we sought the expert opinions of seven appropriate specialists regarding the species status assessment (SSA) report, which informed this proposed rule. The purpose of peer review is to ensure our determination is based on scientifically sound data, assumptions, and analyses.

Because we will consider all comments and information received during the comment period, our final determinations may differ from this proposal. Based on the new information we receive (and any comments on that new information), we may conclude that the species is still in danger of extinction, either now or in the foreseeable future. Such final decisions would be a logical outgrowth of this proposal, as long as we: (a) base the decisions on the best scientific and commercial data available after considering all of the relevant factors; (2) do not rely on factors Congress has not intended us to consider; and (3) articulate a rational connection between the facts found and the conclusions made, including why we changed our conclusion

Previous Federal Actions

On April 14, 1989, we listed *Hexastylis naniflora* as threatened due to residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting, and cattle grazing (54 FR 14964). A recovery plan for the species was never completed. However, over the last 30 years, the Service has worked closely with partners to recover this species. The Service initiated the dwarf-flowered heartleaf species status assessment (SSA) to aid in determining the appropriateness of reclassifying the species.

Background

Deleted: have

Commented [FB5]: How many responses did we get?

Deleted: published a final rule in the *Federal Register*

Deleted: (54 FR 14964) listing

Hexastylis naniflora is a plant species endemic to the Upper Piedmont region of western North Carolina and upstate South Carolina. It is a low-growing herbaceous plant in the birthwort family (Aristolochiaceae). Although *Hexastylis naniflora* is restricted in range, it is not as rare as once thought (Service 2010, p. 15; NCNHP 2016, p. 4). When *Hexastylis naniflora* was federally listed in 1989, the listing rule described 24 extant populations (and one extirpated population) distributed across eight counties in the Upper Piedmont of North and South Carolina. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two States. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is found in Cherokee, Greenville, and Spartanburg Counties.

Hexastylis naniflora appears to have a restricted range due to its habitat requirements. The habitat where dwarf-flowered heartleaf exists is limited in size and scope due to a multitude of factors including soil type, moisture availability, and slope aspect (Padgett 2004, p. 81). This unique combination of factors limits not only the range of *Hexastylis naniflora*, but also the size of any population.

Hexastylis naniflora occurs in Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, p. 114; Weakley 2015, p. 129; Service 2015, entire), or in moist soils adjacent to creeks or streamheads, or along lakes and rivers. Plants grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993, entire). A habitat suitability study was conducted to quantify the habitat requirements for *Hexastylis naniflora*, which may be used for helping identify the species

Deleted: species of

Deleted: rare,

(b)(5) DPP

(b)(5) DPP

Deleted: have been observed to

Deleted: Wagner (2013, pp 30–32) conducted a

when not in flower (relative to other *Hexastylis* species' habitat preferences), finding new populations, or identifying suitable sites for transplants (Wagner 2013, pp. 30-32). The unit of measurement for population size in this species is a "clump" (rosette).

A thorough review of the taxonomy, life history, ecology, and overall viability of the *Hexastylis naniflora* is presented in the SSA report (Service 2018, entire; available at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081).

Regulatory and Analytical Framework

Regulatory Framework

Formatted: Font: (Default) Times New Roman, 12 pt

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an "endangered species" or a "threatened species." The Act defines an endangered species as a species that is "in danger of extinction throughout all or a significant portion of its range," and a threatened species as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether any species is an "endangered species" or a "threatened species" because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

We must consider these same five factors in reclassifying or delisting a species. In other words, for species that are already listed as endangered or threatened, the analysis for delisting due to recovery must include an evaluation of the threats that existed at the time of listing, the threats currently facing the species, and the threats that are reasonably likely to affect the species in the foreseeable future. These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term "threat" to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term "threat" includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term "threat" may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the

Moved (insertion) [2]

Formatted: Font: (Default) Times New Roman, 12 pt

species—such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term "foreseeable future," which appears in the statutory definition of "threatened species." Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term foreseeable future extends only so far into the future as the Services can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. "Reliable" does not mean "certain"; it means sufficient to provide a reasonable degree of confidence in the prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework The SSA report documents the results of our comprehensive biological status review for *Hexastylis naniflora*, including an assessment of the potential stressors to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for removal from the List of Endangered and Threatened Plants

(b)(5) DPP
(b)(5) DPP

(i.e., "delisting"). It does, however, provide the scientific basis for our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found on the Southeast Region website at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081.

Summary of SSA Analysis

The SSA process can be categorized into three sequential stages. During the first stage, we used the conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate the species' individual life-history needs. In the next stage, we assessed the historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. In the final stage, we made predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize the species' viability (i.e., its ability to sustain populations in the wild over time). We used this information to inform this proposed rule.

Deleted: utilized

Summary of Biological Status and Threats

Formatted: Font: Bold, Italic

Formatted: Space After: 8 pt, Widow/Orphan control, Don't keep with next

Current Condition

Resiliency

For *Hexastylis naniflora* to maintain viability, its populations, or some portion thereof, must be resilient. Resiliency is assessed at the level of populations and reflects a species' ability to withstand stochastic events (events arising from random factors). Resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates and

fecundity (demographic stochasticity), variations in rainfall (environmental stochasticity), and the effects of anthropogenic activities. Stochastic factors that have the potential to affect *Hexastylis naniflora* include habitat impacts, particularly human development pressures, but also climate change, and exotic, invasive species. Factors influencing the resiliency of *Hexastylis naniflora* populations include population size, available habitat, and elements of *Hexastylis naniflora* ecology that determine whether populations can maximize habitat occupancy.

(b)(5) DPP

The Natural Heritage Program (NHP) collects information on occurrences of rare plants, animals, natural communities, and animal assemblages. Collectively, these are referred to as "elements of natural diversity" or simply as "elements." Locations of these elements are referred to as "element occurrences" (EO records). In recent years, NatureServe and its member NHPs have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records in meaningful units of conservation interest that may approximate biological populations (NatureServe 2004, n.p.). We regard the NHP database as the best repository for known locations of the dwarf-flowered heartleaf (Service 2010, p. 41). Based on recent reports using the data sources described above (Robinson and Padgett 2016, p. 4; Robinson 2016, p. 7), the species consists of 119 populations distributed across 13 counties in North and South Carolina. Populations are composed of both multiple sub-EOs and stand-alone EO records. For the purpose of assessing resiliency, 78 populations observed since 2005 were assessed due to the high confidence in their persistence.

Deleted: Since the Service does not maintain its own database of known locations of *Hexastylis naniflora*, it

Deleted: s

Deleted: s

Deleted: this information

(b)(5) DPP

Deleted: only the

To determine overall resiliency for populations, we used EO viability ranks and expert opinion to bin population size classes into corresponding resiliency categories. EO viability ranks for the species include excellent, good, fair, poor, extant, historical, and failed to find. The

primary factor in determining these ranks is EO size (as quantified by number of clumps). Condition of habitat (vegetation community and structure) and landscape context (extent of suitable habitat and physical factors) are incorporated secondarily. Recent reports (Robinson 2016, p. 7; Robinson and Padgett 2016, p. 4) focus monitoring studies on populations with greater than 1,000 individuals (assumed to be very viable). Because we do not have habitat-level information for every population we assessed, we synthesized available population size information and created four resiliency categories as follows:

- Very high—populations with more than 1,000 individuals; very high probability of persistence for 20–30 years at or above the current population size.
- High—populations with 500 to 1,000 individuals; moderately high probability of persistence for 20–30 years at or above the current population size.
- Moderate—populations with 100 to 500 individuals; low probability of persistence for 20–30 years at or above the current population size.
- Low—populations with fewer than 100 individuals; low probability of persistence for 20–30 years at or above the current population size, and moderately high probability of extirpation.

Of the 78 populations assessed, 28 have very high resiliency, 5 have high resiliency, 26 have moderate resiliency, and 19 have low resiliency.

Redundancy

Redundancy is also assessed at the species level and reflects a species' ability to withstand catastrophic events (such as a rare destructive natural event or episode involving many populations) by spreading the risk of such an event across multiple, resilient populations. We measured redundancy for *Hexastylis naniflora* by the number and distribution of resilient

populations across the range of the species. It is important to note that *Hexastylis naniflora* has a naturally limited range, so measures of redundancy reflect the distribution within a relatively small area. Redundancy for *Hexastylis naniflora* is the total number and resiliency of population segments and their distribution across the species' range.

We consider a catastrophe to be any population-level disturbance with the potential to negatively influence population resiliency outside of normal environmental and demographic stochasticity. Disturbances often act quickly, and often with devastating effects; however, they can also occur over long periods of time. A disturbance that occurs as a relatively discrete event in time, such as a hurricane, is referred to as a "pulse" disturbance, while more gradual or cumulative pressures on a system are referred to as "press" disturbance. Both types of disturbances are part of the natural variability of *Hexastylis naniflora* ecological systems, and must be considered when assessing redundancy. While there is certainly a variety of potential pulse disturbances for the species (timber harvest, hydrological alterations, road and right-of-way construction), the primary potential catastrophic disturbances are press disturbances from long-term climate change, which have great potential to affect ecosystem processes and communities by altering the underlying abiotic conditions such as temperature and precipitation changes (DeWan et al. 2010, pp. 7–10). There are 119 populations of *Hexastylis naniflora*, spread across 13 counties. This is an increase from 24 populations across eight counties at the time of listing. There appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press disturbances.

(b)(5) DPP

Deleted: ,

(b)(5) DPP(b)(5) DPP

Representation

We lack genetic and ecological diversity data to characterize representation for *Hexastylis naniflora*. In the absence of species-specific genetic and ecological diversity

information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided delineating representative units was not appropriate for this species. Instead, we used the EO data standard, which provides a default separation distance of 1 kilometer (km) (0.62 miles) for plant and animal elements that lack EO specifications, noting that situations involving dispersal barriers could involve even shorter distances. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations. This results in several *Hexastylis naniflora* populations being stand-alone EOs, as well as many populations being aggregates of several EOs.

Summary of Threats and Conservation Measures that Affect the Species

The North Carolina (NC) NHP assessed threats in the populations they monitored from 2012 through 2016 (Robinson and Padgett 2016, pp. 7–8, 17–20). Threats that were observed, inferred, or suspected to have an impact on populations were recorded and assigned a ranking based on their severity, scope, and immediacy from field observations. The rank (A through G) for each threat factor determined an overall value for each threat observed at each population. Threats observed during these years included development; incompatible forestry practices; agriculture; trampling; invasive, exotic species; sedimentation; erosion; and road construction. In this rule, we only discuss the major threats affecting the species which are development, climate change and invasive, exotic species.

Development

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Hexastylis naniflora populations occur in rapidly growing urban areas within expanding suburbs of Charlotte, NC, to the east; Hickory, NC, to the north; and Greenville and Spartanburg, South Carolina (SC), to the south. At the time of listing, the species was determined to be most threatened by habitat loss due to the conversion of land to residential, commercial, and industrial use in these areas. Populations occurring in more rural areas are also threatened by habitat alteration or loss from land conversion to pasture or other agricultural uses, cattle grazing, intensive timber harvesting, residential construction, and construction of small ponds (Robinson 2016, p. 10; Robinson and Padgett 2016, p. 5)

The most recent 5-year review for the species identified the most recurrent source of habitat destruction as road and bridge improvement projects, which is the most common trigger for consultations under section 7 of the Act involving *Hexastylis naniflora*. Ten of the 27 largest populations (containing more than 1,000 rosettes) have been the subject of section 7 consultations. Collectively, these projects have adversely impacted or were expected to impact approximately 22,135 rosettes. In most cases, the section 7 process resulted in avoidance or minimization of adverse effects through relocation of plants and/or commitments of on-site protection. Significant portions of other populations have been purchased by the NC Department of Transportation (NCDOT) as off-site conservation measures in association with these consultations. Other forms of economic development have also resulted in the destruction or modification of habitats occupied by *Hexastylis naniflora*; in many cases, these activities have also required section 7 consultations with the Service. Examples include the maintenance or expansion of hydroelectric and drinking water reservoirs, construction of an industrial development complex, and maintenance activities at a regional airport. Collectively, these activities involved the loss or relocation of several thousand rosettes.

(b)(5) DPP

Deleted: it was determined that

(b)(5) DPP

Deleted: , and certainly

(b)(5) DPP

Deleted: , as road and bridge improvement projects

The North Carolina Plant Protection and Conservation Act (North Carolina General Statutes, sections 106-202.12 et seq.) lists native plants as threatened, endangered, or species of concern, and provides limited protection from collection and trade of listed plants. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. In South Carolina, plants are protected only from disturbance where they occur on those properties owned by the State and specifically managed as South Carolina Heritage Preserves (South Carolina Code of State Regulations, chapter 123, sections 123-200 through 123-204).

The overwhelming majority of *Hexastylis naniflora* populations have been discovered as a direct result of surveys conducted to ensure compliance with the Act. Even more significantly, the majority of sites that have the potential to afford long-term protection to the species have been protected as a direct result of the provisions of section 7 of the Act, which directs consulting agencies to minimize adverse effects to federally listed species through conservation measures pledged as a part of the project description.

Invasive, Exotic Species

Invasive, exotic plant species occur across the range of this species. Plants such as English ivy (*Hedera helix*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and Japanese stiltgrass (*Microstegium vimineum*) are known at several sites that contain *Hexastylis naniflora* (Service 2011, p. 15). Invasive, exotic species were identified as a threat at 8 of 10 North Carolina populations monitored by NCNHP (Robinson and Padgett 2016, pp. 17–19). The eight populations include four stand-alone EOs and four parent EOs with 19 sub-EOs. Of the four stand-alone EOs, one has an invasive threat rank of B (moderate to severe, imminent threat for a significant portion (20–60 percent) of the population, occurrences, or area),

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

two have a rank of F (low severity threat for most or a significant proportion of population, occurrences, or area), and one has a rank of G (low severity threat for a small proportion of population, occurrences, or area). Of the 19 sub-EOs, 9 have invasive, exotic species identified as a threat. Of the nine sub-EOs, one has an invasive threat rank of A (moderate to severe, imminent threat for most (more than 60 percent) of population, occurrences, or area), four have a rank of B, two have a rank of E (moderate to severe threat for a small proportion of population, occurrences, or area), and two have a rank of G. The one stand-alone EO and five sub-EOs with the highest threat ranks (A and B) are located in three populations. Based on the most recent monitoring data, one is increasing, one is stable, and one is decreasing (Robinson and Padgett 2016, p. 11). Thus, even where nonnative species are ranked as a high threat, it does not mean that the dwarf-flowered heartleaf is responding negatively.

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Invasive, exotic species were identified as a threat at all (three) South Carolina populations monitored by NCNHP, and all sites had an invasive threat rank of F (Robinson and Padgett 2016, p. 20). Based on the most recent monitoring data, all populations are stable (Robinson and Padgett 2016, p. 11).

In short, the data indicate that *Hexastylis naniflora* populations can persist and increase in the presence of invasive, exotic species. Despite the long-term presence of invasive, exotic plants, from 2012 to 2016, there were no changes in the severity of threats observed in the field from these species significant enough to elevate the threat ranks of *Hexastylis naniflora* populations evaluated (NCNHP 2016, p. 8).

Climate Change

There is concern that climate change may lead to increased frequency of severe storms and droughts (McLaughlin *et al.* 2002, p. 6074). Because typical habitats for this species include

(b)(5) DPP

Deleted:

moist soils adjacent to creeks or streamheads, or along lakes and rivers, and plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams, potential increases in drought due to the effects of climate change are likely related to changes in soil moisture. Warming in the Southeast is expected to be greatest in the summer (NCCV 2016, n.p.), which is predicted to increase drought frequency, while annual mean precipitation is expected to increase slightly, leading to increased flooding events (IPCC 2013, p. 7; NCCV 2016, n.p.). Changes in climate may affect ecosystem processes and communities by altering the abiotic conditions experienced by biotic assemblages, resulting in potential effects on community composition and individual species interactions (DeWan et al. 2010, p. 7). Although climate change was not a factor leading to the original listing of the species, it should be recognized that the greatest threat from climate change may come from synergistic effects. That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats. In recent years, the Southeast has experienced moderate to severe droughts, which many observers have implicated in population declines and poor transplant survivorship (NCNHP 2010). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations in 2009 (Foothills Landfill in Caldwell County, NC; Golder and Associates, 2009). Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, entire). Although climate change is likely to affect terrestrial habitats in the Southeast, currently, we have no evidence that climate change effects observed to date have had any adverse impact on the species or its habitats. Additionally, *Hexastylis naniflora* is found in 13 counties, up from 8 at listing, and is known from 119 populations, up from 24 at listing.

Deleted: specific effects

Deleted: of

(b)(5) DPP

Deleted:

Deleted:

(b)(5) DPP

(b)(5) DPP

Deleted: ;

Deleted: however

Future Condition

Our analysis of the past, current, and future influences on what *Hexastylis naniflora* needs for long-term viability revealed that there are several influences that may pose risks to the future viability of the species. These risks are primarily related to invasive species, climate change, and habitat changes from development. We have identified 2040 as our foreseeable future based on the lifespan of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape (see SSA report, available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081, for further explanation). We discuss in greater detail how we define "foreseeable future" for this species below, under ***Determination.***

Moved (insertion) [1]

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Invasive, Exotic Species

As discussed above, invasive, exotic plants were identified as a threat at the time of listing; however, the threat may not be as significant as once thought. The NCNHP monitored 13 populations of *Hexastylis naniflora* and assessed threats at each population. Of monitored sites, only 9 percent of populations (one of 11) where invasive, exotic species are present are also in decline, indicating the species has at least some capacity to withstand the presence of invasive, exotic species. The number of populations has increased dramatically since listing; the invasive, exotic plant threat posed at many of the largest populations is low (NCNHP 2016, pp. 8, 17–20); and the number of populations under conservation ownership with management has increased.

Deleted: Their results show that, o

(b)(5) DPP

Therefore, we do not believe that competition from invasive, exotic species will be a significant threat in the foreseeable future.

(b)(5) DPP(b)(5) DPP

Climate Change

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

(b)(5) DPP

(b)(5) DPP

According to IPCC, "most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change on most landscapes" (IPCC 2014, p. 13). Plant species with restricted ranges may experience population declines as a result of the effects of climate change. The concept of changing climate can be meaningfully assessed both by looking into the future and reviewing past changes.

As part of the current, worldwide collaboration in climate modelling under the IPCC, climate assessments of the full dataset of 30 climate models for historical and 21st century comparisons provide predictions at scales ranging from global to county level in the United States (U.S. Geological Survey (USGS) National Climate Change Viewer (NCCV) 2019). This global climate information has been recently downscaled by the National Aeronautics and Space Administration to scales relevant to our region of interest, and projected into the future under two different scenarios of possible emissions of greenhouse gases (Alder and Hostetler 2017, p.

Deleted: ; *https://www2.usgs.gov/landresources/lcs/nccv.asp*

Deleted:

3). Using the NCCV and assuming the more extreme "representative concentration pathways" (RCP) greenhouse gas emission scenario (RCP 8.5), we calculated projected annual mean changes comparing actual temperatures from 1981–2010 to those projected for 2025–2049 for maximum temperature (+2.9–3.1 degrees Fahrenheit (°F) in NC and +2.9 °F in SC), precipitation (+0.02 inches per month for NC and SC), soil storage (-0.1 inch for NC and SC), and evaporative deficit (no change for NC or SC) in all counties where *Hexastylis naniflora* occurs (Adler and Hostetler 2017, entire). Based on these results, all 13 counties within the range of *Hexastylis naniflora* will be subjected to higher temperatures (annual mean increase of 2.9 °F) and slightly higher precipitation (annual mean increase of 0.2 inches per month) relative to the period of 1981–2010. Because the average annual increase in precipitation is predicted to be only slight, the loss in soil storage is likely primarily the result of higher predicted temperatures. While the predictions of a changing climate could negatively impact *Hexastylis naniflora*, the species possesses other biological traits to provide resiliency to this threat.

(b)(5) DPP

Hexastylis naniflora is a long-lived perennial species. Several populations have been revisited after decades and the species was still present. For example, one population in Rutherford County was first observed in 1957, and was next observed in 2001 (NCNHP 2018, n.p.). In their analyses of life-history traits in relation to potential vulnerability to variability in demographic vital rates caused by increased variability in climatic patterns, researchers concluded that longer-lived species should be less influenced by climate-driven increases in demographic variability (Morris *et al.* 2008, p. 22; Dalgleish *et al.* 2010, p. 216).

(b)(5) DPP

Deleted:

(b)(5) DPP

Within the family Aristolochiaeae, more than 50 percent of the plant lineage is myrmecochorous (seed dispersal by ants) (Lengyel et al. 2010, p. 49). Likewise, *Hexastylis naniflora* employs myrmecochory as a method for seed dispersal (Gaddy1986, entire). While

(b)(5) DPP

Deleted: ,

species with ant-dispersed seeds have slower migration rates than species with seeds that are adhesive or ingested (Brunet and Von Oheimb 1998, p. 429), myrmecochory provides the multiple adaptive advantages for plants. Ants can disperse seeds to sites that might be nutrient-enhanced or where plant fitness will be higher. Additionally, ants bury seeds, which may protect them from fire and drought (Boyd 2001, p. 235), two conditions exacerbated by climate change.

Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, p. 111). A wildfire, presumably brought on or at least exacerbated by drought conditions, burned portions of one of the largest known populations of *Hexastylis naniflora* in 2009 (Golder and Associates 2009). However, anecdotal observation suggests that the species was not appreciably harmed by this fire (Service 2011, p. 14). Additionally, the National Park Service (NPS) uses prescribed fire as a vegetation management tool at Cowpens National Battlefield. The NPS's prescribed burning activity includes the majority of the *Hexastylis naniflora* population on site; burning appears to have had no adverse effects upon growth or flowering (Walker et al. 2009, p. 14).

Populations are located within various ecological settings within the species' range. *Hexastylis naniflora* occurs on Piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, p. 7; 1987, pp. 186–196). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (Padgett 2004, p. 114; Weakley 2015, p. 129), or moist soils adjacent to creeks or streamheads, or along lakes and rivers. This variation in habitat type provides species representation in drier and wetter habitats, demonstrating the species' ability to adapt to different environmental conditions that could be brought on by climate change.

Deleted: been shown to have

Deleted: the multiple benefits

Deleted: is evidence for the adaptive advantages of this strategy…

Deleted: are known to

Deleted: and some studies show burying seeds

Deleted: scope of

Deleted:

Deleted: Monitoring data suggest that b

Deleted: has

(b)(5) DPP

Although climate change is almost certain to affect *Hexastylis naniflora* habitats in North and South Carolina (USGS NCCV 2019), there is uncertainty about the specific effects of climate change on the plant. As discussed above, we have no direct evidence that climate change has had any adverse impact on *Hexastylis naniflora* or its habitat, and we are uncertain of how projected changes in temperature, precipitation, and soil moisture will influence the species in the future. However, based on the biological traits discussed above, we do not believe that climate change is a threat to the plant now or within the foreseeable future.

Development

Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status quo, targeted conservation, and high development. Results of future projections within each scenario are focused on current populations and potential habitat identified by the Maxent model as described below.

In constructing our scenarios, we considered two main influences by which species viability projections could be affected: location of additional populations (positive influence) and habitat loss and fragmentation due to urban development (negative influence). Habitat quantity can be negatively impacted by development or land use change (particularly on private lands) or positively impacted by land acquisition, restoration, and/or introductions into unoccupied sites that already have suitable habitat.

We use the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040, a time period for which the models provide reliable data. The SLEUTH model has been successfully applied worldwide over the last 15 years to simulate land use change, including urbanization (Clarke 1995, entire).

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Deleted: ; https://www2.usgs.gov/landresources/lcs/nccv.asp…

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Deleted: would

(b)(5) DPP

The SLEUTH model predictions are broken down by probabilities of urbanization, ranging from 0 to 100 percent. We chose 80 percent probability as our cutoff, as this cutoff has been used by USGS and by us in other SSAs, and this threshold represents a highly likely outlook for urbanization of the landscape. To forecast viability using urban development projections, we assessed the following:

- Percent increase in projected development within current populations; and
- Percent increase in projected development within areas delineated as potential habitat

by the Maxent habitat model.

We know that urban development has extirpated dwarf-flowered heartleaf populations in the past through loss of habitat. There are no data available on the relationships between urbanization and indirect? impacts to ***Hexastylis naniflora*** although several current populations are located in areas with surrounding urban landscapes. Because of this uncertainty, we attempted to capture unknowns in two ways. First, our scenarios reflect a range of potential impacts from nearby urban development. Also, we used two thresholds for percent increase in urban development to capture potential deleterious effects: 25 percent and 50 percent. Our assumptions were that very small increases in development are unlikely to negatively impact populations; development increase of at least 25 percent of the area of current populations was likely to have some negative impacts; and development increase of at least 50 percent was likely to have significant impacts to populations.

We also assessed potential positive effects by integrating the potential location or rediscovery of additional populations throughout the range into two of our scenarios (targeted conservation and status quo). This is appropriate for several reasons. First, location of new EOs is common; many of the populations we consider under **Current Conditions**, above, include

(b)(5) DPP

Deleted: (SLEUTH probability of urbanization less than 80 percent)

Deleted: (SLEUTH probability of urbanization less than 80 percent)

Moved (insertion) [3]

Deleted: also

Deleted: led to extirpation of

Deleted: exact

(b)(5) DPP

Deleted: the

Deleted: We do know that

Formatted: Font: Not Italic

(b)(5) DPP

detections that have occurred within the last few years. Second, we did not include many older detections (i.e., we only included detections since 2005), although many of those detections are likely to persist. Several EOs have been revisited after more than 10 years, and the species was present. For example, one such EO was first observed in 1957, and next observed in 2001. It seems as long as suitable habitat is still present, it is reasonable to assume that the species is still there. Finally, there is plenty of predicted suitable habitat present within older EOs based on the Maxent model predictions that were not included as current populations due to the relatively long time since last observation.

The first step in identifying additional areas where *Hexastylis naniflora* is likely to be found in the future was to identify EOs from populations that were last observed prior to 2005 (i.e., we define current populations as those observed between 2005 and present day). Although our focus is on older EOs, where *Hexastylis naniflora* is likely to persist into the future, we also included current EOs (2005–current day) in our analysis because we were interested in how the older EOs compared to those known to be persisting on the landscape since 2005. Also, by including older EOs that are within current delineated populations, we can investigate whether current populations might be predicted to contain more plants than the most recent abundance estimate. For example, many of our current populations consist of multiple EOs, and we only considered EOs that were detected from 2005 to today. If these older EOs within current populations that were not included in our **Current Conditions** discussion, above, are found to be likely to persist, then it is possible we underestimated the resiliency of that population.

(b)(5) DPP

Once these older EOs were identified, we created a 1,000-meter buffer around the population and calculated a number of useful metrics, including resiliency category based on the last known abundance estimate, Maxent habitat model metrics, and the results of the SLEUTH

model to further refine a list of potential sites where the species would likely be found to persist within our 20–25 year projection window. Resiliency categories were assessed using last known abundance in the same way as populations assessed under **Current Conditions**, above (i.e., low = fewer than 100 individuals; moderate = 100–500 individuals; high = 500–1,000 individuals; very high = greater than 1,000 individuals). We assessed two habitat metrics for these older EOs: average Maxent score and percent Maxent classified as 0.8–1.0 score. Average Maxent score indicates habitat suitability, where in general, the higher the score, the better the habitat, and was calculated by taking the mean Maxent score of all potential habitat within the 1,000-meter buffer. The percent Maxent classified as 0.8–1.0 represents the percentage of all potential habitat within the 1,000-meter buffer that falls within the highest suitability habitat class. Together, these two habitat metrics give general estimates of habitat quantity and quality. Finally, we calculated the total percentage of the 1,000-meter buffer around each EO that is projected to be urbanized in the year 2040, which helps capture the primary risk factor of development when assessing the areas where *Hexastylis naniflora* is likely to persist.

Status Quo Scenario

Under the status quo scenario, we estimate that 75 populations will persist throughout the range, and that there will be a range of impacts from urbanization that are related to the percentage increase in urban development and whether a population is protected or not. We assessed population resiliency under the following assumptions:

- Two additional populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.

(b)(5) DPP

Deleted: assume

Deleted: be identified as

Deleted: ing

- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—no negative impacts from urbanization; and
        - Voluntary protection/non-perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold.
    - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

High Development Scenario

Under the high development scenario, we estimate no additional populations will persist throughout the range, and that impacts from urbanization are relatively high, and are also affected by whether a population is protected or not. We assessed population resiliency under the following assumptions:

Deleted: assume

Deleted: be identified as

Deleted: ing

(b)(5) DPP(b)(5) DPP

- No additional populations are identified as persisting.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
    - Protected areas:
        - Protected in perpetuity—population drops one resilience rank if percent increase in urbanization exceeds 50 percent threshold; and
        - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

- Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold; extirpation of populations if percent increase in urbanization exceeds 90 percent threshold.

Targeted Conservation Scenario

Under the targeted conservation scenario, we estimate it is likely that several additional populations (i.e., more than in the status quo scenario) will persist throughout the range. The range of impacts from urbanization are the same as in the status quo scenario. We assessed population resiliency under the following assumptions:

(b)(5) DPP

Deleted: assume

Deleted: be identified as persisting

- Six populations are identified as persisting based on Maxent model metrics, last known abundance category, and total predicted urbanization from SLEUTH modelling. Six additional EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist based on the same metrics.
- Potential impacts of urban development based on SLEUTH model projections focused on current delineated populations:
  - Protected areas:
    - Protected in perpetuity—no impacts from urbanization; and
    - Voluntary protection/non-perpetuity—population drops one resiliency rank if percent increase in urbanization exceeds 50 percent threshold.
  - Unprotected areas—population drops one resiliency rank if percent increase in urbanization exceeds 25 percent threshold; population drops two resiliency ranks if percent increase in urbanization exceeds 50 percent threshold.

Future Resiliency

Status Quo Scenario

In the status quo scenario, we predict 75 populations of *Hexastylis naniflora* will be extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 2 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

(b)(5) DPP

Deleted: there are

Deleted: ed

Deleted: to be

Deleted: on the landscape

High Development Scenario

In the high development scenario, we predict 72 populations of *Hexastylis naniflora* will remain extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (4); moderate (25); and low (16). No additional populations are identified as persisting. When comparing future population resiliency to current condition, a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to moderate resiliency; one high resiliency population is predicted to drop to moderate resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and six populations (one currently moderate and five currently low) are predicted to be extirpated due to urban development.

Deleted: there are

Deleted: ed

Deleted: to be

Deleted: on the landscape

Targeted Conservation Scenario

In the targeted conservation scenario, we predicted 79 populations of *Hexastylis naniflora* will be extant in 2040. The predicted resiliency of the extant populations are as follows: very high (27); high (6); moderate (23); low (17); and 6 additional populations identified as persisting, with an unknown resiliency. Six EOs within currently delineated populations not included under **Current Conditions**, above, are predicted to persist, but resiliency is unchanged because each of the populations are already predicted to be of very high resiliency. When comparing future population resiliency to current condition a few populations drop in their resiliency category. One current population of very high resiliency is predicted to drop to high resiliency; two moderate resiliency populations are predicted to drop to low resiliency; and five populations (one currently moderate and four currently low) are predicted to be extirpated due to urban development.

Deleted: there are

Deleted: to be

Deleted: on the landscape

Viability Summary

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resiliency and extirpation of a few populations is offset in the status quo and targeted conservation scenarios by the persistence of several additional populations. In the high development scenario, there is a predicted loss of six populations, with loss of resiliency in several additional populations. However, in all three scenarios, the majority of the populations are expected to persist in 2040 at a level of at least moderate resiliency.

Given the relatively high number of populations across each scenario, redundancy remains similar to current conditions. That is to say, there appears to be adequate redundancy within the range of *Hexastylis naniflora* to withstand the impacts of localized press catastrophic

disturbances; however, the species' range is relatively small, making it potentially vulnerable to long-term catastrophic events, such as climate change, over the next 20 to 30 years.

(b)(5) DPP

Based on the assumption that *Hexastylis naniflora* has a very limited range, and after consulting with experts, we decided that delineating representative units was not appropriate. It is worth noting that in two of our scenarios (status quo and targeted conservation), additional populations are found to persist in South Carolina, an area where there are relatively few current populations. Here are opportunities to find additional populations based on the amount of predicted unoccupied potential habitat. Although we did not delineate representative units, our scenarios do not predict declines in species representation.

Table of viability summary for *Hexastylis naniflora* under three future scenarios (projected to year 2040) and compared to current condition.

	Current Condition	Status Quo Scenario	High Development Scenario	Targeted Conservation Scenario
Very High Resiliency	28	27	27	27
High Resiliency	5	6	4	6
Moderate Resiliency	26	23	25	23
Low Resiliency	19	17	16	17
Extirpated	n/a	5	6	5
Persisting	n/a	2	0	6
Total Populations	**78**	**75**	**72**	**79**

Determination of Dwarf-flowered Heartleaf Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." For a more detailed discussion on the factors considered when determining whether a species meets the definition of "endangered species" or "threatened species" and our analysis on how we determine the foreseeable future in making these decisions, please see the *Regulatory Framework* section above.

We carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to *Hexastylis naniflora*. Currently, there are a total of 119 known populations in 13 counties, 78 of which have been documented since 2005. This is a significant increase from 24 known populations in eight counties at the time of listing. Of the 78 populations, 75 percent are characterized as being either very high, high, or moderately resilient, and many are stable or increasing in trend.

(b)(5) DPP

When *Hexastylis naniflora* was listed (54 FR 14964; April 14, 1989), the two prominent threats identified were invasive, exotic plants and habitat loss or destruction. As discussed above, invasive, exotic species are not as significant a threat to *Hexastylis naniflora* as originally thought. Only one of the 11 monitored populations where invasive, exotic species occur was identified is declining. Additionally, *Hexastylis naniflora* has the capacity to withstand habitat loss and destruction due to development. The species currently has significant redundancy (119 populations), resilient populations (33 of 78 evaluated populations with high or very high viability), and representation in two different ecological settings. Even under our high

(b)(5) DPP

(b)(5) DPP(b)(5) DPP

development scenario, only two high or very high viability populations are predicted to have lower viability as a result of development. Therefore, we do not believe that competition from invasive, exotic species or habitat loss and destruction are significant threats to the species. Additionally, since listing, there has been a nearly four-fold increase in the number of known populations, and several populations have entered into conservation ownership by organizations with management staff (e.g., Broad River Greenway) or have commitments of management (e.g., N.C. Department of Transportation). We conclude that the species is currently not in danger of extinction throughout its range.

In order to more closely examine the future threat posed by habitat loss or destruction, the Service analyzed three different development scenarios into the future to 2040. Under all scenarios evaluated, the number of currently known populations (78) remaining in highly, very highly, and moderately resilient condition is 56 (compared to 59 under current conditions). Only a small number (five or six) of currently low resilient populations are projected to become extirpated under all scenarios evaluated. The species will continue to occur across its range, redundancy will remain high to moderately high, and representation will continue in its current condition providing current levels of adaptive capacity. Approximately 31 percent of the 78 currently known populations are permanently protected, and another 23 or so percent are somewhat protected (through voluntary agreements or another type of protection), reducing the likelihood of development impacting those populations. Recent examination of the species also identified climate change and invasive species as potential future threats. The broadened range (8 counties to 13) and significantly increased population numbers (24 to 119) since listing in 1989 indicate that the species benefits from sufficient redundancy and resiliency to withstand perturbations from climate change as well as from invasive species. Based on this analysis, we

Deleted: lost to a lower

Deleted: rank

(b)(5) DPP

(b)(5) DPP

conclude that the species is neither currently in danger of extinction, nor likely to become so within the foreseeable future.

Determination of Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range (SPR). Where the best available information allows the Services to determine a status for the species rangewide, that determination should be given conclusive weight because a rangewide determination of status more accurately reflects the species' degree of imperilment and better promotes the purposes of the Act. Under this reading, we should first consider whether the species warrants listing "throughout all" of its range and proceed to conduct a "significant portion of its range" analysis if, and only if, a species does not qualify for listing as either an endangered or a threatened species according to the "throughout all" language.

Having determined that *Hexastylis naniflora* is not in danger of extinction nor likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in an SPR. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do the "screening" analysis, we ask whether there are portions of the species' range for which there is substantial information indicating that: (1) The portion may be significant; and (2) the species may be, in that portion, either in danger of extinction or likely to become so in the foreseeable future. For a particular portion, if we cannot answer both questions in the affirmative, then that portion does not warrant further consideration and the

species does not warrant listing because of its status in that portion of its range. We emphasize that answering these questions in the affirmative is not a determination that the species is in danger of extinction or likely to become so in the foreseeable future throughout a significant portion of its range—rather, it is a step in determining whether a more detailed analysis of the issue is required.

If we answer these questions in the affirmative, we then conduct a more thorough analysis to determine whether the portion does indeed meet both of the SPR prongs: (1) The portion is significant; and (2) the species is, in that portion, either in danger of extinction or likely to become so in the foreseeable future. Confirmation that a portion does indeed meet one of these prongs does not create a presumption, prejudgment, or other determination as to whether the species is an endangered species or threatened species. Rather, we must then undertake a more detailed analysis of the other prong to make that determination. Only if the portion does indeed meet both SPR prongs would the species warrant listing because of its status in a significant portion of its range.

At both stages in this process—the stage of screening potential portions to identify any portions that warrant further consideration and the stage of undertaking the more detailed analysis of any portions that do warrant further consideration—it might be more efficient for us to address the "significance" question or the "status" question first. Our selection of which question to address first for a particular portion depends on the biology of the species, its range, and the threats it faces. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range.

For *Hexastylis naniflora*, we chose to evaluate the status question (i.e., identifying portions where *Hexastylis naniflora* may be in danger of extinction or likely to become so in the foreseeable future) first. To conduct this screening, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. We examined the following threats: LIST THREATS HERE, including cumulative effects.

The NCNHP monitored 13 populations of *Hexastylis naniflora* throughout the species' range. Eleven of the 13 populations had invasive, exotic species identified as a threat, indicating that invasive, exotic species are found throughout the range and not concentrated in any specific location. Climate change effects, as discussed previously, are very uniform throughout the range. The opportunity for habitat loss and destruction due to development is higher on privately owned lands that could be sold for future development. Of the 78 populations evaluated, we determined that 31 percent are permanently protected and another 23 percent are partially protected (i.e., voluntary landowner agreements). The unprotected populations are spread throughout the species' range and not geographically clustered together. While there is some variability in the habitats occupied by *Hexastylis naniflora* across its range, the basic ecological components required for the species to complete its life cycle are present throughout the habitats occupied by the 119 populations of the species. Thus, we found no concentration of threats in any portion of the dwarf-flowered heartleaf range at a biologically meaningful scale.

If both (1) a species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range and (2) the threats to the species are essentially uniform throughout its range, then the species could not be in danger of extinction or likely to become so in the foreseeable future in any biologically meaningful portion of its range. For the *Hexastylis naniflora*, we found both: the species is not in danger of extinction or likely to

(b)(5) DPP

Formatted: Indent: First line: 0.5

(b)(5) DPP
(b)(5) DPP

Formatted: Highlight

(b)(5) DPP
(b)(5) DPP
(b)(5) DPP
(b)(5) DPP

Formatted: Font: (Default) Times New Roman, 12 pt

Deleted:

Formatted: Font: (Default) Times New Roman, 12 pt

Formatted: Font:

(b)(5) DPP(b)(5) DPP(b)(5) DPP

Formatted: Not Highlight

become so in the foreseeable future throughout all of its range, and there is no geographical concentration of threats so the threats to the species are essentially uniform throughout its range. Therefore, no portions warrant further consideration through a more detailed analysis, and the species is not in danger of extinction or likely to become so in the foreseeable future in any significant portion of its range. Our approach to analyzing SPR in this determination is consistent with the court's holding in *Desert Survivors v. Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018).

Hexastylis naniflora Determination of Status

Our review of the best available scientific and commercial information indicates that the dwarf-flowered heartleaf does not meet the definition of an endangered species or a threatened species in accordance with sections 3(6) and 3(20) of the Act. On the basis of this evaluation we propose to remove *Hexastylis naniflora* from the Federal List of Endangered and Threatened Plants (50 CFR 17.12(h)).

(b)(5) DPP

(b)(5) DPP

(b)(5) DPP

Formatted: Font: Italic

Formatted: Font: (Default) Times New Roman, 12 pt

Formatted: Font: (Default) Times New Roman, 12 pt

(b)(5) DPP

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.12(h) to remove *Hexastylis naniflora* from the Federal List of Endangered and Threatened Plants. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect *Hexastylis naniflora*.

Post-Delisting Monitoring

Section 4(g)(1) of the Act requires us to monitor for not less than 5 years the status of all species that are delisted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as an endangered or threatened species is not again needed. If at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing. At the conclusion of the monitoring period, we will review all available information to determine if relisting, the continuation of monitoring, or the termination of monitoring is appropriate.

Section 4(g) of the Act explicitly requires that we cooperate with the States in development and implementation of PDM programs. However, we remain ultimately responsible for compliance with section 4(g) and, therefore, must remain actively engaged in all phases of PDM. We also seek active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting.

Concurrent with this proposed delisting rule, we announce the draft PDM plan's availability for public review at *http://www.regulations.gov* under Docket Number FWS–R4–ES–2019–0081. Copies can also be obtained from the Service's Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**). We seek information, data, and comments from the public regarding *Hexastylis naniflora* and the PDM plan. We are also seeking peer review of the draft PDM plan concurrently with this comment period. We anticipate finalizing the PDM plan, considering all public and peer review comments, prior to making a final determination on the proposed delisting rule.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are not clearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act

We have determined that we do not need to prepare an environmental assessment or environmental impact statement, as defined in the National Environmental Policy Act (42 U.S.C. 4321 *et seq*.), in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act. We published a notice outlining our reasons for this determination in the *Federal Register* on October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribes or tribal lands affected by this proposed rule.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0081 and upon request from the Field Supervisor, Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Southeastern Region Recovery Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

§ 17.12 [Amended]

2. Amend § 17.12(h) by removing the entry for "*Hexastylis naniflora*" under "FLOWERING PLANTS" from the List of Endangered and Threatened Plants.

Dated: _____

_____

Margaret E. Everson,
Principal Deputy Director,
U.S. Fish and Wildlife Service,
Exercising the Authority of the Director,
U.S. Fish and Wildlife Service.

~~[Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants]~~

Re: Request for re surname Dwarf flowered heartleaf

Hamilton, Byron <byron_hamilton@fws.gov>

Wed 8/19/2020 1:03 PM

To: Speights, Helen H <helen.speights@sol.doi.gov>; Young, Kristi <kristi_young@fws.gov>

Thanks Helen!

Byron A. Hamilton, Sr.
U.S. Fish and Wildlife Service
South Atlantic-Gulf & Mississippi Basin Regions
Ecological Services Program
1875 Century Blvd NE
Atlanta, GA 30345

From: Speights, Helen H <helen.speights@sol.doi.gov>
Sent: Wednesday, August 19, 2020 1:01 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>; Young, Kristi <kristi_young@fws.gov>
Subject: RE: Request for re-surname - Dwarf-flowered heartleaf

Ok, great. Please use the attached version moving forward.

Thanks,
Helen

From: Hamilton, Byron byron hamilton@fws gov
Sent: Wednesday, August 19, 2020 12:33 PM
To: Speights, Helen H helen speights@sol doi gov ; Young, Kristi kristi young@fws gov
Subject: Re: Request for re-surname - Dwarf-flowered heartleaf

Ok, I looks great.

Byron A. Hamilton, Sr.
U.S. Fish and Wildlife Service
South Atlantic-Gulf & Mississippi Basin Regions
Ecological Services Program
1875 Century Blvd NE
Atlanta GA 30345

From: Speights, Helen H <helen.speights@sol.doi.gov>
Sent: Wednesday, August 19, 2020 12:28 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>; Young, Kristi <kristi_young@fws.gov>
Subject: RE: Request for re-surname - Dwarf-flowered heartleaf

Hi Byron,

(b)(5) DPP & ACP

Thank you,

Helen

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, August 19, 2020 11:06 AM
To: Speights, Helen H <helen.speights@sol.doi.gov>; Young, Kristi <kristi_young@fws.gov>
Subject: Re: Request for re-surname - Dwarf-flowered heartleaf

Good morning Helen!

Please see attachment for the Heartleaf rule with the appropriate SPR language. Let me know if you have additional questions.

Byron A. Hamilton, Sr.
U S Fish and Wildlife Service
South Atlantic-Gulf & Mississippi Basin Regions
Ecological Services Program
1875 Century Blvd NE
Atlanta GA 30345

From: Speights, Helen H <helen.speights@sol.doi.gov>
Sent: Wednesday, August 19, 2020 8 42 AM
To: Young, Kristi <kristi_young@fws.gov>
Cc: Hamilton, Byron byron_hamilton@fws gov
Subject: RE: Request for re-surname - Dwarf-flowered heartleaf

And, actually, before I send it to Shannon, can you send it to me with the appropriate SPR discussion? Thanks!

From: Young, Kristi <kristi_young@fws.gov>
Sent: Tuesday, August 18, 2020 5:17 PM
To: Speights, Helen H <helen.speights@sol.doi.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Request for re-surname - Dwarf-flowered heartleaf

Can do. Thanks for your quick review!

Kristi Young
Acting Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic Gulf and Mi i ippi Ba in
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<

From: Speights, Helen H <helen.speights@sol.doi.gov>
Sent: Tuesday, August 18, 2020 3:09 PM
To: Young, Kristi <kristi_young@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: RE: Request for re-surname - Dwarf-flowered heartleaf

Hi Kristi,

(b)(5) DPP & ACP

Also, there is a question mark on the first line of page 32 that should be removed

Thank you,

Helen

From: Young, Kristi <kristi_young@fws.gov>
Sent: Friday, August 14, 2020 12:17 PM
To: Goessling, Shannon L <shannon.goessling@sol.doi.gov>
Cc: Colbert, Janice B <Janice.Colbert@sol.doi.gov>; Hamilton, Byron <byron_hamilton@fws.gov>; Speights, Helen H <helen.speights@sol.doi.gov>
Subject: Request for re-surname - Dwarf-flowered heartleaf

Aloha Shannon,

We are requesting you re-surname the dwarf-flowered heartleaf proposed delisting, as it has been some time since your office reviewed it. I have attached the original rule you surnamed (I believe Mike reviewed it), the current version from HQ, and a compare version so you can see the changes that have been made. I believe a good portion of the changes are to format the rule to the new template, but more substantial changes were made in the threats discussion to better explain non-ESA protections for the species that will remain post-delisting and more information about climate change.

Byron Hamilton is the lead biologist for this rule.

Thank you!

-Kristi

Kristi Young
Acting Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic Gulf and Mi i ippi Ba in
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<

RSOL Resurname for Dwarf flowered heartleaf Proposed Delisting Rule

Speights, Helen H <helen.speights@sol.doi.gov>

Mon 8/24/2020 8:19 AM

To: Miranda, Leopoldo <Leopoldo_Miranda@fws.gov>; Phillips, Catherine <catherine_phillips@fws.gov>; Tirpak, John <John_Tirpak@fws.gov>; Young, Kristi <kristi_young@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Goessling, Shannon L <shannon.goessling@sol.doi.gov>

Attached please find the Regional Solicitor's resurname for the proposed rule to remove the dwarf flowered heartleaf from the List of Threatened and Endangered Plants under the ESA.

Thank you,
Helen

Helen H. Speights
Attorney Advisor
Interior Region 2 | South Atlantic-Gulf & Interior Region 4 | Mississippi Basin
U.S. Department of the Interior | Office of the Solicitor

Richard B. Russell Federal Building
75 Ted Turner Drive, S.W., Ste. 304
Atlanta, Georgia 30303
(404) 331-5604 (direct)
(404) 331 4447 (main)

helen.speights@sol.doi.gov

United States Department of the Interior

OFFICE OF THE SOLICITOR
Regional Solicitor's Office for Interior Regions 2 & 4
Richard B. Russell Federal Building
75 Ted Turner Drive, S.W., Room 304
Atlanta, Georgia 30303
(404) 331-4477

SOLIS00003945.FWS.HHS

August 21, 2020

BY E-MAIL

TO: Leopoldo Miranda, Regional Director

FROM: Shannon Goessling, Regional Solicitor

SUBJECT: Proposed Rule to Delist the Dwarf-flowered Heartleaf under the ESA

We were asked to resurname the above-referenced proposed rule removing the dwarf-flowered heartleaf from the List of Threatened and Endangered Plants under the Endangered Species Act. Based on our review of the draft Federal Register document dated August 19, 2020, we are surnaming the document (surname pages enclosed).

If you have any questions, please contact Helen Speights at (404) 331-5604.

cc: Catherine Phillips, Ecological Services
Byron Hamilton, Ecological Services
Kristi Young, Ecological Services

Enclosures

[ATTORNEY-CLIENT PRIVILEGED COMMUNICATION]
SUMMARY RESULTS OF LEGAL REVIEW OF
DRAFT SECTION 4 (ESA) DOCUMENTS

DESCRIPTION OF DRAFT DOCUMENT: Resurname for Proposed Rule to Delist the Dwarf-flowered Heartleaf under the ESA

REVIEWING OFFICE: Regional Solicitor's Office, Atlanta, Georgia

DATE OF RECEIPT: 8/14/20

RESULTS OF LEGAL REVIEW:

(b)(5) DPP & ACP
(b)(5) DPP & ACP

This summary is issued by:

Date: August 21, 2020

Shannon Goessling, Regional Solicitor
Note: Any Solicitor's Office "surname" attaches only to the draft that was submitted for review, unless subsequent amendments are specifically referred for follow-up review.

Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2019–0081; FF09E22000 FXES11130900000 201

RIN 1018-BD95

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicate that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened species, and does not meet the definition of an endangered species, under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

Fw: RSOL Resurname for Dwarf flowered heartleaf Proposed Delisting Rule

Young, Kristi <kristi_young@fws.gov>
Tue 4/13/2021 11:29 AM

To: Rankin, Nicole <nicole_rankin@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>

Here is the previous resurname

Kristi Young
Deputy Manager, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic Gulf and Mi i ippi Ba in
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<

From: Speights, Helen H <helen.speights@sol.doi.gov>
Sent: Monday, August 24, 2020 6:19 AM
To: Miranda, Leopoldo <Leopoldo_Miranda@fws.gov>; Phillips, Catherine <catherine_phillips@fws.gov>; Tirpak, John <John_Tirpak@fws.gov>; Young, Kristi <kristi_young@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Goessling, Shannon L <shannon.goessling@sol.doi.gov>
Subject: RSOL Resurname for Dwarf-flowered heartleaf Proposed Delisting Rule

Attached please find the Regional Solicitor's resurname for the proposed rule to remove the dwarf-flowered heartleaf from the List of Threatened and Endangered Plants under the ESA.

Thank you,
Helen

Helen H. Speights
Attorney-Advisor
Interior Region 2 | South Atlantic-Gulf & Interior Region 4 | Mississippi Basin
U.S. Department of the Interior | Office of the Solicitor

Richard B. Russell Federal Building
75 Ted Turner Drive, S.W., Ste. 304
Atlanta, Georgia 30303
(404) 331 5604 (direct)
(404) 331-4447 (main)

helen.speights@sol.doi.gov

United States Department of the Interior

OFFICE OF THE SOLICITOR
Regional Solicitor's Office for Interior Regions 2 & 4
Richard B. Russell Federal Building
75 Ted Turner Drive, S.W., Room 304
Atlanta, Georgia 30303
(404) 331-4477

SOLIS00003945.FWS.HHS

August 21, 2020

BY E-MAIL

TO: Leopoldo Miranda, Regional Director

FROM: Shannon Goessling, Regional Solicitor

SHANNON GOESSLING Digitally signed by SHANNON GOESSLING Date: 2020.08.22 09:54:04 -04'00'

SUBJECT: Proposed Rule to Delist the Dwarf-flowered Heartleaf under the ESA

We were asked to resurname the above-referenced proposed rule removing the dwarf-flowered heartleaf from the List of Threatened and Endangered Plants under the Endangered Species Act. Based on our review of the draft Federal Register document dated August 19, 2020, we are surnaming the document (surname pages enclosed).

If you have any questions, please contact Helen Speights at (404) 331-5604.

cc: Catherine Phillips, Ecological Services
Byron Hamilton, Ecological Services
Kristi Young, Ecological Services

Enclosures

[ATTORNEY-CLIENT PRIVILEGED COMMUNICATION]
SUMMARY RESULTS OF LEGAL REVIEW OF
DRAFT SECTION 4 (ESA) DOCUMENTS

DESCRIPTION OF DRAFT DOCUMENT: Resurname for Proposed Rule to Delist the Dwarf-flowered Heartleaf under the ESA

REVIEWING OFFICE: Regional Solicitor's Office, Atlanta, Georgia

DATE OF RECEIPT: 8/14/20

RESULTS OF LEGAL REVIEW:

(b)(5) DPP & AWP
(b)(5) DPP & AWP

This summary is issued by:

SHANNON GOESSLING Digitally signed by SHANNON GOESSLING Date: 2020.08.22 09:55:29 -04'00'

Date: August 21, 2020

Shannon Goessling, Regional Solicitor
Note: Any Solicitor's Office "surname" attaches only to the draft that was submitted for review, unless subsequent amendments are specifically referred for follow-up review.

SHANNON GOESSLING Digitally signed by SHANNON GOESSLING
Date: 2020.08.22 10:05:32 -04'00'

Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2019–0081; FF09E22000 FXES11130900000 201

RIN 1018-BD95

Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*), a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina, from the Federal List of Endangered and Threatened Plants (List). This determination is based on a thorough review of the best available scientific and commercial data, which indicate that the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of a threatened species, and does not meet the definition of an endangered species, under the Endangered Species Act of 1973, as amended (Act). We also announce the availability of a draft post-delisting monitoring (PDM) plan for the dwarf-flowered heartleaf. We seek information, data, and comments from the public regarding this proposal to delist this species and on the draft PDM plan.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments

Fw: Dwarf Flowered Heartleaf Proposed Delisting Rule

Hamilton, Byron <byron_hamilton@fws.gov>

Tue 4/13/2021 12:57 PM

To: Rankin, Nicole <nicole_rankin@fws.gov>

FYI

Byron A. Hamilton, Sr.
U.S. Fish and Wildlife Service
South Atlantic-Gulf & Mississippi Basin Regions
Ecological Services Program
1875 Century Blvd NE
Atlanta, GA 30345

From: Stevens, Michael P <Mike.Stevens@sol.doi.gov>
Sent: Monday, July 15, 2019 1:55 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>; Merritt, Timothy <timothy_merritt@fws.gov>
Subject: Re: Dwarf Flowered Heartleaf Proposed Delisting Rule

(b)(5) DPP & ACP

Let me know if you have any questions.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Thu, Jul 11, 2019 at 10:01 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Hello Mike,
>
> Please see attachment for the updated Dwarf-flowered heartleaf rule with comments addressed. Hope you have a great vacation!

On Wed, Jul 3, 2019 at 10:36 AM Young, Kristi <kristi_young@fws.gov> wrote:

Aloha Mike,

We are working hard to address your comments, but after my initial review of the remaining issues, I don't believe we can address them before noon today. We need to discuss with the field and that's going to take time.

Just wanted to let you know, so you're not expecting the rule back today. Should we send it to Shannon when we are finished?

Enjoy your time off!

- Kristi

>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<
Kristi Young
Deputy Chief Divi ion of Con ervation and Cla ification
U.S. Fish and Wildlife Service
Southeast Region
(919) 856-4520 x30
Kri ti Young@FWS gov

Forwarded message
From: **Hamilton, Byron** byron_hamilton@fws.gov
Date: Wed, Jul 3, 2019 at 8:35 AM
Subject: Fwd: Dwarf Flowered Heartleaf Proposed Delisting Rule
To: Kristi Young kristi_young@fws.gov

Kristi,

Got a few more comments from Mike. I'm addressing them now.

Forwarded message
From: **Stevens, Michael** mike.stevens@sol.doi.gov
Date: Wed, Jul 3, 2019 at 8:18 AM
Subject: Re: Dwarf Flowered Heartleaf Proposed Delisting Rule
To: Hamilton, Byron byron_hamilton@fws.gov
Cc: Merritt, Timothy timothy_merritt@fws.gov

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Thanks--let me know if you want to discuss.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Jun 10, 2019 at 12:05 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

> Thanks. I will get to this as soon as I can. I have numerous packages with deadlines within the next three weeks that will have to come first.
>
> Michael Stevens
> Attorney-Advisor
> Office of the Regional Solicitor
> Southeast Region
> 404-331-5617
>
> This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.
>
> On Mon, Jun 10, 2019 at 11:52 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
>
> > Good afternoon

I've attached the dwarf-flowered heartleaf rule with your comments addressed. Portions of the previous versions of the rule contains outdated information. The new version of the rule includes the info from the updated version of the SSA. Please see attachments for the rule and SSA. Thanks.

On Wed, Apr 17, 2019 at 3:35 PM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP
(b)(5) DPP & ACP

Please let me know if you want to discuss.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Tue, Apr 2, 2019 at 7:37 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good morning Mike,
>
> Please see attachment for the proposed delisting rule for dwarf-flowered heartleaf. If you have any further comments, please let me know. Thanks.
>
> On Tue, Nov 13, 2018 at 9:29 AM Stevens, Michael <mike.stevens@sol.doi.gov> wrote:

(b)(5) DPP & ACP

(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP
(b)(5) DPP & ACP

(b)(5) DPP & ACP(b)(5) DPP & ACP(b)(5) DPP & ACP (b)(5) DPP & ACP Please let me know if you have any questions.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

This e-mail, including any attachments, is intended for the use of the individual or entity to which it is addressed. It may contain information that is privileged, confidential or otherwise protected by applicable law. If you are not the intended recipient or the employee or agent responsible for delivery of this e-mail to the intended recipient, you are hereby notified that any dissemination, distribution, copying, or use of this e-mail and its contents are strictly prohibited. If you received this e-mail in error, please notify the sender immediately and destroy all copies.

On Mon, Oct 29, 2018 at 4:47 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Mike,
> See attached. You can take your full time if needed on this one. Thanks.
> Tim
>
> --

_____
Timothy Merritt
Chief, Division of Conservation and Classification
U S Fish and Wildlife Service
1875 Century Blvd., NE, Suite 200
Atlanta, GA 30345
404-679-7082 office
615 574 8812 cell

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

--
Byron Hamilton, Sr.
Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345

Work - (404) 679-4119
Cell - (803) 707-9518

Name	Affiliation	Address 1	Address 2	Address 3	City, State Zip
Dave Willoughby	RK&K Consulting Engineers	125 Floyd Smith Drive, Suite 140			Charlotte, NC 28262
James Padgett	New Home United Methodist Church	544 Moriah School Road			Casar, NC 28150
	US Army Corps of Engineers - Columbia Regulatory Field Office	Charleston District	Strom Thurmond Federal Building	1835 Assembly Street, Room 865 B-1	Columbia, SC 29201
	Catawba County Wildlife Club	PO Box 544			Hickory, NC 28603
	Girl Scouts of America - Camp Mary Elizabeth	330 Scout Drive			Spartanburg, SC 29301
Robert and Carolyn Tate		4411 US 221 South			Forest City, NC 28043

DRAFT Species Status Assessment Report

for

Dwarf-flowered Heartleaf (*Hexastylis naniflora*)

Version 1.0

xx-xx-201x (date)

U.S. Fish and Wildlife Service

Region 4

Atlanta, GA

ACKNOWLEDGEMENTS

This document was prepared by Michael Marshall (U.S. Fish and Wildlife Service [Service]-Texas A &M Natural Resource Institute [NRI]), Rebekah Reid (Service), Mark Endries (Service), and Stephanie DeMay (Texas A&M NRI). External species expertise, guidance, and document reviews were provided by technical team members Suzanne Mason (North Carolina Natural Heritage Program [NCNHP]), Jame Amoroso (NCNHP), Matt Estep (Appalachian State University), and Laura Robinson (NCNHP). Peer review was provided by _____.

EXECUTIVE SUMMARY

The Species Status Assessment (SSA) reports the results of the comprehensive status review for the dwarf-flowered heartleaf (*Hexastylis naniflora*). For the purpose of this assessment, we generally define viability as the ability of the dwarf-flowered heartleaf to sustain resilient populations in the natural ecosystems within its range over time. Using the SSA framework, we consider what the species needs to maintain viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation (USFWS 2016, entire; Wolf et al. 2015, entire). This SSA provides a thorough assessment of biology and natural history and assesses demographic risks, stressors, and limiting factors in the context of determining the viability for the species. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time.

The dwarf-flowered heartleaf is a low growing herbaceous plant in the birthwort family (Aristolochiaceae) with a range currently restricted to 13 counties within the Upper Piedmont of South Carolina and North Carolina. The species appears to have a restricted range due to its habitat requirements, including soil type, moisture availability, and various other landform characteristics (Wagner 2013).

For the dwarf-flowered heartleaf to maintain viability, its populations or some portion thereof must be resilient. Stochastic factors that have the potential to affect the species include habitat loss due to the conversion of land to residential, commercial, and industrial use. Other factors that influence the resiliency of dwarf-flowered heartleaf populations include habitat loss from land conversion to agricultural use, timber harvest, hydrological alterations from the damming of

ponds, impacts from grazing cattle, ORV damage, trampling from foot traffic, invasive species, highway or road improvements, and erosion or siltation (NCNHP 2016, Robinson and Padgett 2016). Climate change may exacerbate these risk factors through changes in temperature and precipitation.

For the purposes of this SSA, we use population size as the main driver of population resilience. The unit of measurement for population size in this species is a "clump" (rosette). We used Element Occurrence data from both North Carolina Natural Heritage Program and South Carolina Heritage Trust Program as a basis for delineating populations. Delineations were based off of NatureServe criteria such as EO separation distance and intervening landscape matrix. EO data included a wide range of years since the species was last observed at a given location (1964-2017), however, we only used EOs that were observed since 2005.

To determine overall resilience for populations, we used last known abundance estimates to bin population size classes into corresponding resilience categories. EO rank specifications suggest good-excellent viability for populations consisting of at least 500 individuals, given there is sufficient high quality habitat; fair viability for populations consisting of 100-500 individuals, depending on habitat conditions; poor viability for populations consisting of less than 100 individuals. Recent reports (Robinson 2016; Robinson and Padgett 2016) focus monitoring studies on populations with greater than 1,000 individuals, populations that are assumed to be very viable. We synthesized all of the above population size information and created four resilience categories as follows:

- Very high—populations with >1,000 individuals; very high probability of persistence for 20-30 years at or above the current population size.

- High—populations with 500-1,000 individuals; moderate-high probability of persistence for 20-30 years at or above the current population size.

- Moderate—populations with 100-500 individuals; low probability of persistence for 20-30 years at or above the current population size.

- Low—populations with <100 individuals; low probability of persistence for 20-30 years at or above the current population size, and moderate-high probability of extirpation.

There are currently 78 populations of dwarf-flowered heartleaf that have been observed since 2005. The resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low).

Our analysis of future conditions focused on the potential negative impacts of urbanization, and potential positive effects of location or rediscovery of additional populations. Because the actual impacts of urbanization and probability of locating additional populations are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. A projection out to 2040 was based on the life span of the species, expert input, development as the key risk factor brought forward, uncertainty about future conditions, and lack of knowledge about where additional populations may persist on the landscape.

We used the Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (SLEUTH) models to determine areas predicted to be urbanized by 2040. We used a habitat model and corresponding SMART methodology to assess the likelihood that the species would be found to persist on various sites.

Urban development is predicted to have negative impacts on several of the current populations under all of our scenarios. However, this loss of resilience and extirpation of a few populations is offset by the fact that several additional populations were found to persist in the Status Quo and Targeted Conservation scenarios. In the High Development Scenario, there is a predicted loss of 6 populations, with loss of resilience in several additional populations. Regardless of the scenario, the majority of the populations expected to persist on the landscape in 2040 are of at least moderate resilience.

Given the species' current condition and the impacts that the species is expected to experience under the future scenarios, some reductions in resilience are anticipated, but redundancy and representation are unaffected under all scenarios. The results of the SSA indicate the species has a low susceptibility to threats and a high degree of stability.

Table of Contents

INTRODUCTION **1**

SPECIES BIOLOGY **4**

Taxonomy and Species Description 4

Distribution 6

Life History 8

Demographics 8

Pollination and Dispersal 8

Habitat 9

Soils 10

Fire 11

Genetics 11

SPECIES NEEDS FOR VIABILITY **13**

Delineating Populations 13

Population Resiliency 14

Habitat Factors 15

Reproduction and Presence of Pollinators 22

Abundance 22

Population Trends 24

CURRENT CONDITION **25**

Current Population Resilience 26

Categorizing Resilience 26

Occupancy and Abundance 27

Population Trends 30

Current Species Representation 31

Current Species Redundancy 32

INFLUENCES ON VIABILITY **33**

Human Population Change 33

Development 36

Invasive Species and Woody Encroachment 38

Climate Change 39
FUTURE CONDITIONS **41**
Future Considerations 41
Status Quo Scenario 67
High Development Scenario 67
Targeted Conservation Scenario 68
Future Resilience 69
Status Quo Scenario 71
High Development Scenario 73
Targeted Conservation Scenario 76
Viability Summary 78
Opportunities for Additional Conservation 80

LITERATURE CITED **83**

Name	Organization 1 - Name
Jennifer Robertson	Atlas Environmental
Grant Lewis	Axiom Environmental
Brian Smith	Carolina Ecosystems, Inc.
Greg Antemann	Carolina Wetland Services
Clement Riddle	ClearWater Environmental Consultants
Cory Darnell	ECS Carolinas, LLP
Kevin Markham	Environmental Services Inc.
Karri Cecil Blackmon	Habitat Assessment and Restoration Professionals
Jarrod Karl	Hazen and Sawyer
Kevin Mosteller	HDR
Kenneth Smith	HW Lochner
Chris Tinklenberg	Kimley-Horn and Associates, Inc.
Kevin Thomas	Kleinfelder
Seth Ryan	Maser Consulting
Frank Curti	Michael Baker International
Jake Byers	Michael Baker International
Bob Zarzecki	S&EC
Joey Lawler	S&ME
Mary Frazer	Three Oaks Engineering
Tamp Bandy	Wetlands & Waters, Inc.
Len Rindner	Wetlands and Environmental Planning Group
Larry Putnam	Burke County School System
Rich Caplan	City of Landrum
Rick Howell	City of Shelby
Nancy Gutherie	Clean Water Management Trust Fund
Jeff Richardson	Cleveland County
Barry Calloway	Foothills Environmental Landfill
Mack McLeod	Hickory Parks and Recreation
John Slaughter	National Park Service - Cowpens National Battlefield
Tim Bassette	NC Department of Transportation
Jared Gray	NC Department of Transportation
Mike Murphy	NC Division of Parks and Recreation - State Parks
Misty Buchanan	NC Natural Heritage Program
Harry LeGrand	NC Natural Heritage Program
Bruce Sorrie	NC Natural Heritage Program
Cheryl Gregory	NC Plant Conservation Program
Steve Garrison	Rutherford County
Herrick Brown	SC Department of Natural Resources - Heritage Trust Program
Bert Pittman	SC Department of Natural Resources - Heritage Trust Program
Kathy Boyle	SC Department of Natural Resources - Heritage Trust Program
Pat Cloninger	SC Department of Natural Resources - Heritage Trust Program
Chad Long	SC Department of Transportation
Nathan McNeilly	Self McNeilly Landfill - Cleveland County
Tom Hart	Town of Boiling Springs
(b)(6) PII	US Army Corps of Engineers - Asheville Regulatory Field Office
April Punsalan	US Fish and Wildlife Service - Charleston

Dale Suiter	US Fish and Wildlife Service - Raleigh
Jim Matthews	Dr. James F. Matthews Center for Biodiversity Studies
Steve Hodges	Duke Energy
Janie Marlow	NameThatPlant
Nell Allen	NC Zoo
Jeff Beacham	SC Native Plant Society
Sue Schneider	Spartanburg Water
Eddie Dearybury	Spartanburg Water - Lake Blalock Warden's Office
Chick Gaddy	
Moni Bates	
Sean Bloom	Catawba Lands Conservancy
Mary Walter	Conestee Foundation - Lake Conestee Nature Park
Pam Torlina	Conserving Carolinas
Andrew Kota	Foothills Conservancy NC
Alvin Braswell	Friends of Plant Conservation
Frank Hollemon	Naturaland Trust
Frederick Parrish	Spartanburg Area Conservancy (SPACE)
Andrew Waters	Spartanburg Area Conservancy (SPACE)
Brenda Wichmann	The Nature Conservancy - NC
Kristen Austin	The Nature Conservancy - SC
Andrea Cooper	Upstate Forever
Matt Estep	Appalachian State University
Zack Murrell	Appalachian State University
Thomas Jones	Gardner-Webb University
Johnny Randall	NC Botanical Gardens
Michael Kunz	NC Botanical Gardens
Alexander Krings	NCSU Herbarium
Patrick McMillan	SC Botanical Gardens
Alan Weakly	UNC Herbarium
Gill Newberry	USC Upstate
Gill Newberry	
Benjamin Montgomery	USC Upstate Herbarium
Doug Rayner	Wofford College
Mary Bunch	SCDNR

Email 1 - Value

jrobertson@atlasenvi.com
glewis@axiomenvironmental.org
info@carolinaeco.com
gregg@cws-inc.net
clement@cwenv.com
cdarnell@ecslimited.com
kmarkham@esinc.cc
info@habitatassessment.com
jkarl@hazenandsawyer.com
kevin.mosteller@hdrinc.com
ksmith@hwlochner.com
chris.tinklenberg@kimley-horn.com
kthomas@kleinfelder.com
sryan@maserconsulting.com
fcurti@mbakerintl.com
jbyers@mbakerintl.com
bzarzecki@sandec.com
jlawler@smeinc.com
mary.frazer@threeoaksengineering.com
jtampbandy@gmail.com
len.rindner@wetlands-epg.com
lputnam@burke.k12.nc.us
rich.caplan@cityoflandrumsc.com
rick.howell@cityofshelby.com
nancy.gutherie@ncdcr.gov
Jeff.Richardson@clevelandcounty.com
bcalloway@caldwellcountync.org
mmcleod@hickorync.gov
John_Slaughter@nps.gov
tpbassette@ncdot.gov
jgray@ncdot.gov
michael.murphy@ncparks.gov
misty.buchanan@ncdcr.gov
hlegrandjr@gmail.com
basorrie@gmail.com
cheryl.gregory@ncagr.gov
steve.garrison@rutherfordcountync.gov
brownh@dnr.sc.gov
pittmanb@dnr.sc.gov
boylek@dnr.sc.gov
cloningerp@dnr.sc.gov
longcc@scdot.org
Nathan.McNeilly@clevelandcounty.com
tom.hart@boilingspringsnc.net
(b)(6) PII(b)(6) PII
april_punsalan@fws.gov

dale_suiter@fws.gov
centerforbiodiversitystudies@mecklenburgcountync.gov
Steve.Hodges@Duke-Energy.com
webmaster@namethatplant.net
nell.allen@nczoo.org
jeffbeacham@gmail.com
sschneider@spartanburgwater.org
eddied@spartanburgwater.org
llgaddy2@gmail.com
batesmojo@gmail.com
sean@catawbalands.org
mary@lakeconesteenaturepark.com
pam@conservingcarolina.org
akota@foothillsconservancy.org
alvin.braswell@naturalsciences.org
frankholleman@naturalandtrust.org
fmpiii@bellsouth.net
andrew@spartanburgconservation.org
brenda.wichmann@tnc.org
kaustin@tnc.org
acooper@upstateforever.org
estepmc@appstate.edu
murrellze@appstate.edu
tjones@gardner-webb.edu
jrandall@email.unc.edu
mkunz@email.unc.edu
Alexander_Krings@ncsu.edu
pmcmill@clemson.edu
weakley@unc.edu
gnewberry@charter.net
gnewberry@uscupstate.edu
BMONTGOMERY@uscupstate.edu
raynerda@wofford.edu
BunchM@scdnr.org

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
1	**23.000^**	A	Mill Creek Forest and Seep	1,733	>1000	2016	2015		Polk	N	NHP Comp Review and Mont Report.
2	**29.000^**	A	Island Creek Heath Bluff	50,541	>1000	2016	2016		Burk	N	Extrapolated estimate. NHP Comp Review and Mont Report.
3	**31.000*^**	C?	NCDOT TIP: R-2824	1,062	>1000	2010	2001		Cata	N	No formal protection throughout all sites that comprise this occurrence. Small portions of sites NW, SW1 and SW2 are found as a roadside population in right-of-way. DOT monitors. 1,202 plants in 2011. Per 2015 draft report, there are now 1,062 plants.
4	**32.000***	D	NCDOT TIP R-2824	457	100-500	2013	2011		Cata	N	The northern subpopulation of the occurrence (76 plants) is situated within the existing DOT ROW of I-40. This portion of the occurrence is a roadside population that is not under formal protection from a binding agreement. Other plants in population are outside of the ROW. DOT monitors. Per draft 2015 report, there are 72 plants in the ROW. 457 plants counted in 2015 DOT survey.
5	**44.000*^**	AB	Little Gunpowder Creek Rare Plant Site 1	617	500-1000	2015	2011		Cald	Y	The DOT purchased a combined 2.68 acers as a perpetual CE for the species. The two easements are the Wallace and Church Conservation Easements. Has management plan been developed? 2011 survey included only an estimate of plants in CE (1,054)? Do we know the number of plants in the CE now? Last monitoring report indicates that 321 will be widened. Does CE prevent impacts to plants from widening? YES (TB 9/21/2017). Tim will send updated monitoring report with 2015 counts. 390 under protection? Presences noted in 2015. 617 plants counted at sites 38, 39, 43, and 44 in 2012.
6	**77.000***	CD	Little Gunpowder Creek Rare Plant Site 2	699	500-1000	2013	2007		Cald	Y	DOT monitors. Three subpops - B is entirely in ROW, A and C are partially in ROW. Per the Amended Biological Opinion, NCDOT agreed to protect 90 plants within Subpopulation C by acquiring additional right-of-way. No other plants were agreed to be protected. However, additional right-of-way was acquired on the west side of Deal Mill Road for a stream mitigation project. In so doing, additional plants were thereby protected. (After conducting monitoring in 2013, it was determined that 37 plants from Subpopulation B and 52 plants from Subpopulation A are also under protection. In addition, 201 plants in Subpopulation C now exist within the expanded right-of-way, and therefore are also under protection.) Plants in ROW as of 2013 total 617. Per 2015 Draft monitoring report, there are now 699 plants. ROW acquired for formal protection.
7	**87.000**	D	Catawba River: Lower Creek: Miller Creek	0	<100	2011	2011		Cald	N	55 plants dug by HARP on 04 November 2011 and relocated to EO 294 (Bud Geitner Park), few plants left, likely extirpated by Quarry expansion
8	**93.000**	D	West Shelby Mesic Slope		100-500	2005	2005				Parent EO
	93.034	*D*	*West Shelby Mesic Slope*	*60*		*2005*	*2005*		*Clev*	*N*	
	93.035	*D*	*First Broad River: Brushy Creek*	*< 100*		*2016*	*2001*		*Clev*	*N*	*8-10 clumps observed in 2016 but it was not a complete census. Less than 100 plants seen in 2001.*
9	**96.000**	A	Murrays Mill/Upper Balls Creek NA		>1000	2013	2010				Parent EO. Murray Mill Conservation Site, NCDOT Mitigation Site, Part of principal EO 096 having 37,800 plants prior to NCDOT impacts (IPB-2119 at sub EO 184) of which 356 plants are to be impacted and 6,000 are to be preserved on-site, as mitigation (HDR personnel 2005).
	*96.038^*	*CD*	*Catawba River: Deal Property*	*100 200*		*1996*	*1996*		*Cata*	*N*	
	*96.039^*	*D*	*Murrays Mill/Upper Balls Creek NA*	*< 50*		*2002*	*2002*		*Cata*	*?*	*Land in or near this area was purchased as mitigation by NC DOT, details unknown (Wichmann 2005)*
	96.184^*	*A*	*Murrays Mill/Upper Balls Creek NA*	*11,860*		*2013*	*2010*		*Cata*	*Y*	*NCDOT purchased 25.07 acres on May 1, 1996 and an additional 8.61 acres (Bowman Tract) on March 13, 2006 as a permanent conservation site for the species (Herman 2010). Has property been conveyed? NO (TB 9/21/2017) Management plan finalized? YES (TB 9/21/2017)*
10	**98.000**	CD	Cat Square Heartleaf Forest		100-500	2012	2001				Parent EO
	98.002	*X*	*South Fork Catawba River, Indian Creek*	*0*		*1957*	*1980*		*Linc*	*N*	*Extirpated*
	98.003	*D*	*Cat Square Heartleaf Forest*	*160*		*2001*	*1995*		*Linc*	*N*	*presence noted in 2001, 160 plants counted in 1995*
	98.004	*CD*	*Cat Square Heartleaf Forest*	*200*		*2001*	*2001*		*Linc*	*N*	
	98.060	*D*	*NCDOT TIP: B-2119*	*20 50*		*2012*	*2001*		*Linc*	*N*	*EO is associated with NC DOT project B-2119*
11	**99.000**	A	Big Horse Creek Rare Plant Site	106,940	>1000	2015	2015				Parent EO, plant toal for all sub Eos. Estimate population size represents all subEOs, including those not surveyed. (NHP Comp Review and Mont Report).
	*99.009^*	*AB*	*Hensons Creek Natural Area*	*n/a*		*2005*	*2005*		*Ruth*	*N*	*Presence noted in 2012 - no count made, 500 estimate plants in 2005*
	*99.010^*	*A*	*Kudzu Farm Rare Plant Site*	*n/a*		*2014*	*2013*		*Ruth*	*N*	*33,000 plants at the site, owner aware of conservation value. Not protected - BO for Quarry was amended. NHP Comp Review and Mont Report.*
	*99.037^*	*C*	*Broad River: Hunter Road*	*n/a*		*2005*	*2015*		*Ruth*	*N*	*includes EO 37, 55, and 76. 32,000 total plants. NHP Comp Review and Mont Report.*
	*99.052^*	*C*	*Hensons Creek Natural Area*	*n/a*		*2005*	*2001*		*Ruth*	*N*	*200-300*
	*99.053^*	*D*	*Broad River: McKinney Bridge*	*n/a*		*2003*	*2003*		*Ruth*	*N*	*<35*
	*99.055^*	*AB*	*Broad River: Richardson Creek*	*n/a*		*2016*	*2015*		*Ruth*	*N*	*included with EO 37. NHP Comp Review and Mont Report.*
	*99.061^*	*B*	*Broad River: UT at SR1115 and 1116*	*n/a*		*2002*	*2002*		*Ruth*	*N*	*750-1000*
	*99.062^*	*C*	*Broad River: Richardson Creek*	*n/a*		*2002*	*2002*		*Ruth*	*N*	*200-500. NHP Comp Review and Mont Report.*
	*99.063^*	*D*	*Broad River: Hayes Lake*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*20-25*
	*99.075^*	*A*	*Brice Rare Plant Site*	*n/a*		*2013*	*2013*		*Ruth*	*N*	*>7000. NHP Comp Review and Mont Report.*
	*99.076^*	*BC*	*Big Horse Rare Plant Site*	*n/a*		*2015*			*Ruth*	*Y*	*included with EO 37, Parris Heartleaf RHA voluntary agreement, 32,000 plants in 3 Eos. 200-250 in RHA. NHP Comp Review and Mont Report.*
	*99.079^*	*C*	*Broad River: Richardson Creek*	*n/a*		*2012*	*2001*		*Ruth*	*N*	*200-300. NHP Comp Review and Mont Report.*
	*99.090^*	*D*	*Broad River: Richardson Creek*	*n/a*		*2003*	*2003*		*Ruth*	*N*	*100-200*
	*99.121^*	*B*	*Broad River: Dills Creek*	*n/a*		*2004*	*2004*		*Ruth*	*N*	*300*
	*99.172^*	*D*	*Big Horse Rare Plant Site*	*n/a*		*2012*	*2012*		*Ruth*	*Y*	*50-100, Parris Heartleaf RHA voluntary agreement.*
	*99.181^*	*AB*	*Broad River: Dills Creek*	*n/a*		*2012*	*2001*		*Ruth*	*?*	*This suboccurrence is included in the determination of total extrapolated acreage for USFWS Flex Fund Monitoring Site 2, although it was not surveyed. NHP Comp Review and Mont Report.*
	*99.182^*	*A?*	*Hensons Creek Natural Area*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*included with EO 249*
	99.249	*A?*	*Hensons Creek Natural Area*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*3,000-5,000 individuals counted within Eos 182, 249, 250, and 251.*
	99.250	*A?*	*Hensons Creek Natural Area*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*included with EO 249*
	99.251	*A?*	*Hensons Creek Natural Area*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*included with EO 249*
	99.267	*CD*	*Kudzu Farm*	*n/a*		*2006*	*2008*		*Ruth*	*N*	*150-250*
	99.268	*D*	*Kudzu Farm*	*n/a*		*2006*	*2008*		*Ruth*	*N*	*25-30*
	99.319	*E*	*Broad River: Big Horse Creek*	*unk*		*2012*	*2012*		*Ruth*		*observed but no count made.*
12	**100.000**	A	Broad River/Sandy Run NA		>1000	2012	2012				Parent EO. NCDOT Mitigation Site, NCDMS, Broad River Greenway. DOT purchased 1000 AC in 2003 and transferred to Broad River Greenway, Inc. in 2008. 32,702 plants within the Broad River Greenway CE per 2015 draft report.
	*100.014^*	*C?*	*Broad River/Sandy Run NA*	*177*		*2009*	*2001*		*Clev*	*N*	*EO is associated with NC DOT project B-2119, outside Broad River Tract. Presence noted in 2001 and 2009 - no count made, 177 plants counted in 2000*
	*100.049^*	*A*	*Broad River/Sandy Run NA*	*1,118*		*2012*	*2008*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 792 plants reported in 2012, 2015 draft report documents 1118.*
	*100.050^*	*A*	*Broad River/Sandy Run NA*	*4,801*		*2012*	*2008*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 4712 plants reported in 2012, 2015 draft report documents 4801.*
	*100.051^*	*A*	*Broad River/Sandy Run NA*	*2,363*		*2012*	*2008*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 2326 plants reported in 2012, 2015 draft report documents 3241.*
	*100.073^*	*A*	*Broad River/Sandy Run NA*	*13,595*		*2012*	*2012*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 11446 plants reported in 2012, 2015 draft report documents 13959.*
	*100.074^*	*B*	*Broad River/Sandy Run NA*	*722*		*2012*	*2008*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 675 plants reported in 2012, 2015 draft report documents 722.*
	*100.149^*	*A*	*Broad River/Sandy Run NA*	*3,280*		*2012*	*2009*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 2722 plants reported in 2012, 2015 draft report documents 3280. Has site been conveyed to Cleveland County yet? (Ask DOT)*
	*100.233^*	*A*	*Broad River/Sandy Run NA*	*3,383*		*2012*	*2012*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 2352 plants reported in 2012, 2015 draft report documents 3383. Has site been conveyed to Cleveland County yet? (Ask DOT)*
	100.235	*CD*	*Broad River: Trib N of Broad River and SE of Lake Houser*	*100 200*		*2001*	*2005*		*Clev*	*N*	*Outside Broad River Tract*
	*100.236^*	*C*	*Broad River/Sandy Run NA*	*150 300*		*2001*	*2005*		*Clev*	*N*	*Outside Broad River Tract*
	*100.237^*	*E*	*Broad River/Sandy Run NA*	*> 200*		*2012*	*2001*		*Clev*	*N*	*Outside Broad River Tract*
	*100.238^*	*A*	*Broad River/Sandy Run NA*	*1,865*		*2012*	*2008*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 1865 plants reported in 2012, 2015 draft report documents 1898. Has site been conveyed to Cleveland County yet? (Ask DOT)*
	*100.239^*	*D*	*Broad River/Sandy Run NA*	*165*		*2012*	*2008*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 94 plants reported in 2012, 2015 draft report documents 165. Has site been conveyed to Cleveland County yet? (Ask DOT)*
	*100.240^*	*F*	*Broad River/Sandy Run NA*	*20*		*2012*	*2008*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 21 plants reported in 2012, 2015 draft report documents 20. Has site been conveyed to Cleveland County yet? (Ask DOT). Should not be failed to find - F*

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes	
	100.241^	D	Broad River/Sandy Run NA	115		2012	2008		Clev	Y	Occurrence is within the NCDOT mitigation site - The Broad River Tract. 150 plants reported in 2012, 2015 draft report documents 115. Has site been conveyed to Cleveland County yet? (Ask DOT)	
	100.246^	D	Broad River/Sandy Run NA	< 100		2001	2005		Clev	N	Outside Broad River Tract	
13	**125.000^**	A	New Hope Springhead Swamp		>1000	2016	2015		Polk	Y	NHP Comp Review and Mont Report. A portion of this site now has formal protection as a Barefield RHA voluntary agreement.	
14	**154.000^**	C	Facebook Site	2,576	>1000	2016	2015		Ruth	Y	Deed restriction (ask Corps) - Wayne Hawkins. 9/8 - Talked with David Brown at Corps. DR was recorded, site is posted with signs. NHP Comp Review and Mont Report.	
15	**157.000*^**	AB	First Broad River: Crooked Run Creek	330	100-500	2010	2005		Clev	N	DOT no longer monitors, too far from ROW.	
16	**158.000*^**	D	NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	123	100-500	2016	2016		Cata	N	No signed right-of-way, conservation easement, or fee title acquisition. Approximately 15 plants (3%) are within the estimated right-of-way of SR 1115 (Camp Creek Road). Plants found within the right-of-way are not protected under any formal agreement. Future road improvement and/or maintenance may affect portions of the dwarf-flowered heartleaf (DFHL) population adjacent to the existing road. NHP Comp Review and Mont Report.	
17	**176.000**	A	Davenport Road/Mountain View Rare Plant Site	6,750	>1000	2016	2016				Parent EO. Extrapolated estimate for subEOs. NHP Comp Review and Mont Report.	
	176.167^	A	Davenport Road/Mountain View Rare Plant Site	n/a		2005	2015		Ruth	N	included with EO 107. NHP Comp Review and Mont Report.	
	176.168^	A	Davenport Road/Mountain View Rare Plant Site	n/a		2005	2005		Ruth	N	1113. NHP Comp Review and Mont Report.	
	176.169^	D	Davenport Road/Mountain View Rare Plant Site	n/a		2016	2016		Ruth	N	35. NHP Comp Review and Mont Report.	
	176.170^	C	Davenport Road/Mountain View Rare Plant Site	n/a		2016	2015		Ruth	N	191. NHP Comp Review and Mont Report.	
18	**177.000**	A	Broad River: Floyds Creek	12,687	>1000	2016	2016				Parent EO. Extrapolated estimate for subEOs. NHP Comp Review and Mont Report.	
	177.016^	E	Broad River: Floyds Creek	n/a		2014	2012		Ruth	N	5340, any in DOT ROW. Impacted plants moved to Tate, remaining plants have no formal protection (TB 9/21/2017).	
	177.107^	B	Broad River: Floyds Creek	n/a		2008	2015		Ruth	N	241, Individuals of Hexastylis naniflora expected to be impacted by widening of US 221 will be moved to the Tate, remianing plants have no formal protection. (TB 9/21/2017)	
	177.122^	B?	Broad River: Floyds Creek	n/a		2008	2007		Ruth	N	123, any plants impacted by the US221 widening would be moved to Tate, remaining plants have no formal protection (TB 9/21/2017).	
	177.163^	B	Broad River: Floyds Creek	n/a		2016	2015		Ruth	N	included with EO 107	
	177.164^	A	Broad River: Floyds Creek	n/a		2016	2005		Ruth	N	537, May incure impacts from widening of US 221, NCDOT TIP Nos. R-2233A&B, any impacts, any protect via DOT? Impacted plants will be moved to Tate, remaining plants have no formal protection (TB 9/21/2017)	
	177.165^	C	Broad River: Floyds Creek	n/a		2005	2005		Ruth	N	included with EO 107	
	177.166^	CD	Broad River: Floyds Creek	n/a		2005			Ruth	N	included with EO 107	
19	**178.000**	A	Catawba River: Hoyle Crk-Micol Crk		>1000	2013	2016				Parent EO.	
	178.159*^	A	Catawba River: Hoyle Crk-Micol Crk	2182		2013	2005		Burk	N	Unprotected roadside population. A portion of this occurrence is found within North Carolina Department of Transportation (NCDOT) right-of-way. No formal protection. Presence noted in 2013, 2182 plants counted in 2011.	
	178.160^	A	Catawba River: Hoyle Crk-Micol Crk	733		2013	2008		Burk	N	loss of 118 of 851 plants due to DOT construction, any protection? No count since 2008. DOT will update, no plants taken, no protection (TB 9/21/2017)	
	178.161^	A	Catawba River: Hoyle Crk-Micol Crk	2,754		2009			Burk	N	In Dot study area. No formal protection. Presence noted in 2009, plants counted in 2008.	
	178.254^	D?	Catawba River: Hoyle Crk-Micol Crk	> 168		2010	2010		Burk	Y	Permanent conservation easement with Burke Cty and Public School System. New count from 2010 monitoring report (YR4).	
	178.255^	D	Catawba River: Hoyle Crk-Micol Crk	unk		2006	2006		Burk	Y	286 plants moved to a 6.1 ac on-site protected area (guessing EO 254 and 256). Remaining plants in construction area.	
	178.256^	C?	Catawba River: Hoyle Crk-Micol Crk	> 376		2010	2010		Burk	Y	Permanent conservation easement with Burke Cty and Public School System. Considerable number of other plants that were not counted or monitored (2006). New count from 2010 monitoritng report (YR4).	
	178.280^	C	Catawba River: Hoyle Crk	126		2009	2009		Burk	Y	Protection of NCDOT ROW in progress (2009). Expanded ROW to formally preserve plants left after construction, natives and transplants, we will get new data (TB 9/21/2017)	
	178.281^	E	Catawba River: Hoyle Crk-Micol Crk	unk		2009	2009		Burk	N	presence noted, no count made - outside of NCDOT ROW	
	178.282^	E	Catawba River: Hoyle Crk-Micol Crk	unk		2009	2009		Burk	N	included with 281? - presence noted, no count made - outside of NCDOT ROW	
	178.283	E	Catawba River: McGalliard Creek	unk		2009	2009		Burk	N	included with 281? - presence noted, no count made - outside of NCDOT ROW	
	178.284	E	Catawba River: McGalliard Creek	unk		2009	2009		Burk	N	included with 281? - presence noted, no count made - outside of NCDOT ROW	
	178.310	A	Megalliard Creek Slopes; Lake Rhodhiss	1,500 2,000		2016	2016		Burk	Y	Tract is part of an application to CWMTF from the Town of Valdese to protect as a park (2016). The property will be a combination of conservation land, greenway, and town park. We have had discussions with them about designing the park and activities in a way that least impacts the stream buffers and natural heritage values (specifically DFHL). I'm in the process of drafting contracts and expect the Town to purchase the property and record a conservation easement on stream buffers and natural heritage areas before end of January 2018 (end of purchase contract with current owner) Nancy Guthrie 9/25/2017. Verify in January 2018.	NHP
20	**179.000**	CD	South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos		>1000	2012	2005				Parent EO	
*	179.030*	CD	NCDOT TIP R-2824	3,291		2013	2001		Cata	N	DOT monitors. A small portion (71 plants) is situated with the existing DOT ROW. Not under formal protection from a binding agreement. Per draft 2015 report, there are 37 plants in the ROW and 3,291 plants total in the EO. Last report (2013)documented 4,719 plants.	
	179.162*	D	NCDOT TIP R-2825	21		2012	2005		Cata	N	No signed right-of-way, conservation easement, or fee title acquisition. No plants are currently within estimated right-of-way. Future road improvement plans may affect the DFHL plants along the ditch adjacent to the existing road.	
21	**206.000**	D	Buffalo Creek: Ravine	90	<100	2007	2007		Clev	N	in DOT study area. Near Shelby Bypass but not expected to be impacted. No formal protection.	
22	**208.000^**	A	Buffalo Creek: Potts Creek	50 100	<100	2012	2007		Clev	?	Pending NCDOT purchase for ROW protection (2009). NC DOT proposes to protect Sites 33, 44, and 35 [EO 208, in part] throught a conservation easement. Ask DOT	
23	**214.000**	A	Buffalo Creek: Tributaries N and S of SR 2047		>1000	2012	2000				Parent EO	
	214.201^	D	Buffalo Creek: Tributary S	64		2000	2000		Clev	?	14 of 78 plants will be impacted by the Shelby bypass. DOT protection via CE? Ask DOT	
	214.202^	A	Buffalo Creek: Ravine N	1,627		2000	2000		Clev	?	14 of 1641 plants will be impacted by the Shelby bypass. Pending DOT purchase for ROW protection? Ask DOT.	
	214.203^	B	Buffalo Creek: 3rd Tributary S	96		2007	2007		Clev	?	110 of the site's 206 plants were impacted by Shelby bypass. Pending DOT purchase for ROW protection?	
	214.204^	A?	Buffalo Creek: S of SR 2128	?		2000	2000		Clev	?	3,094 plants in site, entire site impacted by Shelby bypass. No estimate of plants remaining. Some protection through CE? Ask DOT	
	214.205^	D	Buffalo Creek: N of SR 2128	171		2000	2000		Clev	?	Pending NCDOT purchase for ROW protection (2009) Ask DOT. 183 plants of which 13 were impacted.	
	214.209^	BC	Buffalo Creek: Tributary E of County Fairgrounds	196		2000	2000		Clev	?	Pending NCDOT purchase for ROW protection (2009). 332 plant of which 136 plants in construction limits. Ask DOT.	
	214.212^	D	Buffalo Creek: Slope along Trib just N of SR 2047	97		2000	2000		Clev	N	In DOT study area for R-2707. No formal protection.	
	214.213^	CD	Buffalo Creek: Ravine just S of SR 2047	50 100		2012	2012		Clev	?	Pending NCDOT purchase for ROW protection (2009) Ask DOT	
24	**216.000**	A	Buffalo Creek: Kings Mountain Res		>1000	2016	2000				Parent EO	
	216.028	B	Buffalo Creek Rare Plant Site	250		2016	2016		Clev	Y	This site has been preserved apart from the landfill and the habitat is intact, the area has been designated as Special Protected Environmental Area by Cleveland County. Spoke with Nathan McNeilly, he will check on protections (09/2017). The area is buffer around the landfill and he has been told to stay out of the area. Area is fenced off. (09/27/17)	
	216.196	D	Buffalo Creek: Friendship Chapel	56		2006	2006		Clev	N	In Dot study area. No formal protection.	
	216.197^	A	Buffalo Creek: Kings Mountain Res	2,067		2000	2000		Clev	?	NC DOT plans NCDOT proposes to protect Site 13 [EO 197] trough a conservation easement	
	216.198^	B	Buffalo Creek: Kings Mountain Res	450		2007	2007		Clev	N	In Dot study area. No formal protection.	
	216.199^	B	Buffalo Creek: Kings Mountain Res	432		2007	2007		Clev	?	Pending NCDOT purchase for ROW protection (2009) Ask DOT. Construction activity will eliminate some.	
	216.200^	D	Buffalo Creek: Kings Mountain Res	55		2000	2000		Clev	?	Pending NCDOT purchase for ROW protection (2009) Ask DOT	
25	**217.000**	B	Broad River: Brushy Creek		>1000	2016	2016				Parent EO	
	217.190	F	Broad River: Brushy Creek	0		2000	2006		Clev	N	No plants found.	
	217.191*	D	Broad River: Brushy Creek	264		2014	2000		Clev	Y	DOT purchased 19 acres of ROW for Shelby By-Pass in Oct. 2013. Of the 19 AC, about 6.4 AC are to preserve HENA in perpetuity at Site 7. 283 plants at Site 7, likely more in EO. Per 2015 draft report, 264 plants at the site.	
	217.192	C	Broad River: Brushy Creek	494		2016	2016		Clev	Y	NCDOT proposes to protect Site 8 [EO 192] through a conservation easement. Site 8, 8A, and 8B of EO 192 are entirely contained in NCDOT ROW. Site contained 311 plants. Per 2015 draft report, site now contains 494 plants. Protected formally in ROW (TB 9/21/2017).	
	217.193	C	Broad River: Brushy Creek	271		2000	2000		Clev	?	NC DOT proposes to protect Site 9 through a conservation easement.	
	217.305	CD	Washburn Switch Business Park	70		2015	2015		Clev	N	Three locations (126 plants) were rescued and moved to southeast corner of property. Relocated plants not included in plant total.	

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
26	**227.000^**	A	Peaked Top Rare Plant Site/Foothills Landfill	16,463	>1000	2014	2014		Cald	Y	CE (260 AC) with the Foothills Conservancy of NC. Any data since 2014,who is contact?
27	**232.000**	A?	Buffalo Creek Rare Plant Site		500-1000	2012	2005				Parent EO.
	232.046	*A*	*Buffalo Creek Rare Plant Site*	*500*		*2005*	*2005*		*Clev*	*N*	*Associated with B-2816, R-2824. This property is eligible as a Historic District on the National Register with much of the historic features still intact and is protected as a 4-F Property. Ask DOT, DOT doesn't know about site (TB 9/21/2017).*
	232.231	*D*	*Buffalo Creek Rare Plant Site*	*20*		*2012*	*2012*		*Clev*	*N*	*Associated with B-2618. Are plants in ROW? Ask DOT, DOT doesn't know about site (TB 9/21/2017).*
28	**243.000**	AB	Jacob Fork West Corridor		>1000	2012	2007				Parent EO
	*243.012^*	*A*	*Jacob Fork West Corridor*	*> 1,000*		*1995*	*1995*		*Cata*	*?*	*Catawba County Wildlife Club RHA voluntary agreement.*
	*243.242^*	*D*	*Jacob Fork West Corridor*	*4*		*2005*	*2005*		*Cata*	*N*	
	*243.269^*	*B*	*Jacob Fork West Corridor*	*> 200*		*2007*	*2008*		*Cata*	*Y*	*TNC has easements but does not do monitoring of HENA, NHP should be most up to date data (Wichmann 09/25/2017).*
	*243.270^*	*C?*	*Jacob Fork West Corridor*	*75 100*		*2012*	*2008*		*Cata*	*Y*	*TNC has easements but does not do monitoring of HENA, NHP should be most up to date data (Wichmann 09/25/2017). Counts from 2006-7, occupied area remapped in 2012.*
29	**245.000**	AB	Floyds Creek Tributray Rare Plant Site		>1000	2010	2005				Parent EO
	245.091	*D*	*Broad River: Floyds Creek*	*30*		*2012*	*2003*		*Ruth*	*N*	
	245.113	*C*	*Floyds Creek Tributray Rare Plant Site*	*1,113*		*2010*	*2007*		*Ruth*	*N*	*7 plants moved from the area to be impacted by the road project to the transplant area at the Tate, 62 moved to Tate?*
	245.175	*C*	*Floyds Creek Tributray Rare Plant Site*	*unk*		*2010*	*2007*		*Ruth*	*N*	*included with EO 113, NCDOT TIP: R-2233, 114 plants moved from the area to be impacted by the road project to the transplant area at the Tate. Impact by US221 widening. Any plants left? Ask DOT. No formal protection.*
30	**247.000**	A	New Bethel Rare Plant Site		>1000	2015	2015				Parent EO, NC DOT Mitigation Site
	247.013	*D*	*Sandy Mush Outcrop*	*< 100*		*2005*	*2005*		*Ruth*	*N*	
	247.056	*D*	*Broad River: Floyds Creek*	*< 150*		*2002*	*2001*		*Ruth*	*N*	
	*247.080^*	*D*	*Broad River: Floyds Creek*	*50*		*2012*	*2003*		*Ruth*	*N*	*No plant count made in 2012. 50 plants counted in 2003.*
***	*247.106*^*	*A*	*New Bethel Rare Plant Site*	*4,547*		*2015*	*2008*		*Ruth*	*Y*	*Tate Conservation Easement (DOT Mitigation Site). Resident plants. Tate has a management plan (TB 9/21/2017).*
	*247.114^*	*D*	*Broad River Floyds Creek*	*0*		*2010*	*2003*		*Ruth*	*N*	*14 plants moved from the area to be impacted by the road project to the transplant area at the Tate. NO formal protection for 114, 115, 173, and 174 (all impacted plants moved to Tate). TB 9/21/2017*
	*247.115^*	*C*	*Broad River Floyds Creek*	*133*		*2005*	*2007*		*Ruth*	*N*	*Combine with EO 114*
	*247.173^*	*D*	*Broad River Floyds Creek*	*102*		*2005*	*2003*		*Ruth*	*N*	*inds of HENA expected to be impacted by widening of US 221 will be moved to the Tate Conservation Easement site. How many? 102 clumps some moved??*
	*247.174^*	*D*	*Broad River Floyds Creek*	*84*		*2010*	*2003*		*Ruth*	*N*	*35 of 119 plants moved from the area to be impacted by the road project to the transplant area at the Tate, in DOT study area*
***	*247.286*^*	*B*	*New Bethel Rare Plant Site*	*326*		*2015*	*2015*		*Ruth*	*Y*	*Tate Conservation Easement (DOT Mitigation Site). Transplanted plants.*
31	**248.000**	C	Jonas Road Rare Plant Site		100-500	2005	2005				Parent EO
	248.040	*C*	*Jonas Road Rare Plant Site*	*150 200*		*2005*	*2005*		*Ruth*	*N*	
	248.054	*D*	*Broad River: McKinney Creek*	*20 30*		*2014*	*2001*		*Ruth*	*N*	*20-30 plants noted for last count in 2005*
32	**252.000**	B	South Fork Catawba River, Henry Fork		100-500	2007	2005				Parent EO
	252.019	*D?*	*NCDOT TIP: R-0085*	*unk*		*2007*	*2007*		*Cata*	*?*	*EO seems to have been extirpated by construction of the 321 Bypass, NCDOT is trying to purchase the property (NCDOT 2009), Some plants protected in conservation easments outside of construction zones. DOT will send updated info.*
	252.020	*B*	*NCDOT TIP: R-0086*	*296*		*2007*	*2005*		*Cata*	*?*	*May have been used as a mitigation site for US-321 Bypass, protected ask DOT. DOT will send updated info.*
33	**271.000**	C?	Pott Creek	5 6	<100	2012	2012		Cata	Y	The Nature Conservancy - likely part of a larger pop containing 700-1,000 plants (2008)
34	**272.000**	BC	No Business Creek, Boyd Tract	75 150	100-500	2007	2007		Clev	N	
35	**274.000**	A?	Broad River/Sandy Run NA	100	100-500	2012	2008		Clev	Y	Broad River Greenway, Town of Boiling Springs
36	**275.000***	C	Buffalo Shoals Creek	257	100-500	2014	2014		Ired	N	Small portion of this population (apprx. 20 plants) is within the DOT ROW, the remainder is on private property. Entire pop. Is monitored. No formal protection.
37	**276.000^**	A	Cliffside Steam Station	39,535	>1000	2016	2016		Clev/Ruth	Y	Voluntary agreement with Duke Energy. NHP Comp Review and Mont Report.
38	**277.000**	D	Hickory: Martin Marietta Quarry	0	extripated	2011	2011		Cata	N	Site developed. Plants moved to EO 294 (Geitner Park).
39	**279.000**	D?	Northeast Lincolnton: UT Walker Branch	?	<100	2009	2009		Linc	N	small
40	**287.000**	AB	Fox Knoll Farm	?	???	2016	2016		Polk	Y	PAC contact Pam Torlina has provided zip file with updates (need to review).
41	**291.000**	C	Gunpowder Creek	82	???	2012	2010		Cald	N	Associated with NCDOT TIP R-3437, any plants in ROW? No formal protection.
42	**292.000**	D	Forest City: Adj to Isothermal CC	150	100-500	2010	2010		Ruth	N	Owner, Ruthford County.
43	**293.000**	E	Killian Crossroads	unk	???	2010	2010		Cata	N	No plant count in EO data.
44	**295.000**	B	Hickory Area		100-500	2016				Y	Owner, Hickory Parks and Rec (protected? Ask NHP)
	295.021	*A*	*Hickory Area, Catawba River: Geitner Park*	*> 300*		*2005*	*2005*		*Burk*	*?*	*Catawba County Open Space, Owner, Hickory Parks and Rec. Ask NHP?*
	295.294	*C*	*Hickory Area: Bud Geitner Park Transplant Site*	*153*		*2016*	*2014*		*Burk*	*?*	*Catawba County Open Space (protected? Ask NHP) - Hickory County Parks and Rec. Includes plants from EOs 227 and 087.*
	295.313	*E*	*NCDOT TIP U-4700*	*unk*		*2012*	*2012*		*Cata*	*N*	*Associated with NCDOT TIP U-4700 (protected? Ask DOT) - EO data indicates report pending? - No plant count in EO data. No formal protection per TB.*
	295.314	*E*	*NCDOT TIP U-4700*	*unk*		*2012*	*2012*		*Cald*	*N*	*Associated with NCDOT TIP U-4700 (protected? Ask DOT) - EO data indicates report pending? - No plant count in EO data. No formal protection per TB (9/21/2017).*
45	**296.000**	CD	UT of Kings Mountain Res	100	100-500	2012	2012		Gast	N	
46	**297.000**	CD	Beaverdam Crk at First Broad River	unk	???	2011	2011		Clev	N	No plant count in EO data.
47	**298.000**	C	Brushy Creek Headwaters	250 300	100-500	2014	2014		Clev	N	
48	**299.000**	D	Lincoln County, SR-1314	27	<100	2014	2014		Linc	N	In DOT study. No formal protection.
49	**300.000**	D	Levan Family Farm	50	<100	2013	2013		Ired	N	
50	**302.000**	A	Rhyne Conservation Preserve		>1000	2016	2014				Parent EO. Catawba Lands Conservancy Easement and NCCMTF Easement.
	302.047	*D*	*NCDOT Project R-617C, South Fork Catawba*	*5*		*2005*	*2005*		*Linc*	*N*	*In DOT ROW, no formal protection.*
	302.262	*A*	*Rhyne Conservation Preserve*	*19,873*		*2016*	*2016*		*Linc*	*Y*	*Catawba Lands Conservancy Easement, NCCWMTF, and Catawba Lands Conservancy Preserve. NHP Comp Review and Mont Report.*
51	**303.000**	AB	Smith Cliff/Henry Fork River	?	100-500	2015	2015		Burk	Y	Hundreds of plants observed. Possible hybrid population. Conservation site managed by the Foothills Conservancy of NC. Is it an RHA, ask NHP?.
52	**304.000**	B?	Simms Hill/Little River Uplands	200 250	100-500	2015	2015		Burk	Y	Conservation site managed by the Foothills Conservancy of NC
53	**306.000**	D	Fanjoy Road Site	75	<100	2015	2015		Ired	N	
54	**308.000**	C	Glade Creek, Alex County	2,194	>1000	2017	2017		Alex	Y	2456 ind at 7 locations. Some plants in DOT ROW. BO with Andrew. 262 plants impacted and 24 HENA plants going back in to the ROW, 12 plants will have formal protection (TB 9/21/2017).
55	**309.000**	D?	South Mountains Pleasant Grove Uplands	?	<100	2016	2016		Burk	N	few
56	**311.000**	A	Collinsville (Hughes) Creek Slopes	200 750	100-500	2016	2016		Polk	Y	several hundred to 750 - Pacolet Area Conservancy Easement. PAC contact Pam Torlina has provided zip file with updates (need to review).
57	**312.000**	A	Richardson Creek trib above Toms Lake	?	>1000	2016	2016		Ruth	Y	several thousand clumps? - managed by Pacolet Area Conservancy Preserve. PAC contact Pam Torlina has provided zip file with updates (need to review).
58	**316.000**	C	Northern Catawba County		???	2017	2017			?	Parent EO; Catawba County Open Space (protected? Ask NHP) - Owner, City of Hickory
59	316.273	C	Northern Catawba County - Catawba River UT to Falling Creek	499	500-1000	2006	2006		Cata	Y	Deed restriction (ask Corps) - Raymond von Drehle 1-ac pond project 2007. 9/11 - Found BO, Log # 4-2-06-396. Total of 530 plants per BO. Impacts reduced to 31 plant per as-built in file.
	316.315	*D*	*NC-127/Cloninger Mill Road*	*60*		*2017*	*2017*		*Cata*	*?*	*Catawba County Open Space (protected? Ask NHP) - Owner, City of Hickory - In study area for NCDOT TIP R-3603A*
60	**317.000**	D	NCDOT TIP R-3603A	30	<100	2017	2017		Alex	N	EO is in study area for NCDOT TIP R-3603A. No formal protection.
61	**318.000**	C	Burke County - Drowning Creek UT	356	100-500	2017	2017		Burk	N	230 plants within DOT ROW fence for TIP B-4447. No formal protection.
62	**320.000**	E	Hickory Creek - UT (Shelby High School)	15	<100	2016	2016		Clev		
63	**321.000**	B	Gunpowder Creek: South of Hudson	2475	>1000	2012	2012		Cald		NCDOT
	Add		*Rock Barn Solar Farm*	*821*					*Cata*	*Y*	*Originally 1,021 plants, 200 impacted by project. 9/8 - David Brown told me about site. 9/11 - Bryan T. looking to see if DR recorded. 9/21 - DR was recorded.*	*NHP*

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
			Total	340,470							

Populations	Pop Number	EO Numbers	EO Rank	Site Name	Total estimated plants	Resilience Category	County	Last Observed	RNR Notes
1	23.000	23.000	A	Mill Creek Forest and Seep	>1000	very high	Polk	2016	
2	29.000	29.000	A	Island Creek Heath Bluff	>1000	very high	Burk	2016	
3	31.000	31.000	C?	NCDOT TIP R-2824	>1000	very high	Cata	2015	
4	32.000	32.000	D	NCDOT TIP R-2824	100-500	moderate	Cata	2015	
5	44.000	44.000	AB	Little Gunpowder Creek Rare Plant Site 1	500-1000	high	Cald	2015	
6	59.000	59.000	C	Third Creek Rare Plant Site	100-500	moderate	Alex	2010	
7	77.000	77.000	CD	Little Gunpowder Creek Rare Plant Site 2	500-1000	high	Cald	2015	
8	93.000	34; 35	D	West Shelby Mesic Slope	100-500	moderate	Clev	2016	
9	96.000	38; 39; 184	A	Murrays Mill/Upper Balls Creek NA	>1000	very high	Cata	2013	
10	98.000	2; 3; 4; 60	CD	Cat Square Heartleaf Forest	100-500	moderate	Linc	2012	
11	99.000	9; 10; 37; 52; 53; 55; 61; 62; 63; 75; 76; 79; 90; 121; 172; 181; 182; 249; 250; 251; 267; 268; 319	A	Big Horse Creek Rare Plant Site	>1000	very high	Ruth	2015	[redacted]
12	100.000	14; 49; 51; 73; 74; 149; 233; 235; 236; 237; 238; 239; 240; 241; 246	A	Broad River/Sandy Run NA	>1000	very high	Clev	2012	Removed 50, duplicate of 233
13	125.000	125.000	A	New Hope Springhead Swamp	>1000	very high	Polk	2016	
14	154.000	154.000	C	Facebook Site	>1000	very high	Ruth	2016	
15	157.000	157.000	AB	First Broad River Crooked Run Creek	100-500	moderate	Clev	2010	
16	158.000	158.000	D	P Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork a	100-500	moderate	Cata	2016	
17	176.000	167; 168; 169; 170	A	Davenport Road/Mountain View Rare Plant Site	>1000	very high	Ruth	2016	
18	177.000	16; 107; 122; 163; 164; 165; 166	A	Broad River Floyds Creek	>1000	very high	Ruth	2016	
19	178.000	159; 160; 161; 254; 255; 256; 280; 281; 282; 283; 284; 310	A	Catawba River Hoyle Crk-Micol Crk	>1000	very high	Burk	2013	
20	179.000	30; 162	CD	South Fork Catawba R Clark Crk, Miller Br, Cata Mem Hos	>1000	very high	Cata	2013	
21	206.000	206.000	D	Buffalo Creek Ravine	<100	low	Clev	2007	
22	208.000	208.000	A	Buffalo Creek Potts Creek	<100	low	Clev	2012	
23	214.000	201; 202; 203; 204; 205; 209; 212; 213	A	Buffalo Creek Tributaries N and S of SR 2047	>1000	very high	Clev	2012	
24	216.000	28; 196; 197; 198; 199; 200	A	Buffalo Creek Kings Mountain Res	>1000	very high	Clev	2016	
25	217.000	190; 191; 192; 193; 305	B	Broad River Brushy Creek	>1000	very high	Clev	2016	
26	227.000	227.000	A	Peaked Top Rare Plant Site/Foothills Landfill	>1000	very high	Cald	2014	
27	232.000	46; 231	A?	Buffalo Creek Rare Plant Site	500-1000	high	Clev	2012	
28	243.000	12; 242; 269; 270	AB	Jacob Fork West Corridor	>1000	very high	Cata	2012	
29	245.000	91; 113; 175	AB	Floyds Creek Tributray Rare Plant Site	>1000	very high	Ruth	2012	
30	247.000	13; 56; 80; 106; 114; 115; 173; 174	A	New Bethel Rare Plant Site	>1000	very high	Ruth	2015	Removed 286, duplicate of 106
31	248.000	40; 54	C	Jonas Road Rare Plant Site	100-500	moderate	Ruth	2014	
32	252.000	19; 20	B	South Fork Catawba River, Henry Fork	100-500	moderate	Cata	2007	
33	271.000	271.000	C?	Pott Creek	<100	low	Cata	2012	
34	272.000	272.000	BC	No Business Creek, Boyd Tract	100-500	moderate	Clev	2007	
35	274.000	274.000	A?	Broad River/Sandy Run NA	100-500	moderate	Clev	2012	
36	275.000	275.000	C	Buffalo Shoals Creek	100-500	moderate	Ired	2014	
37	276.000	276.000	A	Cliffside Steam Station	>1000	very high	Clev/Ruth	2016	
38	277.000	277.000	D	Hickory Martin Marietta Quarry	extripated	extripated	Cata	2011	
39	279.000	279.000	D?	Northeast Lincolnton UT Walker Branch	<100	low	Linc	2009	
40	287.000	287.000	AB	Fox Knoll Farm	100-500	moderate	Polk	2016	found newer data - "several hundred clumps"
41	291.000	291.000	C	Gunpowder Creek	<100	low	Cald	2012	
42	292.000	292.000	D	Forest City Adj to Isothermal CC	100-500	moderate	Ruth	2010	
43	293.000	293.000	E	Killian Crossroads	???	unknown	Cata	2010	
44	295.000	21; 294; 313; 314	B	Hickory Area	100-500	moderate	Burk/Cata/Cald	2016	
45	296.000	296.000	CD	UT of Kings Mountain Res	100-500	moderate	Gast	2012	

Populations	Pop Number	EO Numbers	EO Rank	Site Name	Total estimated plants	Resilience Category	County	Last Observed	RNR Notes
46	297.000	297.000	CD	Beaverdam Crk at First Broad River	???	unknown	Clev	2011	
47	298.000	298.000	C	Brushy Creek Headwaters	100-500	moderate	Clev	2014	
48	299.000	299.000	D	Lincoln County, SR-1314	<100	low	Linc	2014	
49	300.000	300.000	D	Levan Family Farm	<100	low	Ired	2013	
50	302.000	47; 262	A	Rhyne Conservation Preserve	>1000	very high	Linc	2016	
51	303.000	303.000	AB	Smith Cliff/Henry Fork River	100-500	moderate	Burk	2015	
52	304.000	304.000	B?	Simms Hill/Little River Uplands	100-500	moderate	Burk	2015	
53	306.000	306.000	D	Fanjoy Road Site	<100	low	Ired	2015	
54	308.000	308.000	C	Glade Creek, Alex County	>1000	very high	Alex	2017	
55	309.000	309.000	D?	South Mountains Pleasant Grove Uplands	<100	low	Burk	2016	
56	311.000	311.000	A	Collinsville (Hughes) Creek Slopes	100-500	moderate	Polk	2016	
57	312.000	312.000	A	Richardson Creek trib above Toms Lake	>1000	very high	Ruth	2016	
58	316.000	273; 315	C	Northern Catawba County	500-1000	high	Cata	2017	
59	317.000	317.000	D	NCDOT TIP R-3603A	<100	low	Alex	2017	
60	318.000	318.000	C	Burke County - Drowning Creek UT	100-500	moderate	Burk	2017	
61	320.000	320.000	E	Hickory Creek - UT (Shelby High School)	<100	low	Clev	2016	Not processed per agreem
62	321.000	321.000	B	Gunpowder Creek South of Hudson	>1000	very high	Cald	2012	Not processed per agreem
63				Rock Barn Solar Farm	500-1000	high	Cata	2010-2011	I don't think NHP knows about this one. Location Not processed per agreement with

**87 and 277 removed due to extirpation

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
1	**23.000^**	A	Mill Creek Forest and Seep	1,733	>1000	2016	2015		Polk	N	NHP Comp Review and Mont Report.
2	**29.000^**	A	Island Creek Heath Bluff	50,541	>1000	2016	2016		Burk	N	Extrapolated estimate. NHP Comp Review and Mont Report.
3	**31.000*^**	C?	NCDOT TIP: R-2824	1,062	>1000	2010	2001		Cata	N	No formal protection throughout all sites that comprise this occurrence. Small portions of sites NW, SW1 and SW2 are found as a roadside population in right-of-way. DOT monitors. 1,202 plants in 2011. Per 2015 draft report, there are now 1,062 plants.
4	**32.000***	D	NCDOT TIP R-2824	457	100-500	2013	2011		Cata	N	The northern subpopulation of the occurrence (76 plants) is situated within the existing DOT ROW of I-40. This portion of the occurrence is a roadside population that is not under formal protection from a binding agreement. Other plants in population are outside of the ROW. DOT monitors. Per draft 2015 report, there are 72 plants in the ROW. 457 plants counted in 2015 DOT survey.
5	**44.000*^**	AB	Little Gunpowder Creek Rare Plant Site 1	617	500-1000	2015	2011		Cald	Y	The DOT purchased a combined 2.68 acers as a perpetual CE for the species. The two easements are the Wallace and Church Conservation Easements. Has management plan been developed? 2011 survey included only an estimate of plants in CE (1,054)? Do we know the number of plants in the CE now? Last monitoring report indicates that 321 will be widened. Does CE prevent impacts to plants from widening? YES (TB 9/21/2017). Tim will send updated monitoring report with 2015 counts. 390 under protection? Presences noted in 2015. 617 plants counted at sites 38, 39, 43, and 44 in 2012.
6	**77.000***	CD	Little Gunpowder Creek Rare Plant Site 2	699	500-1000	2013	2007		Cald	Y	DOT monitors. Three subpops - B is entirely in ROW, A and C are partially in ROW. Per the Amended Biological Opinion, NCDOT agreed to protect 90 plants within Subpopulation C by acquiring additional right-of-way. No other plants were agreed to be protected. However, additional right-of-way was acquired on the west side of Deal Mill Road for a stream mitigation project. In so doing, additional plants were thereby protected. (After conducting monitoring in 2013, it was determined that 37 plants from Subpopulation B and 52 plants from Subpopulation A are also under protection. In addition, 201 plants in Subpopulation C now exist within the expanded right-of-way, and therefore are also under protection.) Plants in ROW as of 2013 total 617. Per 2015 Draft monitoring report, there are now 699 plants. ROW acquired for formal protection.
7	**87.000**	D	Catawba River: Lower Creek: Miller Creek	0	<100	2011	2011		Cald	N	55 plants dug by HARP on 04 November 2011 and relocated to EO 294 (Bud Geitner Park), few plants left, likely extirpated by Quarry expansion
8	**93.000**	D	West Shelby Mesic Slope		100-500	2005	2005				Parent EO
	93.034	*D*	*West Shelby Mesic Slope*	*60*		*2005*	*2005*		*Clev*	*N*	
	93.035	*D*	*First Broad River: Brushy Creek*	*< 100*		*2016*	*2001*		*Clev*	*N*	*8-10 clumps observed in 2016 but it was not a complete census. Less than 100 plants seen in 2001.*
9	**96.000**	A	Murrays Mill/Upper Balls Creek NA		>1000	2013	2010				Parent EO. Murray Mill Conservation Site, NCDOT Mitigation Site, Part of principal EO 096 having 37,800 plants prior to NCDOT impacts (IPB-2119 at sub EO 184) of which 356 plants are to be impacted and 6,000 are to be preserved on-site, as mitigation (HDR personnel 2005).
	*96.038^*	*CD*	*Catawba River: Deal Property*	*100 200*		*1996*	*1996*		*Cata*	*N*	
	*96.039^*	*D*	*Murrays Mill/Upper Balls Creek NA*	*< 50*		*2002*	*2002*		*Cata*	*?*	*Land in or near this area was purchased as mitigation by NC DOT, details unknown (Wichmann 2005)*
	96.184^*	*A*	*Murrays Mill/Upper Balls Creek NA*	*11,860*		*2013*	*2010*		*Cata*	*Y*	*NCDOT purchased 25.07 acres on May 1, 1996 and an additional 8.61 acres (Bowman Tract) on March 13, 2006 as a permanent conservation site for the species (Herman 2010). Has property been conveyed? NO (TB 9/21/2017) Management plan finalized? YES (TB 9/21/2017)*
10	**98.000**	CD	Cat Square Heartleaf Forest		100-500	2012	2001				Parent EO
	98.002	*X*	*South Fork Catawba River, Indian Creek*	*0*		*1957*	*1980*		*Linc*	*N*	*Extirpated*
	98.003	*D*	*Cat Square Heartleaf Forest*	*160*		*2001*	*1995*		*Linc*	*N*	*presence noted in 2001, 160 plants counted in 1995*
	98.004	*CD*	*Cat Square Heartleaf Forest*	*200*		*2001*	*2001*		*Linc*	*N*	
	98.060	*D*	*NCDOT TIP: B-2119*	*20 50*		*2012*	*2001*		*Linc*	*N*	*EO is associated with NC DOT project B-2119*

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
11	**99.000**	A	Big Horse Creek Rare Plant Site	106,940	>1000	2015	2015				Parent EO, plant toal for all sub Eos. Estimate population size represents all subEOs, including those not surveyed. (NHP Comp Review and Mont Report).
	*99.009^*	*AB*	*Hensons Creek Natural Area*	*n/a*		*2005*	*2005*		*Ruth*	*N*	*Presence noted in 2012 - no count made, 500 estimate plants in 2005*
	*99.010^*	*A*	*Kudzu Farm Rare Plant Site*	*n/a*		*2014*	*2013*		*Ruth*	*N*	*33,000 plants at the site, owner aware of conservation value. Not protected - BO for Quarry was amended. NHP Comp Review and Mont Report.*
	*99.037^*	*C*	*Broad River: Hunter Road*	*n/a*		*2005*	*2015*		*Ruth*	*N*	*includes EO 37, 55, and 76. 32,000 total plants. NHP Comp Review and Mont Report.*
	*99.052^*	*C*	*Hensons Creek Natural Area*	*n/a*		*2005*	*2001*		*Ruth*	*N*	*200-300*
	*99.053^*	*D*	*Broad River: McKinney Bridge*	*n/a*		*2003*	*2003*		*Ruth*	*N*	*<35*
	*99.055^*	*AB*	*Broad River: Richardson Creek*	*n/a*		*2016*	*2015*		*Ruth*	*N*	*included with EO 37. NHP Comp Review and Mont Report.*
	*99.061^*	*B*	*Broad River: UT at SR1115 and 1116*	*n/a*		*2002*	*2002*		*Ruth*	*N*	*750-1000*
	*99.062^*	*C*	*Broad River: Richardson Creek*	*n/a*		*2002*	*2002*		*Ruth*	*N*	*200-500. NHP Comp Review and Mont Report.*
	*99.063^*	*D*	*Broad River: Hayes Lake*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*20-25*
	*99.075^*	*A*	*Brice Rare Plant Site*	*n/a*		*2013*	*2013*		*Ruth*	*N*	*>7000. NHP Comp Review and Mont Report.*
	*99.076^*	*BC*	*Big Horse Rare Plant Site*	*n/a*		*2015*			*Ruth*	*Y*	*included with EO 37, Parris Heartleaf RHA voluntary agreement, 32,000 plants in 3 Eos. 200-250 in RHA. NHP Comp Review and Mont Report.*
	*99.079^*	*C*	*Broad River: Richardson Creek*	*n/a*		*2012*	*2001*		*Ruth*	*N*	*200-300. NHP Comp Review and Mont Report.*
	*99.090^*	*D*	*Broad River: Richardson Creek*	*n/a*		*2003*	*2003*		*Ruth*	*N*	*100-200*
	*99.121^*	*B*	*Broad River: Dills Creek*	*n/a*		*2004*	*2004*		*Ruth*	*N*	*300*
	*99.172^*	*D*	*Big Horse Rare Plant Site*	*n/a*		*2012*	*2012*		*Ruth*	*Y*	*50-100, Parris Heartleaf RHA voluntary agreement.*
	*99.181^*	*AB*	*Broad River: Dills Creek*	*n/a*		*2012*	*2001*		*Ruth*	*?*	*This suboccurrence is included in the determination of total extrapolated acreage for USFWS Flex Fund Monitoring Site 2, although it was not surveyed. NHP Comp Review and Mont Report.*
	*99.182^*	*A?*	*Hensons Creek Natural Area*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*included with EO 249*
	99.249	*A?*	*Hensons Creek Natural Area*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*3,000-5,000 individuals counted within Eos 182, 249, 250, and 251.*
	99.250	*A?*	*Hensons Creek Natural Area*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*included with EO 249*
	99.251	*A?*	*Hensons Creek Natural Area*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*included with EO 249*
	99.267	*CD*	*Kudzu Farm*	*n/a*		*2006*	*2008*		*Ruth*	*N*	*150-250*
	99.268	*D*	*Kudzu Farm*	*n/a*		*2006*	*2008*		*Ruth*	*N*	*25-30*
	99.319	*E*	*Broad River: Big Horse Creek*	*unk*		*2012*	*2012*		*Ruth*		*observed but no count made.*
12	**100.000**	A	Broad River/Sandy Run NA		>1000	2012	2012				Parent EO. NCDOT Mitigation Site, NCDMS, Broad River Greenway. DOT purchased 1000 AC in 2003 and transferred to Broad River Greenway, Inc. in 2008. 32,702 plants within the Broad River Greenway CE per 2015 draft report.
	*100.014^*	*C?*	*Broad River/Sandy Run NA*	*177*		*2009*	*2001*		*Clev*	*N*	*EO is associated with NC DOT project B-2119, outside Broad River Tract. Presence noted in 2001 and 2009 - no count made, 177 plants counted in 2000*
	*100.049^*	*A*	*Broad River/Sandy Run NA*	*1,118*		*2012*	*2008*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 792 plants reported in 2012, 2015 draft report documents 1118.*
	*100.050^*	*A*	*Broad River/Sandy Run NA*	*4,801*		*2012*	*2008*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 4712 plants reported in 2012, 2015 draft report documents 4801.*
	*100.051^*	*A*	*Broad River/Sandy Run NA*	*2,363*		*2012*	*2008*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 2326 plants reported in 2012, 2015 draft report documents 3241.*
	*100.073^*	*A*	*Broad River/Sandy Run NA*	*13,595*		*2012*	*2012*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 11446 plants reported in 2012, 2015 draft report documents 13959.*
	*100.074^*	*B*	*Broad River/Sandy Run NA*	*722*		*2012*	*2008*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 675 plants reported in 2012, 2015 draft report documents 722.*
	*100.149^*	*A*	*Broad River/Sandy Run NA*	*3,280*		*2012*	*2009*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 2722 plants reported in 2012, 2015 draft report documents 3280 Has site been conveyed to Cleveland County yet? (Ask DOT)*
	*100.233^*	*A*	*Broad River/Sandy Run NA*	*3,383*		*2012*	*2012*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 2352 plants reported in 2012, 2015 draft report documents 3383. Has site been conveyed to Cleveland County yet? (Ask DOT)*
	100.235	*CD*	*Broad River: Trib N of Broad River and SE of Lake Houser*	*100 200*		*2001*	*2005*		*Clev*	*N*	*Outside Broad River Tract*
	*100.236^*	*C*	*Broad River/Sandy Run NA*	*150 300*		*2001*	*2005*		*Clev*	*N*	*Outside Broad River Tract*

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
	*100.237^*	*E*	*Broad River/Sandy Run NA*	*> 200*		*2012*	*2001*		*Clev*	*N*	*Outside Broad River Tract*
	*100.238^*	*A*	*Broad River/Sandy Run NA*	*1,865*		*2012*	*2008*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 1865 plants reported in 2012, 2015 draft report documents 1898 Has site been conveyed to Cleveland County yet? (Ask DOT)*
	*100.239^*	*D*	*Broad River/Sandy Run NA*	*165*		*2012*	*2008*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 94 plants reported in 2012, 2015 draft report documents 165 Has site been conveyed to Cleveland County yet? (Ask DOT)*
	*100.240^*	*F*	*Broad River/Sandy Run NA*	*20*		*2012*	*2008*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 21 plants reported in 2012, 2015 draft report documents 20 Has site been conveyed to Cleveland County yet? (Ask DOT). Should not be failed to find - "F"*
	*100.241^*	*D*	*Broad River/Sandy Run NA*	*115*		*2012*	*2008*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 150 plants reported in 2012, 2015 draft report documents 115. Has site been conveyed to Cleveland County yet? (Ask DOT)*
	*100.246^*	*D*	*Broad River/Sandy Run NA*	*< 100*		*2001*	*2005*		*Clev*	*N*	*Outside Broad River Tract*
13	**125.000^**	A	New Hope Springhead Swamp		>1000	2016	2015		Polk	Y	NHP Comp Review and Mont Report. A portion of this site now has formal protection as a Barefield RHA voluntary agreement.
14	**154.000^**	C	Facebook Site	2,576	>1000	2016	2015		Ruth	Y	Deed restriction (ask Corps) - Wayne Hawkins. 9/8 - Talked with David Brown at Corps. DR was recorded, site is posted with signs. NHP Comp Review and Mont Report.
15	**157.000*^**	AB	First Broad River: Crooked Run Creek	330	100-500	2010	2005		Clev	N	DOT no longer monitors, too far from ROW.
16	**158.000*^**	D	NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	123	100-500	2016	2016		Cata	N	No signed right-of-way, conservation easement, or fee title acquisition. Approximately 15 plants (3%) are within the estimated right-of-way of SR 1115 (Camp Creek Road). Plants found within the right-of-way are not protected under any formal agreement. Future road improvement and/or maintenance may affect portions of the dwarf-flowered heartleaf (DFHL) population adjacent to the existing road. NHP Comp Review and Mont Report.
17	**176.000**	A	Davenport Road/Mountain View Rare Plant Site	6,750	>1000	2016	2016				Parent EO. Extrapolated estimate for subEOs. NHP Comp Review and Mont Report.
	*176.167^*	*A*	*Davenport Road/Mountain View Rare Plant Site*	*n/a*		*2005*	*2015*		*Ruth*	*N*	*included with EO 107. NHP Comp Review and Mont Report.*
	*176.168^*	*A*	*Davenport Road/Mountain View Rare Plant Site*	*n/a*		*2005*	*2005*		*Ruth*	*N*	*1113. NHP Comp Review and Mont Report.*
	*176.169^*	*D*	*Davenport Road/Mountain View Rare Plant Site*	*n/a*		*2016*	*2016*		*Ruth*	*N*	*35. NHP Comp Review and Mont Report.*
	*176.170^*	*C*	*Davenport Road/Mountain View Rare Plant Site*	*n/a*		*2016*	*2015*		*Ruth*	*N*	*191. NHP Comp Review and Mont Report.*
18	**177.000**	A	Broad River: Floyds Creek	12,687	>1000	2016	2016				Parent EO. Extrapolated estimate for subEOs. NHP Comp Review and Mont Report.
	*177.016^*	*E*	*Broad River: Floyds Creek*	*n/a*		*2014*	*2012*		*Ruth*	*N*	*5340, any in DOT ROW. Impacted plants moved to Tate, remaining plants have no formal protection (TB 9/21/2017).*
	*177.107^*	*B*	*Broad River: Floyds Creek*	*n/a*		*2008*	*2015*		*Ruth*	*N*	*241, Individuals of Hexastylis naniflora expected to be impacted by widening of US 221 will be moved to the Tate, remianing plants have no formal protection. (TB 9/21/2017)*
	*177.122^*	*B?*	*Broad River: Floyds Creek*	*n/a*		*2008*	*2007*		*Ruth*	*N*	*123, any plants impacted by the US221 widening would be moved to Tate, remaining plants have no formal protection (TB 9/21/2017).*
	*177.163^*	*B*	*Broad River: Floyds Creek*	*n/a*		*2016*	*2015*		*Ruth*	*N*	*included with EO 107*
	*177.164^*	*A*	*Broad River: Floyds Creek*	*n/a*		*2016*	*2005*		*Ruth*	*N*	*537, May incure impacts from widening of US 221, NCDOT TIP Nos. R-2233A&B, any impacts, any protect via DOT? Impacted plants will be moved to Tate, remaining plants have no formal protection (TB 9/21/2017)*
	*177.165^*	*C*	*Broad River: Floyds Creek*	*n/a*		*2005*	*2005*		*Ruth*	*N*	*included with EO 107*
	*177.166^*	*CD*	*Broad River: Floyds Creek*	*n/a*		*2005*			*Ruth*	*N*	*included with EO 107*
19	**178.000**	A	Catawba River: Hoyle Crk-Micol Crk		>1000	2013	2016				Parent EO.

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
	178.159^*	*A*	*Catawba River: Hoyle Crk-Micol Crk*	*2182*		*2013*	*2005*		*Burk*	*N*	*Unprotected roadside population. A portion of this occurrence is found within North Carolina Department of Transportation (NCDOT) right-of-way. No formal protection. Presence noted in 2013, 2182 plants counted in 2011.*
	*178.160^*	*A*	*Catawba River: Hoyle Crk-Micol Crk*	*733*		*2013*	*2008*		*Burk*	*N*	*loss of 118 of 851 plants due to DOT construction, any protection? No count since 2008. DOT will update, no plants taken, no protection (TB 9/21/2017)*
	*178.161^*	*A*	*Catawba River: Hoyle Crk-Micol Crk*	*2,754*		*2009*			*Burk*	*N*	*In Dot study area. No formal protection. Presence noted in 2009, plants counted in 2008.*
	*178.254^*	*D?*	*Catawba River: Hoyle Crk-Micol Crk*	*> 168*		*2010*	*2010*		*Burk*	*Y*	*Permanent conservation easement with Burke Cty and Public School System. New count from 2010 monitoring report (YR4).*
	*178.255^*	*D*	*Catawba River: Hoyle Crk-Micol Crk*	*unk*		*2006*	*2006*		*Burk*	*Y*	*286 plants moved to a 6.1 ac on-site protected area (guessing EO 254 and 256). Remaining plants in construction area.*
	*178.256^*	*C?*	*Catawba River: Hoyle Crk-Micol Crk*	*> 376*		*2010*	*2010*		*Burk*	*Y*	*Permanent conservation easement with Burke Cty and Public School System. "Considerable" number of other plants that were not counted or monitored (2006). New count from 2010 monitoritng report (YR4).*
	*178.280^*	*C*	*Catawba River: Hoyle Crk*	*126*		*2009*	*2009*		*Burk*	*Y*	*Protection of NCDOT ROW in progress (2009). Expanded ROW to formally preserve plants left after construction, natives and transplants, we will get new data (TB 9/21/2017)*
	*178.281^*	*E*	*Catawba River: Hoyle Crk-Micol Crk*	*unk*		*2009*	*2009*		*Burk*	*N*	*presence noted, no count made - outside of NCDOT ROW*
	*178.282^*	*E*	*Catawba River: Hoyle Crk-Micol Crk*	*unk*		*2009*	*2009*		*Burk*	*N*	*included with 281? - presence noted, no count made - outside of NCDOT ROW*
	178.283	*E*	*Catawba River: McGalliard Creek*	*unk*		*2009*	*2009*		*Burk*	*N*	*included with 281? - presence noted, no count made - outside of NCDOT ROW*
	178.284	*E*	*Catawba River: McGalliard Creek*	*unk*		*2009*	*2009*		*Burk*	*N*	*included with 281? - presence noted, no count made - outside of NCDOT ROW*
	178.310	*A*	*Megalliard Creek Slopes; Lake Rhodhiss*	*1,500 2,000*		*2016*	*2016*		*Burk*	*Y*	*Tract is part of an application to CWMTF from the Town of Valdese to protect as a park (2016). The property will be a combination of conservation land, greenway, and town park. We have had discussions with them about designing the park and activities in a way that least impacts the stream buffers and natural heritage values (specifically DFHL). I'm in the process of drafting contracts and expect the Town to purchase the property and record a conservation easement on stream buffers and natural heritage areas before end of January 2018 (end of purchase contract with current owner) Nancy Guthrie 9/25/2017. Verify in January 2018.*	*NHP*
20	**179.000**	CD	South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos		>1000	2012	2005				Parent EO
***	*179.030**	*CD*	*NCDOT TIP R-2824*	*3,291*		*2013*	*2001*		*Cata*	*N*	*DOT monitors. A small portion (71 plants) is situated with the existing DOT ROW. Not under formal protection from a binding agreement. Per draft 2015 report, there are 37 plants in the ROW and 3,291 plants total in the EO. Last report (2013)documented 4,719 plants.*
	*179.162**	*D*	*NCDOT TIP R-2825*	*21*		*2012*	*2005*		*Cata*	*N*	*No signed right-of-way, conservation easement, or fee title acquisition. No plants are currently within estimated right-of-way. Future road improvement plans may affect the DFHL plants along the ditch adjacent to the existing road.*
21	**206.000**	D	Buffalo Creek: Ravine	90	<100	2007	2007		Clev	N	in DOT study area. Near Shelby Bypass but not expected to be impacted. No formal protection.
22	**208.000^**	A	Buffalo Creek: Potts Creek	50 100	<100	2012	2007		Clev	?	Pending NCDOT purchase for ROW protection (2009). NC DOT proposes to protect Sites 33, 44, and 35 [EO 208, in part] throught a conservation easement. Ask DOT
23	**214.000**	A	Buffalo Creek: Tributaries N and S of SR 2047		>1000	2012	2000				Parent EO
	*214.201^*	*D*	*Buffalo Creek: Tributary S*	*64*		*2000*	*2000*		*Clev*	*?*	*14 of 78 plants will be impacted by the Shelby bypass. DOT protection via CE? Ask DOT*
	*214.202^*	*A*	*Buffalo Creek: Ravine N*	*1,627*		*2000*	*2000*		*Clev*	*?*	*14 of 1641 plants will be impacted by the Shelby bypass. Pending DOT purchase for ROW protection? Ask DOT.*

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
	214.203^	B	Buffalo Creek: 3rd Tributary S	96		2007	2007		Clev	?	110 of the site's 206 plants were impacted by Shelby bypass. Pending DOT purchase for ROW protection?
	214.204^	A?	Buffalo Creek: S of SR 2128	?		2000	2000		Clev	?	3,094 plants in site, entire site impacted by Shelby bypass. No estimate of plants remaining. Some protection through CE? Ask DOT
	214.205^	D	Buffalo Creek: N of SR 2128	171		2000	2000		Clev	?	Pending NCDOT purchase for ROW protection (2009) Ask DOT. 183 plants of which 13 were impacted.
	214.209^	BC	Buffalo Creek: Tributary E of County Fairgrounds	196		2000	2000		Clev	?	Pending NCDOT purchase for ROW protection (2009). 332 plant of which 136 plants in construction limits. Ask DOT.
	214.212^	D	Buffalo Creek: Slope along Trib just N of SR 2047	97		2000	2000		Clev	N	In DOT study area for R-2707. No formal protection.
	214.213^	CD	Buffalo Creek: Ravine just S of SR 2047	50 100		2012	2012		Clev	?	Pending NCDOT purchase for ROW protection (2009) Ask DOT
24	**216.000**	A	Buffalo Creek: Kings Mountain Res		>1000	2016	2000				Parent EO
	216.028	B	Buffalo Creek Rare Plant Site	250		2016	2016		Clev	Y	This site has been preserved apart from the landfill and the habitat is intact, the area has been designated as Special Protected Environmental Area by Cleveland County. Spoke with Nathan McNeilly, he will check on protections (09/2017). The area is buffer around the landfill and he has been told to stay out of the area. Area is fenced off. (09/27/17)
	216.196	D	Buffalo Creek: Friendship Chapel	56		2006	2006		Clev	N	In Dot study area. No formal protection.
	216.197^	A	Buffalo Creek: Kings Mountain Res	2,067		2000	2000		Clev	?	NC DOT plans "NCDOT proposes to protect Site 13 [EO 197] trough a conservation easement
	216.198^	B	Buffalo Creek: Kings Mountain Res	450		2007	2007		Clev	N	In Dot study area. No formal protection.
	216.199^	B	Buffalo Creek: Kings Mountain Res	432		2007	2007		Clev	?	Pending NCDOT purchase for ROW protection (2009) Ask DOT. Construction activity will eliminate some.
	216.200^	D	Buffalo Creek: Kings Mountain Res	55		2000	2000		Clev	?	Pending NCDOT purchase for ROW protection (2009) Ask DOT
25	**217.000**	B	Broad River: Brushy Creek		>1000	2016	2016				Parent EO
	217.190	F	Broad River: Brushy Creek	0		2000	2006		Clev	N	No plants found.
	217.191*	D	Broad River: Brushy Creek	264		2014	2000		Clev	Y	DOT purchased 19 acres of ROW for Shelby By-Pass in Oct. 2013. Of the 19 AC, about 6.4 AC are to preserve HENA in perpetuity at Site 7. 283 plants at Site 7, likely more in EO. Per 2015 draft report, 264 plants at the site.
	217.192	C	Broad River: Brushy Creek	494		2016	2016		Clev	Y	NCDOT proposes to protect Site 8 [EO 192] through a conservation easement. Site 8, 8A, and 8B of EO 192 are entirely contained in NCDOT ROW. Site contained 311 plants. Per 2015 draft report, site now contains 494 plants. Protected formally in ROW (TB 9/21/2017).
	217.193	C	Broad River: Brushy Creek	271		2000	2000		Clev	?	NC DOT proposes to protect Site 9 through a conservation easement.
	217.305	CD	Washburn Switch Business Park	70		2015	2015		Clev	N	Three locations (126 plants) were rescued and moved to southeast corner of property. Relocated plants not included in plant total.
26	**227.000^**	A	Peaked Top Rare Plant Site/Foothills Landfill	16,463	>1000	2014	2014		Cald	Y	CE (260 AC) with the Foothills Conservancy of NC. Any data since 2014,who is contact?
27	**232.000**	A?	Buffalo Creek Rare Plant Site		500-1000	2012	2005				Parent EO.
	232.046	A	Buffalo Creek Rare Plant Site	500		2005	2005		Clev	N	Associated with B-2816, R-2824. This property is eligible as a Historic District on the National Register with much of the historic features still intact and is protected as a 4-F Property. Ask DOT, DOT doesn't know about site (TB 9/21/2017).
	232.231	D	Buffalo Creek Rare Plant Site	20		2012	2012		Clev	N	Associated with B-2618. Are plants in ROW? Ask DOT, DOT doesn't know about site (TB 9/21/2017).
28	**243.000**	AB	Jacob Fork West Corridor		>1000	2012	2007				Parent EO
	243.012^	A	Jacob Fork West Corridor	> 1,000		1995	1995		Cata	?	Catawba County Wildlife Club RHA voluntary agreement.
	243.242^	D	Jacob Fork West Corridor	4		2005	2005		Cata	N	
	243.269^	B	Jacob Fork West Corridor	> 200		2007	2008		Cata	Y	TNC has easements but does not do monitoring of HENA, NHP should be most up to date data (Wichmann 09/25/2017).
	243.270^	C?	Jacob Fork West Corridor	75 100		2012	2008		Cata	Y	TNC has easements but does not do monitoring of HENA, NHP should be most up to date data (Wichmann 09/25/2017). Counts from 2006-7, occupied area remapped in 2012.
29	**245.000**	AB	Floyds Creek Tributray Rare Plant Site		>1000	2010	2005				Parent EO
	245.091	D	Broad River: Floyds Creek	30		2012	2003		Ruth	N	

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
	245.113	*C*	*Floyds Creek Tributray Rare Plant Site*	*1,113*		*2010*	*2007*		*Ruth*	*N*	*7 plants moved from the area to be impacted by the road project to the transplant area at the Tate, 62 moved to Tate?*
	245.175	*C*	*Floyds Creek Tributray Rare Plant Site*	*unk*		*2010*	*2007*		*Ruth*	*N*	*included with EO 113, NCDOT TIP: R-2233, 114 plants moved from the area to be impacted by the road project to the transplant area at the Tate. Impact by US221 widening. Any plants left? Ask DOT. No formal protection.*
30	**247.000**	A	New Bethel Rare Plant Site		>1000	2015	2015				Parent EO, NC DOT Mitigation Site
	247.013	*D*	*Sandy Mush Outcrop*	*< 100*		*2005*	*2005*		*Ruth*	*N*	
	247.056	*D*	*Broad River: Floyds Creek*	*< 150*		*2002*	*2001*		*Ruth*	*N*	
	*247.080^*	*D*	*Broad River: Floyds Creek*	*50*		*2012*	*2003*		*Ruth*	*N*	*No plant count made in 2012. 50 plants counted in 2003.*
***	*247.106*^*	*A*	*New Bethel Rare Plant Site*	*4,547*		*2015*	*2008*		*Ruth*	*Y*	*Tate Conservation Easement (DOT Mitigation Site). Resident plants. Tate has a management plan (TB 9/21/2017).*
	*247.114^*	*D*	*Broad River Floyds Creek*	*0*		*2010*	*2003*		*Ruth*	*N*	*14 plants moved from the area to be impacted by the road project to the transplant area at the Tate. NO formal protection for 114, 115, 173, and 174 (all impacted plants moved to Tate). TB 9/21/2017*
	*247.115^*	*C*	*Broad River Floyds Creek*	*133*		*2005*	*2007*		*Ruth*	*N*	*Combine with EO 114*
	*247.173^*	*D*	*Broad River Floyds Creek*	*102*		*2005*	*2003*		*Ruth*	*N*	*inds of HENA expected to be impacted by widening of US 221 will be moved to the Tate Conservation Easement site. How many? 102 clumps some moved??*
	*247.174^*	*D*	*Broad River Floyds Creek*	*84*		*2010*	*2003*		*Ruth*	*N*	*35 of 119 plants moved from the area to be impacted by the road project to the transplant area at the Tate, in DOT study area*
***	*247.286*^*	*B*	*New Bethel Rare Plant Site*	*326*		*2015*	*2015*		*Ruth*	*Y*	*Tate Conservation Easement (DOT Mitigation Site). Transplanted plants.*
31	**248.000**	C	Jonas Road Rare Plant Site		100-500	2005	2005				Parent EO
	248.040	*C*	*Jonas Road Rare Plant Site*	*150 200*		*2005*	*2005*		*Ruth*	*N*	
	248.054	*D*	*Broad River: McKinney Creek*	*20 30*		*2014*	*2001*		*Ruth*	*N*	*20-30 plants noted for last count in 2005*
32	**252.000**	B	South Fork Catawba River, Henry Fork		100-500	2007	2005				Parent EO
	252.019	*D?*	*NCDOT TIP: R-0085*	*unk*		*2007*	*2007*		*Cata*	*?*	*EO seems to have been extirpated by construction of the 321 Bypass, NCDOT is trying to purchase the property (NCDOT 2009), Some plants protected in conservation easments outside of construction zones. DOT will send updated info.*
	252.020	*B*	*NCDOT TIP: R-0086*	*296*		*2007*	*2005*		*Cata*	*?*	*May have been used as a mitigation site for US-321 Bypass, protected ask DOT. DOT will send updated info.*
33	**271.000**	C?	Pott Creek	5 6	<100	2012	2012		Cata	Y	The Nature Conservancy - likely part of a larger pop containing 700-1,000 plants (2008)
34	**272.000**	BC	No Business Creek, Boyd Tract	75 150	100-500	2007	2007		Clev	N	
35	**274.000**	A?	Broad River/Sandy Run NA	100	100-500	2012	2008		Clev	Y	Broad River Greenway, Town of Boiling Springs
36	**275.000***	C	Buffalo Shoals Creek	257	100-500	2014	2014		Ired	N	Small portion of this population (apprx. 20 plants) is within the DOT ROW, the remainder is on private property. Entire pop. Is monitored. No formal protection.
37	**276.000^**	A	Cliffside Steam Station	39,535	>1000	2016	2016		Clev/Ruth	Y	Voluntary agreement with Duke Energy. NHP Comp Review and Mont Report.
38	**277.000**	D	Hickory: Martin Marietta Quarry	0	extripated	2011	2011		Cata	N	Site developed. Plants moved to EO 294 (Geitner Park).
39	**279.000**	D?	Northeast Lincolnton: UT Walker Branch	?	<100	2009	2009		Linc	N	small
40	**287.000**	AB	Fox Knoll Farm	?	???	2016	2016		Polk	Y	PAC contact Pam Torlina has provided zip file with updates (need to review).
41	**291.000**	C	Gunpowder Creek	82	???	2012	2010		Cald	N	Associated with NCDOT TIP R-3437, any plants in ROW? No formal protection.
42	**292.000**	D	Forest City: Adj to Isothermal CC	150	100-500	2010	2010		Ruth	N	Owner, Ruthford County.
43	**293.000**	E	Killian Crossroads	unk	???	2010	2010		Cata	N	No plant count in EO data.
44	**295.000**	B	Hickory Area		100-500	2016				Y	Owner, Hickory Parks and Rec (protected? Ask NHP)
	295.021	*A*	*Hickory Area, Catawba River: Geitner Park*	*> 300*		*2005*	*2005*		*Burk*	*?*	*Catawba County Open Space, Owner, Hickory Parks and Rec. Ask NHP?*
	295.294	*C*	*Hickory Area: Bud Geitner Park Transplant Site*	*153*		*2016*	*2014*		*Burk*	*?*	*Catawba County Open Space (protected? Ask NHP) - Hickory County Parks and Rec. Includes plants from EOs 227 and 087.*
	295.313	*E*	*NCDOT TIP U-4700*	*unk*		*2012*	*2012*		*Cata*	*N*	*Associated with NCDOT TIP U-4700 (protected? Ask DOT) - EO data indicates report pending? - No plant count in EO data. No formal protection per TB.*

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
	295.314	*E*	*NCDOT TIP U-4700*	*unk*		*2012*	*2012*		*Cald*	*N*	*Associated with NCDOT TIP U-4700 (protected? Ask DOT) - EO data indicates report pending? - No plant count in EO data. No formal protection per TB (9/21/2017).*
45	**296.000**	CD	UT of Kings Mountain Res	100	100-500	2012	2012		Gast	N	
46	**297.000**	CD	Beaverdam Crk at First Broad River	unk	???	2011	2011		Clev	N	No plant count in EO data.
47	**298.000**	C	Brushy Creek Headwaters	250 300	100-500	2014	2014		Clev	N	
48	**299.000**	D	Lincoln County, SR-1314	27	<100	2014	2014		Linc	N	In DOT study. No formal protection.
49	**300.000**	D	Levan Family Farm	50	<100	2013	2013		Ired	N	
50	**302.000**	A	Rhyne Conservation Preserve		>1000	2016	2014				Parent EO. Catawba Lands Conservancy Easement and NCCMTF Easement.
	302.047	*D*	*NCDOT Project R-617C, South Fork Catawba*	*5*		*2005*	*2005*		*Linc*	*N*	*In DOT ROW, no formal protection.*
	302.262	*A*	*Rhyne Conservation Preserve*	*19,873*		*2016*	*2016*		*Linc*	*Y*	*Catawba Lands Conservancy Easement, NCCWMTF, and Catawba Lands Conservancy Preserve. NHP Comp Review and Mont Report.*
51	**303.000**	AB	Smith Cliff/Henry Fork River	?	100-500	2015	2015		Burk	Y	Hundreds of plants observed. Possible hybrid population. Conservation site managed by the Foothills Conservancy of NC. Is it an RHA, ask NHP?.
52	**304.000**	B?	Simms Hill/Little River Uplands	200 250	100-500	2015	2015		Burk	Y	Conservation site managed by the Foothills Conservancy of NC
53	**306.000**	D	Fanjoy Road Site	75	<100	2015	2015		Ired	N	
54	**308.000**	C	Glade Creek, Alex County	2,194	>1000	2017	2017		Alex	Y	2456 ind at 7 locations. Some plants in DOT ROW. BO with Andrew. 262 plants impacted and 24 HENA plants going back in to the ROW, 12 plants will have formal protection (TB 9/21/2017).
55	**309.000**	D?	South Mountains Pleasant Grove Uplands	?	<100	2016	2016		Burk	N	few
56	**311.000**	A	Collinsville (Hughes) Creek Slopes	200 750	100-500	2016	2016		Polk	Y	several hundred to 750 - Pacolet Area Conservancy Easement. PAC contact Pam Torlina has provided zip file with updates (need to review).
57	**312.000**	A	Richardson Creek trib above Toms Lake	?	>1000	2016	2016		Ruth	Y	several thousand clumps? - managed by Pacolet Area Conservancy Preserve. PAC contact Pam Torlina has provided zip file with updates (need to review).
58	**316.000**	C	Northern Catawba County		???	2017	2017			?	Parent EO; Catawba County Open Space (protected? Ask NHP) - Owner, City of Hickory
59	316.273	C	Northern Catawba County - Catawba River UT to Falling Creek	499	500-1000	2006	2006		Cata	Y	Deed restriction (ask Corps) - Raymond von Drehle 1-ac pond project 2007. 9/11 - Found BO, Log # 4-2-06-396. Total of 530 plants per BO. Impacts reduced to 31 plant per as-built in file.
	316.315	*D*	*NC-127/Cloninger Mill Road*	*60*		*2017*	*2017*		*Cata*	*?*	*Catawba County Open Space (protected? Ask NHP) - Owner, City of Hickory - In study area for NCDOT TIP R-3603A*
60	**317.000**	D	NCDOT TIP R-3603A	30	<100	2017	2017		Alex	N	EO is in study area for NCDOT TIP R-3603A. No formal protection.
61	**318.000**	C	Burke County - Drowning Creek UT	356	100-500	2017	2017		Burk	N	230 plants within DOT ROW fence for TIP B-4447. No formal protection.
62	**320.000**	E	Hickory Creek - UT (Shelby High School)	15	<100	2016	2016		Clev		
63	**321.000**	B	Gunpowder Creek: South of Hudson	2475	>1000	2012	2012		Cald		NCDOT
	Add		*Rock Barn Solar Farm*	*821*					*Cata*	*Y*	*Originally 1,021 plants, 200 impacted by project. 9/8 - David Brown told me about site. 9/11 - Bryan T. looking to see if DR recorded. 9/21 - DR was recorded.* *NHP*
			Total	340,470							

* DOT monitors

^ In 2011 5-YR Review as Populations estimated to contain >1,000 plants.

Pops/subpops >1,000 plants, current data.

green Broad River Greenway

Populations	Pop Number	EO Numbers	EO Rank	Site Name	Total estimated plants	Resilience Category	County	Last Observed	RNR Notes
1	**23.000**	**23.000**	A	Mill Creek Forest and Seep	>1000	very high	Polk	2016	
2	**29.000**	**29.000**	A	Island Creek Heath Bluff	>1000	very high	Burk	2016	
3	**31.000**	**31.000**	C?	NCDOT TIP: R-2824	>1000	very high	Cata	2015	
4	**32.000**	**32.000**	D	NCDOT TIP R-2824	100-500	moderate	Cata	2015	
5	**44.000**	**44.000**	AB	Little Gunpowder Creek Rare Plant Site 1	500-1000	high	Cald	2015	
6	**77.000**	**77.000**	CD	Little Gunpowder Creek Rare Plant Site 2	500-1000	high	Cald	2015	
7	**87.000**	**87.000**	D	Catawba River: Lower Creek: Miller Creek	<100	low	Cald	2011	likely extirpated, do we want to include this one?
8	**93.000**	**34; 35**	D	West Shelby Mesic Slope	100-500	moderate	Clev	2016	
9	**96.000**	**38; 39; 184**	A	Murrays Mill/Upper Balls Creek NA	>1000	very high	Cata	2013	
10	**98.000**	**2; 3; 4; 60**	CD	Cat Square Heartleaf Forest	100-500	moderate	Linc	2012	
11	**99.000**	**9; 10; 37; 52; 53; 55; 61; 62; 63; 75; 76; 79; 90; 121; 172; 181; 182; 249; 250; 251; 267; 268; 319**	A	Big Horse Creek Rare Plant Site	>1000	very high	Ruth	2015	
12	**100.000**	**14; 49; 50; 51; 73; 74; 149; 233; 235; 236; 237; 238; 239; 240; 241; 246**	A	Broad River/Sandy Run NA	>1000	very high	Clev	2012	
13	**125.000**	**125.000**	A	New Hope Springhead Swamp	>1000	very high	Polk	2016	
14	**154.000**	**157; 158**	C	Facebook Site	>1000	very high	Ruth	2016	
15	**176.000**	**167; 168; 169; 170**	A	Davenport Road/Mountain View Rare Plant Site	>1000	very high	Ruth	2016	
16	**177.000**	**16; 107; 122; 163; 164; 165; 166**	A	Broad River: Floyds Creek	>1000	very high	Ruth	2016	
17	**178.000**	**159; 160; 161; 254; 255; 256; 280; 281; 282; 283; 284; 310**	A	Catawba River: Hoyle Crk-Micol Crk	>1000	very high	Burk	2013	
18	**179.000**	**30; 162**	CD	South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	>1000	very high	Cata	2013	
19	**206.000**	**206.000**	D	Buffalo Creek: Ravine	<100	low	Clev	2007	
20	**208.000^**	**208.000**	A	Buffalo Creek: Potts Creek	<100	low	Clev	2012	
21	**214.000**	**201; 202; 203; 204; 205; 209; 212; 213**	A	Buffalo Creek: Tributaries N and S of SR 2047	>1000	very high	Clev	2012	
22	**216.000**	**28; 196; 197; 198; 199; 200**	A	Buffalo Creek: Kings Mountain Res	>1000	very high	Clev	2016	
23	**217.000**	**190; 191; 192; 193; 305**	B	Broad River: Brushy Creek	>1000	very high	Clev	2016	
24	**227.000**	**227.000**	A	Peaked Top Rare Plant Site/Foothills Landfill	>1000	very high	Cald	2014	
25	**232.000**	**46; 231**	A?	Buffalo Creek Rare Plant Site	500-1000	high	Clev	2012	
26	**243.000**	**12; 242; 269; 270**	AB	Jacob Fork West Corridor	>1000	very high	Cata	2012	
27	**245.000**	**91; 113; 175**	AB	Floyds Creek Tributray Rare Plant Site	>1000	very high	Ruth	2012	
28	**247.000**	**13; 56; 80; 106; 114; 115; 173; 174; 286**	A	New Bethel Rare Plant Site	>1000	very high	Ruth	2015	
29	**248.000**	**40; 54**	C	Jonas Road Rare Plant Site	100-500	moderate	Ruth	2014	

Populations	Pop Number	EO Numbers	EO Rank	Site Name	Total estimated plants	Resilience Category	County	Last Observed	RNR Notes
30	**252.000**	**19; 20**	B	South Fork Catawba River, Henry Fork	100-500	moderate	Cata	2007	
31	**271.000**	**271.000**	C?	Pott Creek	<100	low	Cata	2012	
32	**272.000**	**272.000**	BC	No Business Creek, Boyd Tract	100-500	moderate	Clev	2007	
33	**274.000**	**274.000**	A?	Broad River/Sandy Run NA	100-500	moderate	Clev	2012	
34	**275.000**	**275.000**	C	Buffalo Shoals Creek	100-500	moderate	Ired	2014	
35	**276.000**	**276.000**	A	Cliffside Steam Station	>1000	very high	Clev/Ruth	2016	
36	**279.000**	**279.000**	D?	Northeast Lincolnton: UT Walker Branch	<100	low	Linc	2009	
37	**287.000**	**287.000**	AB	Fox Knoll Farm	100-500	moderate	Polk	2016	found newer data - "several hundred clumps"
38	**291.000**	**291.000**	C	Gunpowder Creek	<100	low	Cald	2012	
39	**292.000**	**292.000**	D	Forest City: Adj to Isothermal CC	100-500	moderate	Ruth	2010	
40	**293.000**	**293.000**	E	Killian Crossroads	<100	low	Cata	2010	
41	**295.000**	**21; 294; 313; 314**	B	Hickory Area	100-500	moderate	Burk/Cata/Cald	2016	
42	**296.000**	**296.000**	CD	UT of Kings Mountain Res	100-500	moderate	Gast	2012	
43	**297.000**	**297.000**	CD	Beaverdam Crk at First Broad River	<100	low	Clev	2011	
44	**298.000**	**298.000**	C	Brushy Creek Headwaters	100-500	moderate	Clev	2014	
45	**299.000**	**299.000**	D	Lincoln County, SR-1314	<100	low	Linc	2014	
46	**300.000**	**300.000**	D	Levan Family Farm	<100	low	Ired	2013	
47	**302.000**	**47; 262**	A	Rhyne Conservation Preserve	>1000	very high	Linc	2016	
48	**303.000**	**303.000**	AB	Smith Cliff/Henry Fork River	100-500	moderate	Burk	2015	
49	**304.000**	**304.000**	B?	Simms Hill/Little River Uplands	100-500	moderate	Burk	2015	
50	**306.000**	**306.000**	D	Fanjoy Road Site	<100	low	Ired	2015	
51	**308.000**	**308.000**	C	Glade Creek, Alex County	>1000	very high	Alex	2017	
52	**309.000**	**309.000**	D?	South Mountains Pleasant Grove Uplands	<100	low	Burk	2016	
53	**311.000**	**311.000**	A	Collinsville (Hughes) Creek Slopes	100-500	moderate	Polk	2016	
54	**312.000**	**312.000**	A	Richardson Creek trib above Toms Lake	>1000	very high	Ruth	2016	
55	**316.000**	**273; 315**	C	Northern Catawba County	500-1000	high	Cata	2017	
56	**317.000**	**317.000**	D	NCDOT TIP R-3603A	<100	low	Alex	2017	
57	**318.000**	**318.000**	C	Burke County - Drowning Creek UT	100-500	moderate	Burk	2017	
58	**320.000**	**320.000**	E	Hickory Creek - UT (Shelby High School)	<100	low	Clev	2016	
59	**321.000**	**321.000**	B	Gunpowder Creek: South of Hudson	>1000	very high	Cald	2012	
60	**59.000**	59.000	C	Third Creek Rare Plant Site	100-500	moderate	Alex	2010	
61	**157.000**	157.000	AB	First Broad River: Crooked Run Creek	100-500	moderate	Clev	2010	
62	**158.000**	158.000	D	P Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork ar	100-500	moderate	Cata	2016	
63				Rock Barn Solar Farm	500-1000	high	Cata	2010-2011	I don't think NHP knows about this one. Location - Not processed per agreement with P Not processed per agreement with P

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
1	**23.000^**	A	Mill Creek Forest and Seep	1,733	>1000	2016	2015		Polk	N	NHP Comp Review and Mont Report.
2	**29.000^**	A	Island Creek Heath Bluff	50,541	>1000	2016	2016		Burk	N	Extrapolated estimate. NHP Comp Review and Mont Report.
3	**31.000*^**	C?	NCDOT TIP: R-2824	1,062	>1000	2010	2001		Cata	N	No formal protection throughout all sites that comprise this occurrence. Small portions of sites NW, SW1 and SW2 are found as a roadside population in right-of-way. DOT monitors. 1,202 plants in 2011. Per 2015 draft report, there are now 1,062 plants.
4	**32.000***	D	NCDOT TIP R-2824	457	100-500	2013	2011		Cata	N	The northern subpopulation of the occurrence (76 plants) is situated within the existing DOT ROW of I-40. This portion of the occurrence is a roadside population that is not under formal protection from a binding agreement. Other plants in population are outside of the ROW. DOT monitors. Per draft 2015 report, there are 72 plants in the ROW. 457 plants counted in 2015 DOT survey.
5	**44.000*^**	AB	Little Gunpowder Creek Rare Plant Site 1	617	500-1000	2015	2011		Cald	Y	The DOT purchased a combined 2.68 acers as a perpetual CE for the species. The two easements are the Wallace and Church Conservation Easements. Has management plan been developed? 2011 survey included only an estimate of plants in CE (1,054)? Do we know the number of plants in the CE now? Last monitoring report indicates that 321 will be widened. Does CE prevent impacts to plants from widening? YES (TB 9/21/2017). Tim will send updated monitoring report with 2015 counts. 390 under protection? Presences noted in 2015. 617 plants counted at sites 38, 39, 43, and 44 in 2012.
6	**77.000***	CD	Little Gunpowder Creek Rare Plant Site 2	699	500-1000	2013	2007		Cald	Y	DOT monitors. Three subpops - B is entirely in ROW, A and C are partially in ROW. Per the Amended Biological Opinion, NCDOT agreed to protect 90 plants within Subpopulation C by acquiring additional right-of-way. No other plants were agreed to be protected. However, additional right-of-way was acquired on the west side of Deal Mill Road for a stream mitigation project. In so doing, additional plants were thereby protected. (After conducting monitoring in 2013, it was determined that 37 plants from Subpopulation B and 52 plants from Subpopulation A are also under protection. In addition, 201 plants in Subpopulation C now exist within the expanded right-of-way, and therefore are also under protection.) Plants in ROW as of 2013 total 617. Per 2015 Draft monitoring report, there are now 699 plants. ROW acquired for formal protection.
7	**87.000**	D	Catawba River: Lower Creek: Miller Creek	0	<100	2011	2011		Cald	N	55 plants dug by HARP on 04 November 2011 and relocated to EO 294 (Bud Geitner Park), few plants left, likely extirpated by Quarry expansion
8	**93.000**	D	West Shelby Mesic Slope		100-500	2005	2005				Parent EO
	93.034	*D*	*West Shelby Mesic Slope*	*60*		*2005*	*2005*		*Clev*	*N*	
	93.035	*D*	*First Broad River: Brushy Creek*	*< 100*		*2016*	*2001*		*Clev*	*N*	*8-10 clumps observed in 2016 but it was not a complete census. Less than 100 plants seen in 2001.*
9	**96.000**	A	Murrays Mill/Upper Balls Creek NA		>1000	2013	2010				Parent EO. Murray Mill Conservation Site, NCDOT Mitigation Site, Part of principal EO 096 having 37,800 plants prior to NCDOT impacts (IPB-2119 at sub EO 184) of which 356 plants are to be impacted and 6,000 are to be preserved on-site, as mitigation (HDR personnel 2005).
	*96.038^*	*CD*	*Catawba River: Deal Property*	*100 200*		*1996*	*1996*		*Cata*	*N*	
	*96.039^*	*D*	*Murrays Mill/Upper Balls Creek NA*	*< 50*		*2002*	*2002*		*Cata*	*?*	*Land in or near this area was purchased as mitigation by NC DOT, details unknown (Wichmann 2005)*
	96.184^*	*A*	*Murrays Mill/Upper Balls Creek NA*	*11,860*		*2013*	*2010*		*Cata*	*Y*	*NCDOT purchased 25.07 acres on May 1, 1996 and an additional 8.61 acres (Bowman Tract) on March 13, 2006 as a permanent conservation site for the species (Herman 2010). Has property been conveyed? NO (TB 9/21/2017) Management plan finalized? YES (TB 9/21/2017)*
10	**98.000**	CD	Cat Square Heartleaf Forest		100-500	2012	2001				Parent EO
	98.002	*X*	*South Fork Catawba River, Indian Creek*	*0*		*1957*	*1980*		*Linc*	*N*	*Extirpated*
	98.003	*D*	*Cat Square Heartleaf Forest*	*160*		*2001*	*1995*		*Linc*	*N*	*presence noted in 2001, 160 plants counted in 1995*
	98.004	*CD*	*Cat Square Heartleaf Forest*	*200*		*2001*	*2001*		*Linc*	*N*	
	98.060	*D*	*NCDOT TIP: B-2119*	*20 50*		*2012*	*2001*		*Linc*	*N*	*EO is associated with NC DOT project B-2119*
11	**99.000**	A	Big Horse Creek Rare Plant Site	106,940	>1000	2015	2015				Parent EO, plant toal for all sub Eos. Estimate population size represents all subEOs, including those not surveyed. (NHP Comp Review and Mont Report).
	*99.009^*	*AB*	*Hensons Creek Natural Area*	*n/a*		*2005*	*2005*		*Ruth*	*N*	*Presence noted in 2012 - no count made, 500 estimate plants in 2005*
	*99.010^*	*A*	*Kudzu Farm Rare Plant Site*	*n/a*		*2014*	*2013*		*Ruth*	*N*	*33,000 plants at the site, owner aware of conservation value. Not protected - BO for Quarry was amended. NHP Comp Review and Mont Report.*
	*99.037^*	*C*	*Broad River: Hunter Road*	*n/a*		*2005*	*2015*		*Ruth*	*N*	*includes EO 37, 55, and 76. 32,000 total plants. NHP Comp Review and Mont Report.*
	*99.052^*	*C*	*Hensons Creek Natural Area*	*n/a*		*2005*	*2001*		*Ruth*	*N*	*200-300*
	*99.053^*	*D*	*Broad River: McKinney Bridge*	*n/a*		*2003*	*2003*		*Ruth*	*N*	*<35*
	*99.055^*	*AB*	*Broad River: Richardson Creek*	*n/a*		*2016*	*2015*		*Ruth*	*N*	*included with EO 37. NHP Comp Review and Mont Report.*
	*99.061^*	*B*	*Broad River: UT at SR1115 and 1116*	*n/a*		*2002*	*2002*		*Ruth*	*N*	*750-1000*
	*99.062^*	*C*	*Broad River: Richardson Creek*	*n/a*		*2002*	*2002*		*Ruth*	*N*	*200-500. NHP Comp Review and Mont Report.*
	*99.063^*	*D*	*Broad River: Hayes Lake*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*20-25*
	*99.075^*	*A*	*Brice Rare Plant Site*	*n/a*		*2013*	*2013*		*Ruth*	*N*	*>7000. NHP Comp Review and Mont Report.*
	*99.076^*	*BC*	*Big Horse Rare Plant Site*	*n/a*		*2015*			*Ruth*	*Y*	*included with EO 37, Parris Heartleaf RHA voluntary agreement, 32,000 plants in 3 Eos. 200-250 in RHA. NHP Comp Review and Mont Report.*
	*99.079^*	*C*	*Broad River: Richardson Creek*	*n/a*		*2012*	*2001*		*Ruth*	*N*	*200-300. NHP Comp Review and Mont Report.*
	*99.090^*	*D*	*Broad River: Richardson Creek*	*n/a*		*2003*	*2003*		*Ruth*	*N*	*100-200*
	*99.121^*	*B*	*Broad River: Dills Creek*	*n/a*		*2004*	*2004*		*Ruth*	*N*	*300*
	*99.172^*	*D*	*Big Horse Rare Plant Site*	*n/a*		*2012*	*2012*		*Ruth*	*Y*	*50-100, Parris Heartleaf RHA voluntary agreement.*
	*99.181^*	*AB*	*Broad River: Dills Creek*	*n/a*		*2012*	*2001*		*Ruth*	*?*	*This suboccurrence is included in the determination of total extrapolated acreage for USFWS Flex Fund Monitoring Site 2, although it was not surveyed. NHP Comp Review and Mont Report.*
	*99.182^*	*A?*	*Hensons Creek Natural Area*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*included with EO 249*
	99.249	*A?*	*Hensons Creek Natural Area*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*3,000-5,000 individuals counted within Eos 182, 249, 250, and 251.*
	99.250	*A?*	*Hensons Creek Natural Area*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*included with EO 249*
	99.251	*A?*	*Hensons Creek Natural Area*	*n/a*		*2001*	*2001*		*Ruth*	*N*	*included with EO 249*
	99.267	*CD*	*Kudzu Farm*	*n/a*		*2006*	*2008*		*Ruth*	*N*	*150-250*
	99.268	*D*	*Kudzu Farm*	*n/a*		*2006*	*2008*		*Ruth*	*N*	*25-30*
	99.319	*E*	*Broad River: Big Horse Creek*	*unk*		*2012*	*2012*		*Ruth*		*observed but no count made.*
12	**100.000**	A	Broad River/Sandy Run NA		>1000	2012	2012				Parent EO. NCDOT Mitigation Site, NCDMS, Broad River Greenway. DOT purchased 1000 AC in 2003 and transferred to Broad River Greenway, Inc. in 2008. 32,702 plants within the Broad River Greenway CE per 2015 draft report.
	*100.014^*	*C?*	*Broad River/Sandy Run NA*	*177*		*2009*	*2001*		*Clev*	*N*	*EO is associated with NC DOT project B-2119, outside Broad River Tract. Presence noted in 2001 and 2009 - no count made, 177 plants counted in 2000*
	*100.049^*	*A*	*Broad River/Sandy Run NA*	*1,118*		*2012*	*2008*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 792 plants reported in 2012, 2015 draft report documents 1118.*
	*100.050^*	*A*	*Broad River/Sandy Run NA*	*4,801*		*2012*	*2008*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 4712 plants reported in 2012, 2015 draft report documents 4801.*
	*100.051^*	*A*	*Broad River/Sandy Run NA*	*2,363*		*2012*	*2008*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 2326 plants reported in 2012, 2015 draft report documents 3241.*
	*100.073^*	*A*	*Broad River/Sandy Run NA*	*13,595*		*2012*	*2012*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 11446 plants reported in 2012, 2015 draft report documents 13959.*
	*100.074^*	*B*	*Broad River/Sandy Run NA*	*722*		*2012*	*2008*		*Clev*	*Y*	*In part in the Broad River Tract, DMS, NCDOT Mitigation Site. 675 plants reported in 2012, 2015 draft report documents 722.*
	*100.149^*	*A*	*Broad River/Sandy Run NA*	*3,280*		*2012*	*2009*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 2722 plants reported in 2012, 2015 draft report documents 3280 Has site been conveyed to Cleveland County yet? (Ask DOT)*
	*100.233^*	*A*	*Broad River/Sandy Run NA*	*3,383*		*2012*	*2012*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 2352 plants reported in 2012, 2015 draft report documents 3383. Has site been conveyed to Cleveland County yet? (Ask DOT)*
	100.235	*CD*	*Broad River: Trib N of Broad River and SE of Lake Houser*	*100 200*		*2001*	*2005*		*Clev*	*N*	*Outside Broad River Tract*
	*100.236^*	*C*	*Broad River/Sandy Run NA*	*150 300*		*2001*	*2005*		*Clev*	*N*	*Outside Broad River Tract*
	*100.237^*	*E*	*Broad River/Sandy Run NA*	*> 200*		*2012*	*2001*		*Clev*	*N*	*Outside Broad River Tract*
	*100.238^*	*A*	*Broad River/Sandy Run NA*	*1,865*		*2012*	*2008*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 1865 plants reported in 2012, 2015 draft report documents 1898 Has site been conveyed to Cleveland County yet? (Ask DOT)*
	*100.239^*	*D*	*Broad River/Sandy Run NA*	*165*		*2012*	*2008*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 94 plants reported in 2012, 2015 draft report documents 165 Has site been conveyed to Cleveland County yet? (Ask DOT)*
	*100.240^*	*F*	*Broad River/Sandy Run NA*	*20*		*2012*	*2008*		*Clev*	*Y*	*Occurrence is within the NCDOT mitigation site - The Broad River Tract. 21 plants reported in 2012, 2015 draft report documents 20 Has site been conveyed to Cleveland County yet? (Ask DOT). Should not be failed to find - "F"*

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes	
	100.241^	D	Broad River/Sandy Run NA	115		2012	2008		Clev	Y	Occurrence is within the NCDOT mitigation site - The Broad River Tract. 150 plants reported in 2012, 2015 draft report documents 115. Has site been conveyed to Cleveland County yet? (Ask DOT)	
	100.246^	D	Broad River/Sandy Run NA	< 100		2001	2005		Clev	N	Outside Broad River Tract	
13	**125.000^**	A	New Hope Springhead Swamp		>1000	2016	2015		Polk	Y	NHP Comp Review and Mont Report. A portion of this site now has formal protection as a Barefield RHA voluntary agreement.	
14	**154.000^**	C	Facebook Site	2,576	>1000	2016	2015		Ruth	Y	Deed restriction (ask Corps) - Wayne Hawkins. 9/8 - Talked with David Brown at Corps. DR was recorded, site is posted with signs. NHP Comp Review and Mont Report.	
15	**157.000*^**	AB	First Broad River: Crooked Run Creek	330	100-500	2010	2005		Clev	N	DOT no longer monitors, too far from ROW.	
16	**158.000*^**	D	NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	123	100-500	2016	2016		Cata	N	No signed right-of-way, conservation easement, or fee title acquisition. Approximately 15 plants (3%) are within the estimated right-of-way of SR 1115 (Camp Creek Road). Plants found within the right-of-way are not protected under any formal agreement. Future road improvement and/or maintenance may affect portions of the dwarf-flowered heartleaf (DFHL) population adjacent to the existing road. NHP Comp Review and Mont Report.	
17	**176.000**	A	Davenport Road/Mountain View Rare Plant Site	6,750	>1000	2016	2016				Parent EO. Extrapolated estimate for subEOs. NHP Comp Review and Mont Report.	
	176.167^	A	Davenport Road/Mountain View Rare Plant Site	n/a		2005	2015		Ruth	N	included with EO 107. NHP Comp Review and Mont Report.	
	176.168^	A	Davenport Road/Mountain View Rare Plant Site	n/a		2005	2005		Ruth	N	1113. NHP Comp Review and Mont Report.	
	176.169^	D	Davenport Road/Mountain View Rare Plant Site	n/a		2016	2016		Ruth	N	35. NHP Comp Review and Mont Report.	
	176.170^	C	Davenport Road/Mountain View Rare Plant Site	n/a		2016	2015		Ruth	N	191. NHP Comp Review and Mont Report.	
18	**177.000**	A	Broad River: Floyds Creek	12,687	>1000	2016	2016				Parent EO. Extrapolated estimate for subEOs. NHP Comp Review and Mont Report.	
	177.016^	E	Broad River: Floyds Creek	n/a		2014	2012		Ruth	N	5340, any in DOT ROW. Impacted plants moved to Tate, remaining plants have no formal protection (TB 9/21/2017).	
	177.107^	B	Broad River: Floyds Creek	n/a		2008	2015		Ruth	N	241, Individuals of Hexastylis naniflora expected to be impacted by widening of US 221 will be moved to the Tate, remianing plants have no formal protection. (TB 9/21/2017)	
	177.122^	B?	Broad River: Floyds Creek	n/a		2008	2007		Ruth	N	123, any plants impacted by the US221 widening would be moved to Tate, remaining plants have no formal protection (TB 9/21/2017).	
	177.163^	B	Broad River: Floyds Creek	n/a		2016	2015		Ruth	N	included with EO 107	
	177.164^	A	Broad River: Floyds Creek	n/a		2016	2005		Ruth	N	537, May incure impacts from widening of US 221, NCDOT TIP Nos. R-2233A&B, any impacts, any protect via DOT? Impacted plants will be moved to Tate, remaining plants have no formal protection (TB 9/21/2017)	
	177.165^	C	Broad River: Floyds Creek	n/a		2005	2005		Ruth	N	included with EO 107	
	177.166^	CD	Broad River: Floyds Creek	n/a		2005			Ruth	N	included with EO 107	
19	**178.000**	A	Catawba River: Hoyle Crk-Micol Crk		>1000	2013	2016				Parent EO.	
	178.159*^	A	Catawba River: Hoyle Crk-Micol Crk	2182		2013	2005		Burk	N	Unprotected roadside population. A portion of this occurrence is found within North Carolina Department of Transportation (NCDOT) right-of-way. No formal protection. Presence noted in 2013, 2182 plants counted in 2011.	
	178.160^	A	Catawba River: Hoyle Crk-Micol Crk	733		2013	2008		Burk	N	loss of 118 of 851 plants due to DOT construction, any protection? No count since 2008. DOT will update, no plants taken, no protection (TB 9/21/2017)	
	178.161^	A	Catawba River: Hoyle Crk-Micol Crk	2,754		2009			Burk	N	In Dot study area. No formal protection. Presence noted in 2009, plants counted in 2008.	
	178.254^	D?	Catawba River: Hoyle Crk-Micol Crk	> 168		2010	2010		Burk	Y	Permanent conservation easement with Burke Cty and Public School System. New count from 2010 monitoring report (YR4).	
	178.255^	D	Catawba River: Hoyle Crk-Micol Crk	unk		2006	2006		Burk	Y	286 plants moved to a 6.1 ac on-site protected area (guessing EO 254 and 256). Remaining plants in construction area.	
	178.256^	C?	Catawba River: Hoyle Crk-Micol Crk	> 376		2010	2010		Burk	Y	Permanent conservation easement with Burke Cty and Public School System. "Considerable" number of other plants that were not counted or monitored (2006). New count from 2010 monitoritng report (YR4).	
	178.280^	C	Catawba River: Hoyle Crk	126		2009	2009		Burk	Y	Protection of NCDOT ROW in progress (2009). Expanded ROW to formally preserve plants left after construction, natives and transplants, we will get new data (TB 9/21/2017)	
	178.281^	E	Catawba River: Hoyle Crk-Micol Crk	unk		2009	2009		Burk	N	presence noted, no count made - outside of NCDOT ROW	
	178.282^	E	Catawba River: Hoyle Crk-Micol Crk	unk		2009	2009		Burk	N	included with 281? - presence noted, no count made - outside of NCDOT ROW	
	178.283	E	Catawba River: McGalliard Creek	unk		2009	2009		Burk	N	included with 281? - presence noted, no count made - outside of NCDOT ROW	
	178.284	E	Catawba River: McGalliard Creek	unk		2009	2009		Burk	N	included with 281? - presence noted, no count made - outside of NCDOT ROW	
	178.310	A	Megalliard Creek Slopes; Lake Rhodhiss	1,500 2,000		2016	2016		Burk	Y	Tract is part of an application to CWMTF from the Town of Valdese to protect as a park (2016). The property will be a combination of conservation land, greenway, and town park. We have had discussions with them about designing the park and activities in a way that least impacts the stream buffers and natural heritage values (specifically DFHL). I'm in the process of drafting contracts and expect the Town to purchase the property and record a conservation easement on stream buffers and natural heritage areas before end of January 2018 (end of purchase contract with current owner) Nancy Guthrie 9/25/2017. Verify in January 2018.	NHP
20	**179.000**	CD	South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos		>1000	2012	2005				Parent EO	
*	179.030*	CD	NCDOT TIP R-2824	3,291		2013	2001		Cata	N	DOT monitors. A small portion (71 plants) is situated with the existing DOT ROW. Not under formal protection from a binding agreement. Per draft 2015 report, there are 37 plants in the ROW and 3,291 plants total in the EO. Last report (2013)documented 4,719 plants.	
	179.162*	D	NCDOT TIP R-2825	21		2012	2005		Cata	N	No signed right-of-way, conservation easement, or fee title acquisition. No plants are currently within estimated right-of-way. Future road improvement plans may affect the DFHL plants along the ditch adjacent to the existing road.	
21	**206.000**	D	Buffalo Creek: Ravine	90	<100	2007	2007		Clev	N	in DOT study area. Near Shelby Bypass but not expected to be impacted. No formal protection.	
22	**208.000^**	A	Buffalo Creek: Potts Creek	50 100	<100	2012	2007		Clev	?	Pending NCDOT purchase for ROW protection (2009). NC DOT proposes to protect Sites 33, 44, and 35 [EO 208, in part] throught a conservation easement. Ask DOT	
23	**214.000**	A	Buffalo Creek: Tributaries N and S of SR 2047		>1000	2012	2000				Parent EO	
	214.201^	D	Buffalo Creek: Tributary S	64		2000	2000		Clev	?	14 of 78 plants will be impacted by the Shelby bypass. DOT protection via CE? Ask DOT	
	214.202^	A	Buffalo Creek: Ravine N	1,627		2000	2000		Clev	?	14 of 1641 plants will be impacted by the Shelby bypass. Pending DOT purchase for ROW protection? Ask DOT.	
	214.203^	B	Buffalo Creek: 3rd Tributary S	96		2007	2007		Clev	?	110 of the site's 206 plants were impacted by Shelby bypass. Pending DOT purchase for ROW protection?	
	214.204^	A?	Buffalo Creek: S of SR 2128	?		2000	2000		Clev	?	3,094 plants in site, entire site impacted by Shelby bypass. No estimate of plants remaining. Some protection through CE? Ask DOT	
	214.205^	D	Buffalo Creek: N of SR 2128	171		2000	2000		Clev	?	Pending NCDOT purchase for ROW protection (2009) Ask DOT. 183 plants of which 13 were impacted.	
	214.209^	BC	Buffalo Creek: Tributary E of County Fairgrounds	196		2000	2000		Clev	?	Pending NCDOT purchase for ROW protection (2009). 332 plant of which 136 plants in construction limits. Ask DOT.	
	214.212^	D	Buffalo Creek: Slope along Trib just N of SR 2047	97		2000	2000		Clev	N	In DOT study area for R-2707. No formal protection.	
	214.213^	CD	Buffalo Creek: Ravine just S of SR 2047	50 100		2012	2012		Clev	?	Pending NCDOT purchase for ROW protection (2009) Ask DOT	
24	**216.000**	A	Buffalo Creek: Kings Mountain Res		>1000	2016	2000				Parent EO	
	216.028	B	Buffalo Creek Rare Plant Site	250		2016	2016		Clev	Y	This site has been preserved apart from the landfill and the habitat is intact, the area has been designated as Special Protected Environmental Area by Cleveland County. Spoke with Nathan McNeilly, he will check on protections (09/2017). The area is buffer around the landfill and he has been told to stay out of the area. Area is fenced off. (09/27/17)	
	216.196	D	Buffalo Creek: Friendship Chapel	56		2006	2006		Clev	N	In Dot study area. No formal protection.	
	216.197^	A	Buffalo Creek: Kings Mountain Res	2,067		2000	2000		Clev	?	NC DOT plans "NCDOT proposes to protect Site 13 [EO 197] trough a conservation easement	
	216.198^	B	Buffalo Creek: Kings Mountain Res	450		2007	2007		Clev	N	In Dot study area. No formal protection.	
	216.199^	B	Buffalo Creek: Kings Mountain Res	432		2007	2007		Clev	?	Pending NCDOT purchase for ROW protection (2009) Ask DOT. Construction activity will eliminate some.	
	216.200^	D	Buffalo Creek: Kings Mountain Res	55		2000	2000		Clev	?	Pending NCDOT purchase for ROW protection (2009) Ask DOT	
25	**217.000**	B	Broad River: Brushy Creek		>1000	2016	2016				Parent EO	
	217.190	F	Broad River: Brushy Creek	0		2000	2006		Clev	N	No plants found.	
	217.191*	D	Broad River: Brushy Creek	264		2014	2000		Clev	Y	DOT purchased 19 acres of ROW for Shelby By-Pass in Oct. 2013. Of the 19 AC, about 6.4 AC are to preserve HENA in perpetuity at Site 7. 283 plants at Site 7, likely more in EO. Per 2015 draft report, 264 plants at the site.	
	217.192	C	Broad River: Brushy Creek	494		2016	2016		Clev	Y	NCDOT proposes to protect Site 8 [EO 192] through a conservation easement. Site 8, 8A, and 8B of EO 192 are entirely contained in NCDOT ROW. Site contained 311 plants. Per 2015 draft report, site now contains 494 plants. Protected formally in ROW (TB 9/21/2017).	
	217.193	C	Broad River: Brushy Creek	271		2000	2000		Clev	?	NC DOT proposes to protect Site 9 through a conservation easement.	
	217.305	CD	Washburn Switch Business Park	70		2015	2015		Clev	N	Three locations (126 plants) were rescued and moved to southeast corner of property. Relocated plants not included in plant total.	

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
26	**227.000^**	A	Peaked Top Rare Plant Site/Foothills Landfill	16,463	>1000	2014	2014		Cald	Y	CE (260 AC) with the Foothills Conservancy of NC. Any data since 2014,who is contact?
27	**232.000**	A?	Buffalo Creek Rare Plant Site		500-1000	2012	2005				Parent EO.
	232.046	*A*	*Buffalo Creek Rare Plant Site*	*500*		*2005*	*2005*		*Clev*	*N*	*Associated with B-2816, R-2824. This property is eligible as a Historic District on the National Register with much of the historic features still intact and is protected as a 4-F Property. Ask DOT, DOT doesn't know about site (TB 9/21/2017).*
	232.231	*D*	*Buffalo Creek Rare Plant Site*	*20*		*2012*	*2012*		*Clev*	*N*	*Associated with B-2618. Are plants in ROW? Ask DOT, DOT doesn't know about site (TB 9/21/2017).*
28	**243.000**	AB	Jacob Fork West Corridor		>1000	2012	2007				Parent EO
	*243.012^*	*A*	*Jacob Fork West Corridor*	*> 1,000*		*1995*	*1995*		*Cata*	*?*	*Catawba County Wildlife Club RHA voluntary agreement.*
	*243.242^*	*D*	*Jacob Fork West Corridor*	*4*		*2005*	*2005*		*Cata*	*N*	
	*243.269^*	*B*	*Jacob Fork West Corridor*	*> 200*		*2007*	*2008*		*Cata*	*Y*	*TNC has easements but does not do monitoring of HENA, NHP should be most up to date data (Wichmann 09/25/2017).*
	*243.270^*	*C?*	*Jacob Fork West Corridor*	*75 100*		*2012*	*2008*		*Cata*	*Y*	*TNC has easements but does not do monitoring of HENA, NHP should be most up to date data (Wichmann 09/25/2017). Counts from 2006-7, occupied area remapped in 2012.*
29	**245.000**	AB	Floyds Creek Tributray Rare Plant Site		>1000	2010	2005				Parent EO
	245.091	*D*	*Broad River: Floyds Creek*	*30*		*2012*	*2003*		*Ruth*	*N*	
	245.113	*C*	*Floyds Creek Tributray Rare Plant Site*	*1,113*		*2010*	*2007*		*Ruth*	*N*	*7 plants moved from the area to be impacted by the road project to the transplant area at the Tate, 62 moved to Tate?*
	245.175	*C*	*Floyds Creek Tributray Rare Plant Site*	*unk*		*2010*	*2007*		*Ruth*	*N*	*included with EO 113, NCDOT TIP: R-2233, 114 plants moved from the area to be impacted by the road project to the transplant area at the Tate. Impact by US221 widening. Any plants left? Ask DOT. No formal protection.*
30	**247.000**	A	New Bethel Rare Plant Site		>1000	2015	2015				Parent EO, NC DOT Mitigation Site
	247.013	*D*	*Sandy Mush Outcrop*	*< 100*		*2005*	*2005*		*Ruth*	*N*	
	247.056	*D*	*Broad River: Floyds Creek*	*< 150*		*2002*	*2001*		*Ruth*	*N*	
	*247.080^*	*D*	*Broad River: Floyds Creek*	*50*		*2012*	*2003*		*Ruth*	*N*	*No plant count made in 2012. 50 plants counted in 2003.*
***	*247.106*^*	*A*	*New Bethel Rare Plant Site*	*4,547*		*2015*	*2008*		*Ruth*	*Y*	*Tate Conservation Easement (DOT Mitigation Site). Resident plants. Tate has a management plan (TB 9/21/2017).*
	*247.114^*	*D*	*Broad River Floyds Creek*	*0*		*2010*	*2003*		*Ruth*	*N*	*14 plants moved from the area to be impacted by the road project to the transplant area at the Tate. NO formal protection for 114, 115, 173, and 174 (all impacted plants moved to Tate). TB 9/21/2017*
	*247.115^*	*C*	*Broad River Floyds Creek*	*133*		*2005*	*2007*		*Ruth*	*N*	*Combine with EO 114*
	*247.173^*	*D*	*Broad River Floyds Creek*	*102*		*2005*	*2003*		*Ruth*	*N*	*inds of HENA expected to be impacted by widening of US 221 will be moved to the Tate Conservation Easement site. How many? 102 clumps some moved??*
	*247.174^*	*D*	*Broad River Floyds Creek*	*84*		*2010*	*2003*		*Ruth*	*N*	*35 of 119 plants moved from the area to be impacted by the road project to the transplant area at the Tate, in DOT study area*
***	*247.286*^*	*B*	*New Bethel Rare Plant Site*	*326*		*2015*	*2015*		*Ruth*	*Y*	*Tate Conservation Easement (DOT Mitigation Site). Transplanted plants.*
31	**248.000**	C	Jonas Road Rare Plant Site		100-500	2005	2005				Parent EO
	248.040	*C*	*Jonas Road Rare Plant Site*	*150 200*		*2005*	*2005*		*Ruth*	*N*	
	248.054	*D*	*Broad River: McKinney Creek*	*20 30*		*2014*	*2001*		*Ruth*	*N*	*20-30 plants noted for last count in 2005*
32	**252.000**	B	South Fork Catawba River, Henry Fork		100-500	2007	2005				Parent EO
	252.019	*D?*	*NCDOT TIP: R-0085*	*unk*		*2007*	*2007*		*Cata*	*?*	*EO seems to have been extirpated by construction of the 321 Bypass, NCDOT is trying to purchase the property (NCDOT 2009), Some plants protected in conservation easments outside of construction zones. DOT will send updated info.*
	252.020	*B*	*NCDOT TIP: R-0086*	*296*		*2007*	*2005*		*Cata*	*?*	*May have been used as a mitigation site for US-321 Bypass, protected ask DOT. DOT will send updated info.*
33	**271.000**	C?	Pott Creek	5 6	<100	2012	2012		Cata	Y	The Nature Conservancy - likely part of a larger pop containing 700-1,000 plants (2008)
34	**272.000**	BC	No Business Creek, Boyd Tract	75 150	100-500	2007	2007		Clev	N	
35	**274.000**	A?	Broad River/Sandy Run NA	100	100-500	2012	2008		Clev	Y	Broad River Greenway, Town of Boiling Springs
36	**275.000***	C	Buffalo Shoals Creek	257	100-500	2014	2014		Ired	N	Small portion of this population (apprx. 20 plants) is within the DOT ROW, the remainder is on private property. Entire pop. Is monitored. No formal protection.
37	**276.000^**	A	Cliffside Steam Station	39,535	>1000	2016	2016		Clev/Ruth	Y	Voluntary agreement with Duke Energy. NHP Comp Review and Mont Report.
38	**277.000**	D	Hickory: Martin Marietta Quarry	0	extripated	2011	2011		Cata	N	Site developed. Plants moved to EO 294 (Geitner Park).
39	**279.000**	D?	Northeast Lincolnton: UT Walker Branch	?	<100	2009	2009		Linc	N	small
40	**287.000**	AB	Fox Knoll Farm	?	???	2016	2016		Polk	Y	PAC contact Pam Torlina has provided zip file with updates (need to review).
41	**291.000**	C	Gunpowder Creek	82	???	2012	2010		Cald	N	Associated with NCDOT TIP R-3437, any plants in ROW? No formal protection.
42	**292.000**	D	Forest City: Adj to Isothermal CC	150	100-500	2010	2010		Ruth	N	Owner, Ruthford County.
43	**293.000**	E	Killian Crossroads	unk	???	2010	2010		Cata	N	No plant count in EO data.
44	**295.000**	B	Hickory Area		100-500	2016				Y	Owner, Hickory Parks and Rec (protected? Ask NHP)
	295.021	*A*	*Hickory Area, Catawba River: Geitner Park*	*> 300*		*2005*	*2005*		*Burk*	*?*	*Catawba County Open Space, Owner, Hickory Parks and Rec. Ask NHP?*
	295.294	*C*	*Hickory Area: Bud Geitner Park Transplant Site*	*153*		*2016*	*2014*		*Burk*	*?*	*Catawba County Open Space (protected? Ask NHP) - Hickory County Parks and Rec. Includes plants from EOs 227 and 087.*
	295.313	*E*	*NCDOT TIP U-4700*	*unk*		*2012*	*2012*		*Cata*	*N*	*Associated with NCDOT TIP U-4700 (protected? Ask DOT) - EO data indicates report pending? - No plant count in EO data. No formal protection per TB.*
	295.314	*E*	*NCDOT TIP U-4700*	*unk*		*2012*	*2012*		*Cald*	*N*	*Associated with NCDOT TIP U-4700 (protected? Ask DOT) - EO data indicates report pending? - No plant count in EO data. No formal protection per TB (9/21/2017).*
45	**296.000**	CD	UT of Kings Mountain Res	100	100-500	2012	2012		Gast	N	
46	**297.000**	CD	Beaverdam Crk at First Broad River	unk	???	2011	2011		Clev	N	No plant count in EO data.
47	**298.000**	C	Brushy Creek Headwaters	250 300	100-500	2014	2014		Clev	N	
48	**299.000**	D	Lincoln County, SR-1314	27	<100	2014	2014		Linc	N	In DOT study. No formal protection.
49	**300.000**	D	Levan Family Farm	50	<100	2013	2013		Ired	N	
50	**302.000**	A	Rhyne Conservation Preserve		>1000	2016	2014				Parent EO. Catawba Lands Conservancy Easement and NCCMTF Easement.
	302.047	*D*	*NCDOT Project R-617C, South Fork Catawba*	*5*		*2005*	*2005*		*Linc*	*N*	*In DOT ROW, no formal protection.*
	302.262	*A*	*Rhyne Conservation Preserve*	*19,873*		*2016*	*2016*		*Linc*	*Y*	*Catawba Lands Conservancy Easement, NCCWMTF, and Catawba Lands Conservancy Preserve. NHP Comp Review and Mont Report.*
51	**303.000**	AB	Smith Cliff/Henry Fork River	?	100-500	2015	2015		Burk	Y	Hundreds of plants observed. Possible hybrid population. Conservation site managed by the Foothills Conservancy of NC. Is it an RHA, ask NHP?.
52	**304.000**	B?	Simms Hill/Little River Uplands	200 250	100-500	2015	2015		Burk	Y	Conservation site managed by the Foothills Conservancy of NC
53	**306.000**	D	Fanjoy Road Site	75	<100	2015	2015		Ired	N	
54	**308.000**	C	Glade Creek, Alex County	2,194	>1000	2017	2017		Alex	Y	2456 ind at 7 locations. Some plants in DOT ROW. BO with Andrew. 262 plants impacted and 24 HENA plants going back in to the ROW, 12 plants will have formal protection (TB 9/21/2017).
55	**309.000**	D?	South Mountains Pleasant Grove Uplands	?	<100	2016	2016		Burk	N	few
56	**311.000**	A	Collinsville (Hughes) Creek Slopes	200 750	100-500	2016	2016		Polk	Y	several hundred to 750 - Pacolet Area Conservancy Easement. PAC contact Pam Torlina has provided zip file with updates (need to review).
57	**312.000**	A	Richardson Creek trib above Toms Lake	?	>1000	2016	2016		Ruth	Y	several thousand clumps? - managed by Pacolet Area Conservancy Preserve. PAC contact Pam Torlina has provided zip file with updates (need to review).
58	**316.000**	C	Northern Catawba County		???	2017	2017			?	Parent EO; Catawba County Open Space (protected? Ask NHP) - Owner, City of Hickory
59	316.273	C	Northern Catawba County - Catawba River UT to Falling Creek	499	500-1000	2006	2006		Cata	Y	Deed restriction (ask Corps) - Raymond von Drehle 1-ac pond project 2007. 9/11 - Found BO, Log # 4-2-06-396. Total of 530 plants per BO. Impacts reduced to 31 plant per as-built in file.
	316.315	*D*	*NC-127/Cloninger Mill Road*	*60*		*2017*	*2017*		*Cata*	*?*	*Catawba County Open Space (protected? Ask NHP) - Owner, City of Hickory - In study area for NCDOT TIP R-3603A*
60	**317.000**	D	NCDOT TIP R-3603A	30	<100	2017	2017		Alex	N	EO is in study area for NCDOT TIP R-3603A. No formal protection.
61	**318.000**	C	Burke County - Drowning Creek UT	356	100-500	2017	2017		Burk	N	230 plants within DOT ROW fence for TIP B-4447. No formal protection.
62	**320.000**	E	Hickory Creek - UT (Shelby High School)	15	<100	2016	2016		Clev		
63	**321.000**	B	Gunpowder Creek: South of Hudson	2475	>1000	2012	2012		Cald		NCDOT
	Add		*Rock Barn Solar Farm*	*821*					*Cata*	*Y*	*Originally 1,021 plants, 200 impacted by project. 9/8 - David Brown told me about site. 9/11 - Bryan T. looking to see if DR recorded. 9/21 - DR was recorded.* *NHP*

Populations	EO Number	EO Rank	Site Name	Number of Plants	Total estimated plants	Last Observed	Rank Date	Resilience Category	County	Protection	Notes
			Total	340,470							

Populations	Pop Number	EO Numbers	EO Rank	Site Name	Total estimated plants	Resilience Category	County	Last Observed
1	**23.000^**	**23.000**	A	Mill Creek Forest and Seep	>1000	very high	Polk	2016
2	**29.000^**	**29.000**	A	Island Creek Heath Bluff	>1000	very high	Burk	2016
3	**31.000*^**	**31.000**	C?	NCDOT TIP: R-2824	>1000	very high	Cata	2010
4	**32.000***	**32.000**	D	NCDOT TIP R-2824	100-500		Cata	2013
5	**44.000*^**	**44.000**	AB	Little Gunpowder Creek Rare Plant Site 1	500-1000	high	Cald	2015
6	**77.000***	**77.000**	CD	Little Gunpowder Creek Rare Plant Site 2	500-1000	high	Cald	2013
7	**87.000**	**87.000**	D	Catawba River: Lower Creek: Miller Creek	<100	low	Cald	2011
8	**93.000**	**34; 35**	D	West Shelby Mesic Slope	100-500	moderate		2016
9	**96.000**	**38; 39; 184**	A	Murrays Mill/Upper Balls Creek NA	>1000	very high		2013
10	**98.000**	**2; 3; 4; 60**	CD	Cat Square Heartleaf Forest	100-500	moderate		2012
11	**99.000**	**9; 10; 37; 52; 53; 55; 61; 62; 63; 75; 76; 79; 90; 121; 172; 181; 182; 249; 250; 251; 267; 268; 319**	A	Big Horse Creek Rare Plant Site	>1000	very high		2015
12	**100.000**	**14; 49; 50; 51; 73; 74; 149; 233; 235; 236; 237; 238; 239; 240; 241; 246**	A	Broad River/Sandy Run NA	>1000	very high		2012
13	**125.000^**	**125.000**	A	New Hope Springhead Swamp	>1000	very high	Polk	2016
14	**154.000^**	**157; 158**	C	Facebook Site	>1000	very high	Ruth	2016
17	**176.000**	**167; 168; 169; 170**	A	Davenport Road/Mountain View Rare Plant Site	>1000	very high		2016
18	**177.000**	**16; 107; 122; 163; 164; 165; 166**	A	Broad River: Floyds Creek	>1000	very high		2016
19	**178.000**	**159; 160; 161; 254; 255; 256; 280; 281; 282; 283; 284; 310**	A	Catawba River: Hoyle Crk-Micol Crk	>1000	very high		2013
20	**179.000**	**30; 162**	CD	South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	>1000	very high		2012
21	**206.000**	**206.000**	D	Buffalo Creek: Ravine	<100	low	Clev	2007
22	**208.000^**	**208.000**	A	Buffalo Creek: Potts Creek	<100	low	Clev	2012

Populations	Pop Number	EO Numbers	EO Rank	Site Name	Total estimated plants	Resilience Category	County	Last Observed
23	**214.000**	**201; 202; 203; 204; 205; 209; 212; 213**	A	Buffalo Creek: Tributaries N and S of SR 2047	>1000	very high		2012
24	**216.000**	**28; 196; 197; 198; 199; 200**	A	Buffalo Creek: Kings Mountain Res	>1000	very high		2016
25	**217.000**	**190; 191; 192; 193; 305**	B	Broad River: Brushy Creek	>1000	very high		2016
26	**227.000^**	**227.000**	A	Peaked Top Rare Plant Site/Foothills Landfill	>1000	very high	Cald	2014
27	**232.000**	**46; 231**	A?	Buffalo Creek Rare Plant Site	500-1000	high		2012
28	**243.000**	**12; 242; 269; 270**	AB	Jacob Fork West Corridor	>1000	very high		2012
29	**245.000**	**91; 113; 175**	AB	Floyds Creek Tributray Rare Plant Site	>1000	very high		2010
30	**247.000**	**13; 56; 80; 106; 114; 115; 173; 174; 286**	A	New Bethel Rare Plant Site	>1000	very high		2015
31	**248.000**	**40; 54**	C	Jonas Road Rare Plant Site	100-500	moderate		2005
32	**252.000**	**19; 20**	B	South Fork Catawba River, Henry Fork	100-500	moderate		2007
33	**271.000**	**271.000**	C?	Pott Creek	<100	low	Cata	2012
34	**272.000**	**272.000**	BC	No Business Creek, Boyd Tract	100-500	moderate	Clev	2007
35	**274.000**	**274.000**	A?	Broad River/Sandy Run NA	100-500	moderate	Clev	2012
36	**275.000***	**275.000**	C	Buffalo Shoals Creek	100-500	moderate	Ired	2014
37	**276.000^**	**276.000**	A	Cliffside Steam Station	>1000	very high	Clev/Ruth	2016
38	**277.000**	**277.000**	D	Hickory: Martin Marietta Quarry	extripated	extripated	Cata	2011
39	**279.000**	**279.000**	D?	Northeast Lincolnton: UT Walker Branch	<100	low	Linc	2009
40	**287.000**	**287.000**	AB	Fox Knoll Farm	???	unknown	Polk	2016
41	**291.000**	**291.000**	C	Gunpowder Creek	???	unknown	Cald	2012
42	**292.000**	**292.000**	D	Forest City: Adj to Isothermal CC	100-500	moderate	Ruth	2010
43	**293.000**	**293.000**	E	Killian Crossroads	???	unknown	Cata	2010
44	**295.000**	**21; 294; 313; 314**	B	Hickory Area	100-500	moderate		2016
45	**296.000**	**296.000**	CD	UT of Kings Mountain Res	100-500	moderate	Gast	2012
46	**297.000**	**297.000**	CD	Beaverdam Crk at First Broad River	???		Clev	2011
47	**298.000**	**298.000**	C	Brushy Creek Headwaters	100-500	moderate	Clev	2014
48	**299.000**	**299.000**	D	Lincoln County, SR-1314	<100	low	Linc	2014
49	**300.000**	**300.000**	D	Levan Family Farm	<100	low	Ired	2013
50	**302.000**	**47; 262**	A	Rhyne Conservation Preserve	>1000	very high		2016
51	**303.000**	**303.000**	AB	Smith Cliff/Henry Fork River	100-500	moderate	Burk	2015
52	**304.000**	**304.000**	B?	Simms Hill/Little River Uplands	100-500	moderate	Burk	2015
53	**306.000**	**306.000**	D	Fanjoy Road Site	<100	low	Ired	2015
54	**308.000**	**308.000**	C	Glade Creek, Alex County	>1000	very high	Alex	2017
55	**309.000**	**309.000**	D?	South Mountains Pleasant Grove Uplands	<100	low	Burk	2016
56	**311.000**	**311.000**	A	Collinsville (Hughes) Creek Slopes	100-500	moderate	Polk	2016
57	**312.000**	**312.000**	A	Richardson Creek trib above Toms Lake	>1000	very high	Ruth	2016

Populations	Pop Number	EO Numbers	EO Rank	Site Name	Total estimated plants	Resilience Category	County	Last Observed
58	**316.000**	**273; 315**	C	Northern Catawba County	???	unknown		2017
59	**317.000**	**317.000**	D	NCDOT TIP R-3603A	<100	low	Alex	2017
60	**318.000**	**318.000**	C	Burke County - Drowning Creek UT	100-500	moderate	Burk	2017
61	**320.000**	**320.000**	E	Hickory Creek - UT (Shelby High School)	<100	low	Clev	2016
62	**321.000**	**321.000**	B	Gunpowder Creek: South of Hudson	>1000	very high	Cald	2012

Populations	EO Number	EO ID Number	EO Rank	Site Name	Number of Plants			Last Observed	Rank Date	County	Protection	Notes	Who might know/contact
1	3	3852	H	Beaverdam Creek/3 mi east of Travelers Rest				1964	2009	GREE			
1	5	7689	CD	Sagittaria Hydrology Site		150	200	1991	2008	GREE			Doug Rayner (Wofford College) - emailed 12/12/17
1	6	1160	CD	Junction of SSR173 and SSR 262		75	100	1991	2008	GREE			
1	8	4875	BD	UT Beaverdam Creek/S-903		150		1991	2008	GREE			
1	15	1713	AC	DNR Bunched Arrowhead Preserve		1		1991	2010	GREE	Y	DNR Bunched Arrowhead Preserve	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
1	52	730	AC	DNR Belvue Springs Heritage Preserve		?		1999	2008	GREE		"numerous clumps", DNR Belvue Springs HP. Is this the same as the Bunched Arrowhead Preserve?	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
2	10	7931	H?	UT Enoree River				1985	2010	GREE			
2	51	6287	BC	DNR Clear Creek Heritage Preserve		1		1999	2008	GREE	Y	DNR Clear Creek Heritage Preserve	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
3	22	1649	BD	UT Tyger River/south of S-75		50	100	1991	2008	SPAR		same as 9058	
3	23	9058	BD	UT Tyger River/south of S-75						SPAR		same as 1649 (duplicate plant count)	
4	2	7399	BD	1.5 mi south of Gowensville/SC14		150		1991	2008	GREE			
4	4	3101	CD	Fairview Farms		75		1991	2008	SPAR			
4	24	6179	CD	UT Motlow Creek		50	100	1991	2008	SPAR			
4	32	5677	BD	Page Creek at Landrum HS		155		1991	2008	SPAR			
4	33	4879	BD	NW of Junction SC11 and SC14		168		1991	2008	GREE			
4	36	1993	BD	Clear Branch Creek		303		1991	2008	SPAR			
4	38	3367	BD	UT Spivey Creek	+	1000		1991	2008	SPAR			Doug Rayner (Wofford College) - emailed 12/12/17
4	39	8503	CD	1 mi SW of US176 and S-209 in Ingleside		66		1991	2008	SPAR			
4	40	8504	BD	UT Clear Branch Creek		221		1991	2008	SPAR			
4	41	1460	CD	SC 14 and High Farm Road		50	100	1991	2008	SPAR			
4	42	8856	BD	1/4 mi E of SC14 and South Pacolet River		189		1991	2008	GREE/SPAR			
4	49	1450	AB	UT Page Creek/Campbell Ave		750	800	2001	2008	SPAR	?	2001 "new Spartanburg Water Systems preserve"	Spartanburg Water System (who?)
4	50	1449	BD	Page Creek Sewer Line		400	550	2001	2008	SPAR	?	2001 "an easment is being sought"	Spartanburg Water System (who?)
4	54	2719	BD	Headwater UT Wolfe Creek		400		2001	2008	SPAR	?	"On City of Landrum Property"	
4	59	13002	BD	Beaver Dam Creek/MetCalf		250	500	2005	2011	SPAR			
5	30	6009	BD	Greene Creek		100		1994	2008	SPAR			
6	25	878	CD	Lake William Bowen		10	20	1991	2008	SPAR			
7	37	6749	CD	Bear Creek		56		1991	2008	SPAR			
8	35	108	BD	Alverson Grove Church		74		1991	2008	SPAR			
9	34	7788	BD	Arrowood Branch		13		1991	2008	SPAR			
10	31	1730	H?	Blalock Res Site P				1984	2009	SPAR		NCNHP includes EO 7 and 31 as Blalock sites, 5-YR Review includes EO 7 and 29. 2km rule groups EO 7 and 29 together with EO 31 separate (>2km) but close by.	Spartanburg Water System (who?)
11	7	7013	BD	Taylor Blalock Res		3505		2016	2008	SPAR		James Padgett partially remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive, use two files in combination (data from L. Robinson 09.28.17); Sites (2 Eos) last visited in 2016, 351 plants in plots, extrapolated for site - 3,505 plants. Site includes all EOs in orange.	Spartanburg Water System (who?) or Gaddy
11	29	6010	H?	Blalock Res Site C				1984	2009	SPAR			Spartanburg Water System (who?)
12	20	3552	BD	Camp Mary Elizabeth		150		1991	2008	SPAR	?	Girl Scouts of America	Fred Parrish
12	21	1984	BD	Beaverdam Creek/Claggett Raintree		700		1991	2008	SPAR	?	SC Nature Conservancy	Kristen Austin (TNC SC) emailed 12/12/17, or Fred Parrish
12	55	2486	CD	UT North Tyger River/Woodridge		50		2001	2008	SPAR			
13	9	7930	CD	Chinquapin Creek		?		1991	2008	SPAR		"two small colonies"	Fred Parrish
13	13	6456	BD	UT Cleveland Park Lake		50		1991	2008	SPAR	?	City of Spartanburg - Cleveland Park	Fred Parrish
13	19	3551	BC	USC-Upstate		25	50	1991	2008	SPAR			Doug Rayner (Wofford College) - emailed 12/12/17
13	46	2369	CD	Shoally Creek		25		1998	2008	SPAR			
13	53	8981	BC	USC-Upstate		250	300	2000	2008	SPAR		Is this a part of other USC population?	Doug Rayner (Wofford College) - emailed 12/12/17
13	56	6523	BD	Lawsons Fork Creek on US221		200	250	2001	2008	SPAR			
14	11	6097	AB	DNR Peters Creek Heritage Preserve		3306		2016	2008	SPAR	Y	DNR Peters Creek Heritage Preserve; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Site last visited in 2016, only EO11 was monitored but high accuracy mapping was obtained for other EOs, 335 plants in plots, extrapolated for site - 3,306 plants. Site includes all EOs in purple.	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	14	2791	AB	DNR Peters Creek Heritage Preserve		5000		1991	2008	SPAR	Y	DNR Peters Creek Heritage Preserve, Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	26	5183	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	27	4476	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	28	8667	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	47	6953	U	Cannon Campground Road and Kelly Road				1998	2008	SPAR			
14	48	2769	U	Kelly Road				1998	2008	SPAR			
14	57	4312	BD	Lincoln Memorial Cem/Cannon Campground Rd		450	600	1997	2012	SPAR			
15	16	916	BC	Cowpens NBF - Site 1		2823		2016	2008	CHER		US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Sites (all 3 Eos) last visited in 2016, 322 plants in plots, extrapolated for site - 2,823 plants. Site includes all EOs in green.	Park manager (who?) or NCNHP

Populations	EO Number	EO ID Number	EO Rank	Site Name	Number of Plants			Last Observed	Rank Date	County	Protection	Notes	Who might know/contact
15	17	5173	BC	Cowpens NBF - Site 3	+	130		1991	2008	CHER	Y	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17)	Park manager (who?) or NCNHP
15	18	6825	BC	Cowpens NBF - Site 2		50		1991	2008	CHER	Y	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17)	Park manager (who?) or NCNHP
16	1	235	BD	Cherokee Creek/SC 11		200		1991	2008	CHER			
16	44	3124	H?	SW side of SC 11 - 5.45 mi NW of I-85				1984	2009	CHER			
16	45	5554	U	Lenzer Circle				1989	2008	CHER			
16	60	13003	BD	Cherokee Creek/Bonner and Robin School Roads		1500		2004	2011	CHER			
17	43	7286	CD	McKee Drive		20		1991	2008	CHER			
18	12	1322	H?	Horse Creek				1986	2012	CHER			
				Boulder Creek Subdivision - Jordan Road		15	20	2006		GREE	Y	"25-foot protective buffer will be fenced and maintained in restrictive covenants" (per FWS Log No 2006-I-0420); 8-acres, Greer, SC, recorded RCs, est. 15-20 plants, management plan not in place (F. Holleman 12/12/17)	April Punsalan
				Gateway Elementary School						GREE		"number of clumps around trees near streams" (F. Hollemon 12/12/17)	

Populations	EO Number	EO Rank	Site Name	Total Estimated Plants	Resilience Category	Last Observed	County	Notes	RNR Notes
1	7; 29	BD	Taylor Blalock Res	>1000	Very High	2016	SPAR	James Padgett partially remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive, use two files in combination (data from L. Robinson 09.28.17); Sites (2 Eos) last visited in 2016, 351 plants in plots, extrapolated for site - 3,505 plants. Site includes all EOs in orange.	
2	11; 14; 26; 27; 28; 47; 48; 57	AB	DNR Peters Creek Heritage Preserve	>1000	Very High	2016	SPAR	DNR Peters Creek Heritage Preserve; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Site last visited in 2016, only EO11 was monitored but high accuracy mapping was obtained for other EOs, 335 plants in plots, extrapolated for site - 3,306 plants. Site includes all EOs in purple.	
3	16; 17; 18	BC	Cowpens NBF - Site 1	>1000	Very High	2016	CHER	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Sites (all 3 Eos) last visited in 2016, 322 plants in plots, extrapolated for site - 2,823 plants. Site includes all EOs in green.	
4	?	?	Boulder Creek Subdivision - Jordan Road	<100	Low	2016	GREE	"25-foot protective buffer will be fenced and maintained in restrictive covenants" (per FWS Log No 2006-I-0420); 8-acres, Greer, SC, recorded RCs, est. 15-20 plants, management plan not in place (F. Holleman 12/12/17). Last seen in 2016 per F. Hollemon (02/06/18).	Two locations [redacted] and [redacted]. Coordinates located from paper maps.
5	?	?	Gateway Elementary School	<100	Low	2017	GREE	"number of clumps around trees near streams" (F. Hollemon 12/12/17). Last seen in 2017, not a full survey just noticed plants likely additional plants in wooded area. Plants located directly behind school per F. Hollemon (02/06/18)	"Directly behind school" is approximately [redacted]

Populations	EO Number	EO ID Number	EO Rank	Site Name	Number of Plants			Last Observed	Rank Date	County	Protection	Notes	Who might know/contact
1	3	3852	H	Beaverdam Creek/3 mi east of Travelers Rest				1964	2009	GREE			
1	5	7689	CD	Sagittaria Hydrology Site		150	200	1991	2008	GREE			Doug Rayner (Wofford College) - emailed 12/12/17
1	6	1160	CD	Junction of SSR173 and SSR 262		75	100	1991	2008	GREE			
1	8	4875	BD	UT Beaverdam Creek/S-903		150		1991	2008	GREE			
1	15	1713	AC	DNR Bunched Arrowhead Preserve		1		1991	2010	GREE	Y	DNR Bunched Arrowhead Preserve	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
1	52	730	AC	DNR Belvue Springs Heritage Preserve		?		1999	2008	GREE		"numerous clumps", DNR Belvue Springs HP. Is this the same as the Bunched Arrowhead Preserve?	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
2	10	7931	H?	UT Enoree River				1985	2010	GREE			
2	51	6287	BC	DNR Clear Creek Heritage Preserve		1		1999	2008	GREE	Y	DNR Clear Creek Heritage Preserve	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
3	22	1649	BD	UT Tyger River/south of S-75		50	100	1991	2008	SPAR		same as 9058	
3	23	9058	BD	UT Tyger River/south of S-75						SPAR		same as 1649 (duplicate plant count)	
4	2	7399	BD	1.5 mi south of Gowensville/SC14		150		1991	2008	GREE			
4	4	3101	CD	Fairview Farms		75		1991	2008	SPAR			
4	24	6179	CD	UT Motlow Creek		50	100	1991	2008	SPAR			
4	32	5677	BD	Page Creek at Landrum HS		155		1991	2008	SPAR			
4	33	4879	BD	NW of Junction SC11 and SC14		168		1991	2008	GREE			
4	36	1993	BD	Clear Branch Creek		303		1991	2008	SPAR			
4	38	3367	BD	UT Spivey Creek	+	1000		1991	2008	SPAR			Doug Rayner (Wofford College) - emailed 12/12/17
4	39	8503	CD	1 mi SW of US176 and S-209 in Ingleside		66		1991	2008	SPAR			
4	40	8504	BD	UT Clear Branch Creek		221		1991	2008	SPAR			
4	41	1460	CD	SC 14 and High Farm Road		50	100	1991	2008	SPAR			
4	42	8856	BD	1/4 mi E of SC14 and South Pacolet River		189		1991	2008	GREE/SPAR			
4	49	1450	AB	UT Page Creek/Campbell Ave		750	800	2001	2008	SPAR	?	2001 "new Spartanburg Water Systems preserve"	Spartanburg Water System (who?)
4	50	1449	BD	Page Creek Sewer Line		400	550	2001	2008	SPAR	?	2001 "an easment is being sought"	Spartanburg Water System (who?)
4	54	2719	BD	Headwater UT Wolfe Creek		400		2001	2008	SPAR	?	"On City of Landrum Property"	
4	59	13002	BD	Beaver Dam Creek/MetCalf		250	500	2005	2011	SPAR			
5	30	6009	BD	Greene Creek		100		1994	2008	SPAR			
6	25	878	CD	Lake William Bowen		10	20	1991	2008	SPAR			
7	37	6749	CD	Bear Creek		56		1991	2008	SPAR			
8	35	108	BD	Alverson Grove Church		74		1991	2008	SPAR			
9	34	7788	BD	Arrowood Branch		13		1991	2008	SPAR			
10	31	1730	H?	Blalock Res Site P				1984	2009	SPAR		NCNHP includes EO 7 and 31 as Blalock sites, 5-YR Review includes EO 7 and 29. 2km rule groups EO 7 and 29 together with EO 31 separate (>2km) but close by.	Spartanburg Water System (who?)
11	7	7013	BD	Taylor Blalock Res		3505		2016	2008	SPAR		James Padgett partially remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive, use two files in combination (data from L. Robinson 09.28.17); Sites (2 Eos) last visited in 2016, 351 plants in plots, extrapolated for site - 3,505 plants. Site includes all EOs in orange.	Spartanburg Water System (who?) or Gaddy
11	29	6010	H?	Blalock Res Site C				1984	2009	SPAR			Spartanburg Water System (who?)
12	20	3552	BD	Camp Mary Elizabeth		150		1991	2008	SPAR	?	Girl Scouts of America	Fred Parrish
12	21	1984	BD	Beaverdam Creek/Claggett Raintree		700		1991	2008	SPAR	?	SC Nature Conservancy	Kristen Austin (TNC SC) emailed 12/12/17, or Fred Parrish
12	55	2486	CD	UT North Tyger River/Woodridge		50		2001	2008	SPAR			
13	9	7930	CD	Chinquapin Creek		?		1991	2008	SPAR		"two small colonies"	Fred Parrish
13	13	6456	BD	UT Cleveland Park Lake		50		1991	2008	SPAR	?	City of Spartanburg - Cleveland Park	Fred Parrish
13	19	3551	BC	USC-Upstate		25	50	1991	2008	SPAR			Doug Rayner (Wofford College) - emailed 12/12/17
13	46	2369	CD	Shoally Creek		25		1998	2008	SPAR			
13	53	8981	BC	USC-Upstate		250	300	2000	2008	SPAR		Is this a part of other USC population?	Doug Rayner (Wofford College) - emailed 12/12/17
13	56	6523	BD	Lawsons Fork Creek on US221		200	250	2001	2008	SPAR			
14	11	6097	AB	DNR Peters Creek Heritage Preserve		3306		2016	2008	SPAR	Y	DNR Peters Creek Heritage Preserve; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Site last visited in 2016, only EO11 was monitored but high accuracy mapping was obtained for other EOs, 335 plants in plots, extrapolated for site - 3,306 plants. Site includes all EOs in purple.	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	14	2791	AB	DNR Peters Creek Heritage Preserve		5000		1991	2008	SPAR	Y	DNR Peters Creek Heritage Preserve, Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	26	5183	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	27	4476	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	28	8667	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	47	6953	U	Cannon Campground Road and Kelly Road				1998	2008	SPAR			
14	48	2769	U	Kelly Road				1998	2008	SPAR			
14	57	4312	BD	Lincoln Memorial Cem/Cannon Campground Rd		450	600	1997	2012	SPAR			
15	16	916	BC	Cowpens NBF - Site 1		2823		2016	2008	CHER		US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Sites (all 3 Eos) last visited in 2016, 322 plants in plots, extrapolated for site - 2,823 plants. Site includes all EOs in green.	Park manager (who?) or NCNHP
15	17	5173	BC	Cowpens NBF - Site 3	+	130		1991	2008	CHER	Y	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17)	Park manager (who?) or NCNHP

Populations	EO Number	EO ID Number	EO Rank	Site Name	Number of Plants			Last Observed	Rank Date	County	Protection	Notes	Who might know/contact
15	18	6825	BC	Cowpens NBF - Site 2		50		1991	2008	CHER	Y	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17)	Park manager (who?) or NCNHP
16	1	235	BD	Cherokee Creek/SC 11		200		1991	2008	CHER			
16	44	3124	H?	SW side of SC 11 - 5.45 mi NW of I-85				1984	2009	CHER			
16	45	5554	U	Lenzer Circle				1989	2008	CHER			
16	60	13003	BD	Cherokee Creek/Bonner and Robin School Roads		1500		2004	2011	CHER			
17	43	7286	CD	McKee Drive		20		1991	2008	CHER			
18	12	1322	H?	Horse Creek				1986	2012	CHER			
				Boulder Creek Subdivision - Jordan Road		15	20	2006		GREE	Y	"25-foot protective buffer will be fenced and maintained in restrictive covenants" (per FWS Log No 2006-I-0420); 8-acres, Greer, SC, recorded RCs, est. 15-20 plants, management plan not in place (F. Holleman 12/12/17)	April Punsalan
				Gateway Elementary School						GREE		"number of clumps around trees near streams" (F. Hollemon 12/12/17)	

Populations	EO Number	EO Rank	Site Name	Total Estimated Plants	Resilience Category	Last Observed	County	Notes	RNR Notes
1	7; 29	BD	Taylor Blalock Res	>1000	Very High	2016	SPAR	James Padgett partially remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive, use two files in combination (data from L. Robinson 09.28.17); Sites (2 Eos) last visited in 2016, 351 plants in plots, extrapolated for site - 3,505 plants. Site includes all EOs in orange.	
2	11; 14; 26; 27; 28; 47; 48; 57	AB	DNR Peters Creek Heritage Preserve	>1000	Very High	2016	SPAR	DNR Peters Creek Heritage Preserve; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Site last visited in 2016, only EO11 was monitored but high accuracy mapping was obtained for other EOs, 335 plants in plots, extrapolated for site - 3,306 plants. Site includes all EOs in purple.	
3	16; 17; 18	BC	Cowpens NBF - Site 1	>1000	Very High	2016	CHER	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Sites (all 3 Eos) last visited in 2016, 322 plants in plots, extrapolated for site - 2,823 plants. Site includes all EOs in green.	
4			Boulder Creek Subdivision - Jordan Road	<100	Low	2016	GREE	"25-foot protective buffer will be fenced and maintained in restrictive covenants" (per FWS Log No 2006-I-0420); 8-acres, Greer, SC, recorded RCs, est. 15-20 plants, management plan not in place (F. Holleman 12/12/17). Last seen in 2016 per F. Hollemon (02/06/18).	Not in EO data. Two locations [redacted] and [redacted] Coordinates located from paper maps.
5			Gateway Elementary School	<100	Low	2017	GREE	"number of clumps around trees near streams" (F. Hollemon 12/12/17). Last seen in 2017, not a full survey just noticed plants likely additional plants in wooded area. Plants located directly behind school per F. Hollemon (02/06/18)	Not in EO data. "Directly behind school" is approximately [redacted]

Populations	EO Number	EO ID Number	EO Rank	Site Name	Number of Plants			Last Observed	Rank Date	County	Protection	Notes	Who might know/contact
1	3	3852	H	Beaverdam Creek/3 mi east of Travelers Rest				1964	2009	GREE			
1	5	7689	CD	Sagittaria Hydrology Site		150	200	1991	2008	GREE			Doug Rayner (Wofford College) - emailed 12/12/17
1	6	1160	CD	Junction of SSR173 and SSR 262		75	100	1991	2008	GREE			
1	8	4875	BD	UT Beaverdam Creek/S-903		150		1991	2008	GREE			
1	15	1713	AC	DNR Bunched Arrowhead Preserve		1		1991	2010	GREE	Y	DNR Bunched Arrowhead Preserve	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
1	52	730	AC	DNR Belvue Springs Heritage Preserve		?		1999	2008	GREE		"numerous clumps", DNR Belvue Springs HP. Is this the same as the Bunched Arrowhead Preserve?	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
2	10	7931	H?	UT Enoree River				1985	2010	GREE			
2	51	6287	BC	DNR Clear Creek Heritage Preserve		1		1999	2008	GREE	Y	DNR Clear Creek Heritage Preserve	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
3	22	1649	BD	UT Tyger River/south of S-75		50	100	1991	2008	SPAR		same as 9058	
3	23	9058	BD	UT Tyger River/south of S-75						SPAR		same as 1649 (duplicate plant count)	
4	2	7399	BD	1.5 mi south of Gowensville/SC14		150		1991	2008	GREE			
4	4	3101	CD	Fairview Farms		75		1991	2008	SPAR			
4	24	6179	CD	UT Motlow Creek		50	100	1991	2008	SPAR			
4	32	5677	BD	Page Creek at Landrum HS		155		1991	2008	SPAR			
4	33	4879	BD	NW of Junction SC11 and SC14		168		1991	2008	GREE			
4	36	1993	BD	Clear Branch Creek		303		1991	2008	SPAR			
4	38	3367	BD	UT Spivey Creek	+	1000		1991	2008	SPAR			Doug Rayner (Wofford College) - emailed 12/12/17
4	39	8503	CD	1 mi SW of US176 and S-209 in Ingleside		66		1991	2008	SPAR			
4	40	8504	BD	UT Clear Branch Creek		221		1991	2008	SPAR			
4	41	1460	CD	SC 14 and High Farm Road		50	100	1991	2008	SPAR			
4	42	8856	BD	1/4 mi E of SC14 and South Pacolet River		189		1991	2008	GREE/SPAR			
4	49	1450	AB	UT Page Creek/Campbell Ave		750	800	2001	2008	SPAR	?	2001 "new Spartanburg Water Systems preserve"	Spartanburg Water System (who?)
4	50	1449	BD	Page Creek Sewer Line		400	550	2001	2008	SPAR	?	2001 "an easment is being sought"	Spartanburg Water System (who?)
4	54	2719	BD	Headwater UT Wolfe Creek		400		2001	2008	SPAR	?	"On City of Landrum Property"	
4	59	13002	BD	Beaver Dam Creek/MetCalf		250	500	2005	2011	SPAR			
5	30	6009	BD	Greene Creek		100		1994	2008	SPAR			
6	25	878	CD	Lake William Bowen		10	20	1991	2008	SPAR			
7	37	6749	CD	Bear Creek		56		1991	2008	SPAR			
8	35	108	BD	Alverson Grove Church		74		1991	2008	SPAR			
9	34	7788	BD	Arrowood Branch		13		1991	2008	SPAR			
10	31	1730	H?	Blalock Res Site P				1984	2009	SPAR		NCNHP includes EO 7 and 31 as Blalock sites, 5-YR Review includes EO 7 and 29. 2km rule groups EO 7 and 29 together with EO 31 separate (>2km) but close by.	Spartanburg Water System (who?)
11	7	7013	BD	Taylor Blalock Res		3505		2016	2008	SPAR		James Padgett partially remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive, use two files in combination (data from L. Robinson 09.28.17); Sites (2 Eos) last visited in 2016, 351 plants in plots, extrapolated for site - 3,505 plants. Site includes all EOs in orange.	Spartanburg Water System (who?) or Gaddy
11	29	6010	H?	Blalock Res Site C				1984	2009	SPAR			Spartanburg Water System (who?)
12	20	3552	BD	Camp Mary Elizabeth		150		1991	2008	SPAR	?	Girl Scouts of America	Fred Parrish
12	21	1984	BD	Beaverdam Creek/Claggett Raintree		700		1991	2008	SPAR	?	SC Nature Conservancy	Kristen Austin (TNC SC) emailed 12/12/17, or Fred Parrish
12	55	2486	CD	UT North Tyger River/Woodridge		50		2001	2008	SPAR			
13	9	7930	CD	Chinquapin Creek		?		1991	2008	SPAR		"two small colonies"	Fred Parrish
13	13	6456	BD	UT Cleveland Park Lake		50		1991	2008	SPAR	?	City of Spartanburg - Cleveland Park	Fred Parrish
13	19	3551	BC	USC-Upstate		25	50	1991	2008	SPAR			Doug Rayner (Wofford College) - emailed 12/12/17
13	46	2369	CD	Shoally Creek		25		1998	2008	SPAR			
13	53	8981	BC	USC-Upstate		250	300	2000	2008	SPAR		Is this a part of other USC population?	Doug Rayner (Wofford College) - emailed 12/12/17
13	56	6523	BD	Lawsons Fork Creek on US221		200	250	2001	2008	SPAR			
14	11	6097	AB	DNR Peters Creek Heritage Preserve		3306		2016	2008	SPAR	Y	DNR Peters Creek Heritage Preserve; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Site last visited in 2016, only EO11 was monitored but high accuracy mapping was obtained for other EOs, 335 plants in plots, extrapolated for site - 3,306 plants. Site includes all EOs in purple.	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	14	2791	AB	DNR Peters Creek Heritage Preserve		5000		1991	2008	SPAR	Y	DNR Peters Creek Heritage Preserve, Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	26	5183	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	27	4476	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	28	8667	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	47	6953	U	Cannon Campground Road and Kelly Road				1998	2008	SPAR			
14	48	2769	U	Kelly Road				1998	2008	SPAR			
14	57	4312	BD	Lincoln Memorial Cem/Cannon Campground Rd		450	600	1997	2012	SPAR			
15	16	916	BC	Cowpens NBF - Site 1		2823		2016	2008	CHER		US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Sites (all 3 Eos) last visited in 2016, 322 plants in plots, extrapolated for site - 2,823 plants. Site includes all EOs in green.	Park manager (who?) or NCNHP

Populations	EO Number	EO ID Number	EO Rank	Site Name	Number of Plants			Last Observed	Rank Date	County	Protection	Notes	Who might know/contact
15	17	5173	BC	Cowpens NBF - Site 3	+	130		1991	2008	CHER	Y	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17)	Park manager (who?) or NCNHP
15	18	6825	BC	Cowpens NBF - Site 2		50		1991	2008	CHER	Y	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17)	Park manager (who?) or NCNHP
16	1	235	BD	Cherokee Creek/SC 11		200		1991	2008	CHER			
16	44	3124	H?	SW side of SC 11 - 5.45 mi NW of I-85				1984	2009	CHER			
16	45	5554	U	Lenzer Circle				1989	2008	CHER			
16	60	13003	BD	Cherokee Creek/Bonner and Robin School Roads		1500		2004	2011	CHER			
17	43	7286	CD	McKee Drive		20		1991	2008	CHER			
18	12	1322	H?	Horse Creek				1986	2012	CHER			
				Boulder Creek Subdivision - Jordan Road		15	20	2006		GREE	Y	"25-foot protective buffer will be fenced and maintained in restrictive covenants" (per FWS Log No 2006-I-0420); 8-acres, Greer, SC, recorded RCs, est. 15-20 plants, management plan not in place (F. Holleman 12/12/17)	April Punsalan
				Gateway Elementary School						GREE		"number of clumps around trees near streams" (F. Hollemon 12/12/17)	

Populations	EO Number	EO Rank	Site Name	Total Estimated Plants	Resilience Category	Last Observed	County	Notes	RNR Notes
1	7; 29	BD	Taylor Blalock Res	>1000	Very High	2016	SPAR	James Padgett partially remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive, use two files in combination (data from L. Robinson 09.28.17); Sites (2 Eos) last visited in 2016, 351 plants in plots, extrapolated for site - 3,505 plants. Site includes all EOs in orange.	
2	11; 14; 26; 27; 28; 47; 48; 57	AB	DNR Peters Creek Heritage Preserve	>1000	Very High	2016	SPAR	DNR Peters Creek Heritage Preserve; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Site last visited in 2016, only EO11 was monitored but high accuracy mapping was obtained for other EOs, 335 plants in plots, extrapolated for site - 3,306 plants. Site includes all EOs in purple.	
3	16; 17; 18	BC	Cowpens NBF - Site 1	>1000	Very High	2016	CHER	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Sites (all 3 Eos) last visited in 2016, 322 plants in plots, extrapolated for site - 2,823 plants. Site includes all EOs in green.	
4	?	?	Boulder Creek Subdivision - Jordan Road	<100	Low	2016	GREE	"25-foot protective buffer will be fenced and maintained in restrictive covenants" (per FWS Log No 2006-I-0420); 8-acres, Greer, SC, recorded RCs, est. 15-20 plants, management plan not in place (F. Holleman 12/12/17). Last seen in 2016 per F. Hollemon (02/06/18).	Two locations [redacted] and [redacted]. Coordinates located from paper maps.
5	?	?	Gateway Elementary School	<100	Low	2017	GREE	"number of clumps around trees near streams" (F. Hollemon 12/12/17). Last seen in 2017, not a full survey just noticed plants likely additional plants in wooded area. Plants located directly behind school per F. Hollemon (02/06/18)	"Directly behind school" is approximately [redacted]

Populations	EO Number	EO ID Number	EO Rank	Site Name	Number of Plants			Last Observed	Rank Date	County	Protection	Notes	Who might know/contact
1	3	3852	H	Beaverdam Creek/3 mi east of Travelers Rest				1964	2009	GREE			
1	5	7689	CD	Sagittaria Hydrology Site		150	200	1991	2008	GREE			Doug Rayner (Wofford College) - emailed 12/12/17
1	6	1160	CD	Junction of SSR173 and SSR 262		75	100	1991	2008	GREE			
1	8	4875	BD	UT Beaverdam Creek/S-903		150		1991	2008	GREE			
1	15	1713	AC	DNR Bunched Arrowhead Preserve		1		1991	2010	GREE	Y	DNR Bunched Arrowhead Preserve	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
1	52	730	AC	DNR Belvue Springs Heritage Preserve		?		1999	2008	GREE		"numerous clumps", DNR Belvue Springs HP. Is this the same as the Bunched Arrowhead Preserve?	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
2	10	7931	H?	UT Enoree River				1985	2010	GREE			
2	51	6287	BC	DNR Clear Creek Heritage Preserve		1		1999	2008	GREE	Y	DNR Clear Creek Heritage Preserve	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
3	22	1649	BD	UT Tyger River/south of S-75		50	100	1991	2008	SPAR		same as 9058	
3	23	9058	BD	UT Tyger River/south of S-75						SPAR		same as 1649 (duplicate plant count)	
4	2	7399	BD	1.5 mi south of Gowensville/SC14		150		1991	2008	GREE			
4	4	3101	CD	Fairview Farms		75		1991	2008	SPAR			
4	24	6179	CD	UT Motlow Creek		50	100	1991	2008	SPAR			
4	32	5677	BD	Page Creek at Landrum HS		155		1991	2008	SPAR			
4	33	4879	BD	NW of Junction SC11 and SC14		168		1991	2008	GREE			
4	36	1993	BD	Clear Branch Creek		303		1991	2008	SPAR			
4	38	3367	BD	UT Spivey Creek	+	1000		1991	2008	SPAR			Doug Rayner (Wofford College) - emailed 12/12/17
4	39	8503	CD	1 mi SW of US176 and S-209 in Ingleside		66		1991	2008	SPAR			
4	40	8504	BD	UT Clear Branch Creek		221		1991	2008	SPAR			
4	41	1460	CD	SC 14 and High Farm Road		50	100	1991	2008	SPAR			
4	42	8856	BD	1/4 mi E of SC14 and South Pacolet River		189		1991	2008	GREE/SPAR			
4	49	1450	AB	UT Page Creek/Campbell Ave		750	800	2001	2008	SPAR	?	2001: "new Spartanburg Water Systems preserve"	Spartanburg Water System (who?)
4	50	1449	BD	Page Creek Sewer Line		400	550	2001	2008	SPAR	?	2001: "an easment is being sought"	Spartanburg Water System (who?)
4	54	2719	BD	Headwater UT Wolfe Creek		400		2001	2008	SPAR	?	"On City of Landrum Property"	
4	59	13002	BD	Beaver Dam Creek/MetCalf		250	500	2005	2011	SPAR			
5	30	6009	BD	Greene Creek		100		1994	2008	SPAR			
6	25	878	CD	Lake William Bowen		10	20	1991	2008	SPAR			
7	37	6749	CD	Bear Creek		56		1991	2008	SPAR			
8	35	108	BD	Alverson Grove Church		74		1991	2008	SPAR			
9	34	7788	BD	Arrowood Branch		13		1991	2008	SPAR			
10	31	1730	H?	Blalock Res Site P				1984	2009	SPAR		NCNHP includes EO 7 and 31 as Blalock sites, 5-YR Review includes EO 7 and 29. 2km rule groups EO 7 and 29 together with EO 31 separate (>2km) but close by.	Spartanburg Water System (who?)
11	7	7013	BD	Taylor Blalock Res		3505		2016	2008	SPAR		James Padgett partially remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive, use two files in combination (data from L. Robinson 09.28.17); Sites (2 Eos) last visited in 2016, 351 plants in plots, extrapolated for site - 3,505 plants. Site includes all EOs in orange.	Spartanburg Water System (who?) or Gaddy
11	29	6010	H?	Blalock Res Site C				1984	2009	SPAR			Spartanburg Water System (who?)
12	20	3552	BD	Camp Mary Elizabeth		150		1991	2008	SPAR	?	Girl Scouts of America	Fred Parrish
12	21	1984	BD	Beaverdam Creek/Claggett Raintree		700		1991	2008	SPAR	?	SC Nature Conservancy	Kristen Austin (TNC SC) emailed 12/12/17, or Fred Parrish
12	55	2486	CD	UT North Tyger River/Woodridge		50		2001	2008	SPAR			
13	9	7930	CD	Chinquapin Creek		?		1991	2008	SPAR		"two small colonies"	Fred Parrish
13	13	6456	BD	UT Cleveland Park Lake		50		1991	2008	SPAR	?	City of Spartanburg - Cleveland Park	Fred Parrish
13	19	3551	BC	USC-Upstate		25	50	1991	2008	SPAR			Doug Rayner (Wofford College) - emailed 12/12/17
13	46	2369	CD	Shoally Creek		25		1998	2008	SPAR			
13	53	8981	BC	USC-Upstate		250	300	2000	2008	SPAR		Is this a part of other USC population?	Doug Rayner (Wofford College) - emailed 12/12/17
13	56	6523	BD	Lawsons Fork Creek on US221		200	250	2001	2008	SPAR			
14	11	6097	AB	DNR Peters Creek Heritage Preserve		3306		2016	2008	SPAR	Y	DNR Peters Creek Heritage Preserve; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Site last visited in 2016, only EO11 was monitored but high accuracy mapping was obtained for other EOs, 335 plants in plots, extrapolated for site - 3,306 plants. Site includes all EOs in purple.	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	14	2791	AB	DNR Peters Creek Heritage Preserve		5000		1991	2008	SPAR	Y	DNR Peters Creek Heritage Preserve, Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	26	5183	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	27	4476	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	28	8667	BD	Peters Creek Dwarf-flowered Heartleaf Site		5000		1991	2008	SPAR	?	Is this part of the Heritage Preserve? Part of a very large population (5000 plants total)	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
14	47	6953	U	Cannon Campground Road and Kelly Road				1998	2008	SPAR			
14	48	2769	U	Kelly Road				1998	2008	SPAR			
14	57	4312	BD	Lincoln Memorial Cem/Cannon Campground Rd		450	600	1997	2012	SPAR			
15	16	916	BC	Cowpens NBF - Site 1		2823		2016	2008	CHER		US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Sites (all 3 Eos) last visited in 2016, 322 plants in plots, extrapolated for site - 2,823 plants. Site includes all EOs in green.	Park manager (who?) or NCNHP
15	17	5173	BC	Cowpens NBF - Site 3	+	130		1991	2008	CHER	Y	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17)	Park manager (who?) or NCNHP

Populations	EO Number	EO ID Number	EO Rank	Site Name	Number of Plants			Last Observed	Rank Date	County	Protection	Notes	Who might know/contact
15	18	6825	BC	Cowpens NBF - Site 2		50		1991	2008	CHER	Y	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17)	Park manager (who?) or NCNHP
16	1	235	BD	Cherokee Creek/SC 11		200		1991	2008	CHER			
16	44	3124	H?	SW side of SC 11 - 5.45 mi NW of I-85				1984	2009	CHER			
16	45	5554	U	Lenzer Circle				1989	2008	CHER			
16	60	13003	BD	Cherokee Creek/Bonner and Robin School Roads		1500		2004	2011	CHER			
17	43	7286	CD	McKee Drive		20		1991	2008	CHER			
18	12	1322	H?	Horse Creek				1986	2012	CHER			
				Boulder Creek Subdivision - Jordan Road		15	20	2006		GREE	Y	"25-foot protective buffer will be fenced and maintained in restrictive covenants" (per FWS Log No 2006-I-0420); 8-acres, Greer, SC, recorded RCs, est. 15-20 plants, management plan not in place (F. Holleman 12/12/17)	April Punsalan
				Gateway Elementary School						GREE		"number of clumps around trees near streams" (F. Hollemon 12/12/17)	

Populations	EO Number	EO Rank	Site Name	Total Estimated Plants	Resilience Category	Last Observed	County	Notes	Who might know/contact
1	7; 29	BD	Taylor Blalock Res	>1000	Very High	2016	SPAR	James Padgett partially remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive, use two files in combination (data from L. Robinson 09.28.17); Sites (2 Eos) last visited in 2016, 351 plants in plots, extrapolated for site - 3,505 plants. Site includes all EOs in orange.	Spartanburg Water System (who?) or Gaddy
2	11; 14; 26; 27; 28; 47; 48; 57	AB	DNR Peters Creek Heritage Preserve	>1000	Very High	2016	SPAR	DNR Peters Creek Heritage Preserve; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Site last visited in 2016, only EO11 was monitored but high accuracy mapping was obtained for other EOs, 335 plants in plots, extrapolated for site - 3,306 plants. Site includes all EOs in purple.	Pat Cloninger (Preserve Manager) - emailed 12/12/17, ask Fred Parrish too
3	16; 17; 18	BC	Cowpens NBF - Site 1	>1000	Very High	2016	CHER	US National Park Service; James Padgett remapped site in 2012, included in "HENA Polygons (3) in SC" on Drive (data from L. Robinson 09.28.17); Sites (all 3 Eos) last visited in 2016, 322 plants in plots, extrapolated for site - 2,823 plants. Site includes all EOs in green.	Park manager (who?) or NCNHP
4	?	?	Boulder Creek Subdivision - Jordan Road	<100	Low	2017	GREE	"25-foot protective buffer will be fenced and maintained in restrictive covenants" (per FWS Log No 2006-I-0420); 8-acres, Greer, SC, recorded RCs, est. 15-20 plants, management plan not in place (F. Holleman 12/12/17)	April Punsalan
5	?	?	Gateway Elementary School	<100	Low	2017	GREE	"number of clumps around trees near streams" (F. Hollemon 12/12/17)	

Name	Organization 1 - Name	Email 1 - Value
Jennifer Robertson	Atlas Environmental	jrobertson@atlasenvi.com
Grant Lewis	Axiom Environmental	glewis@axiomenvironmental.org
Brian Smith	Carolina Ecosystems, Inc.	info@carolinaeco.com
Greg Antemann	Carolina Wetland Services	gregg@cws-inc.net
Clement Riddle	ClearWater Environmental Consultants	clement@cwenv.com
Cory Darnell	ECS Carolinas, LLP	cdarnell@ecslimited.com
Kevin Markham	Environmental Services Inc.	kmarkham@esinc.cc
Karri Cecil Blackmon	Habitat Assessment and Restoration Professionals	info@habitatassessment.com
Jarrod Karl	Hazen and Sawyer	jkarl@hazenandsawyer.com
Kevin Mosteller	HDR	kevin.mosteller@hdrinc.com
Kenneth Smith	HW Lochner	ksmith@hwlochner.com
Chris Tinklenberg	Kimley-Horn and Associates, Inc.	chris.tinklenberg@kimley-horn.com
Kevin Thomas	Kleinfelder	kthomas@kleinfelder.com
Seth Ryan	Maser Consulting	sryan@maserconsulting.com
Frank Curti	Michael Baker International	fcurti@mbakerintl.com
Jake Byers	Michael Baker International	jbyers@mbakerintl.com

Name	Organization 1 - Name	Email 1 - Value
Bob Zarzecki	S&EC	bzarzecki@sandec.com
Mary Frazer	Three Oaks Engineering	mary.frazer@threeoaksengineering.com
Tamp Bandy	Wetlands & Waters, Inc.	jtampbandy@gmail.com
Len Rindner	Wetlands and Environmental Planning Group	len.rindner@wetlands-epg.com
Larry Putnam	Burke County School System	lputnam@burke.k12.nc.us
Rich Caplan	City of Landrum	rich.caplan@cityoflandrumsc.com
Rick Howell	City of Shelby	rick.howell@cityofshelby.com
Nancy Gutherie	Clean Water Management Trust Fund	nancy.gutherie@ncdcr.gov
Jeff Richardson	Cleveland County	Jeff.Richardson@clevelandcounty.com
Barry Calloway	Foothills Environmental Landfill	bcalloway@caldwellcountync.org
Mack McLeod	Hickory Parks and Recreation	mmcleod@hickorync.gov
John Slaughter	National Park Service - Cowpens National Battlefield	John_Slaughter@nps.gov
Tim Bassette	NC Department of Transportation	tpbassette@ncdot.gov
Jared Gray	NC Department of Transportation	jgray@ncdot.gov
Mike Murphy	NC Division of Parks and Recreation - State Parks	michael.murphy@ncparks.gov
Misty Buchanan	NC Natural Heritage Program	misty.buchanan@ncdcr.gov

Name	Organization 1 - Name	Email 1 - Value
Harry LeGrand	NC Natural Heritage Program	hlegrandjr@gmail.com
Bruce Sorrie	NC Natural Heritage Program	basorrie@gmail.com
Cheryl Gregory	NC Plant Conservation Program	cheryl.gregory@ncagr.gov
Steve Garrison	Rutherford County	steve.garrison@rutherfordcountync.gov
Herrick Brown	SC Department of Natural Resources - Heritage Trust Program	brownh@dnr.sc.gov
Bert Pittman	SC Department of Natural Resources - Heritage Trust Program	pittmanb@dnr.sc.gov
Kathy Boyle	SC Department of Natural Resources - Heritage Trust Program	boylek@dnr.sc.gov
Pat Cloninger	SC Department of Natural Resources - Heritage Trust Program	cloningerp@dnr.sc.gov
Chad Long	SC Department of Transportation	longcc@scdot.org
Nathan McNeilly	Self McNeilly Landfill - Cleveland County	Nathan.McNeilly@clevelandcounty.com
Tom Hart	Town of Boiling Springs	tom.hart@boilingspringsnc.net
(b)(6) PII	US Army Corps of Engineers - Asheville Regulatory Field Office	(b)(6) PII(b)(6) PII
April Punsalan	US Fish and Wildlife Service - Charleston	april_punsalan@fws.gov
Dale Suiter	US Fish and Wildlife Service - Raleigh	dale_suiter@fws.gov
Jim Matthews	Dr. James F. Matthews Center for Biodiversity Studies	centerforbiodiversitystudies@mecklenburgcountync.gov
Steve Hodges	Duke Energy	Steve.Hodges@Duke-Energy.com

Name	Organization 1 - Name	Email 1 - Value
Janie Marlow	NameThatPlant	webmaster@namethatplant.net
Nell Allen	NC Zoo	nell.allen@nczoo.org
Jeff Beacham	SC Native Plant Society	jeffbeacham@gmail.com
Sue Schneider	Spartanburg Water	sschneider@spartanburgwater.org
Eddie Dearybury	Spartanburg Water - Lake Blalock Warden's Office	eddied@spartanburgwater.org
Chick Gaddy		llgaddy2@gmail.com
Moni Bates		batesmojo@gmail.com
Sean Bloom	Catawba Lands Conservancy	sean@catawbalands.org
Mary Walter	Conestee Foundation - Lake Conestee Nature Park	mary@lakeconesteenaturepark.com
Pam Torlina	Conserving Carolinas	pam@conservingcarolina.org
Andrew Kota	Foothills Conservancy NC	akota@foothillsconservancy.org
Alvin Braswell	Friends of Plant Conservation	alvin.braswell@naturalsciences.org
Frank Hollemon	Naturaland Trust	frankholleman@naturalandtrust.org
Frederick Parrish	Spartanburg Area Conservancy (SPACE)	fmpiii@bellsouth.net
Andrew Waters	Spartanburg Area Conservancy (SPACE)	andrew@spartanburgconservation.org
Brenda Wichmann	The Nature Conservancy - NC	brenda.wichmann@tnc.org

Name	Organization 1 - Name	Email 1 - Value
Kristen Austin	The Nature Conservancy - SC	kaustin@tnc.org
Andrea Cooper	Upstate Forever	acooper@upstateforever.org
Matt Estep	Appalachian State University	estepmc@appstate.edu
Zack Murrell	Appalachian State University	murrellze@appstate.edu
Thomas Jones	Gardner-Webb University	tjones@gardner-webb.edu
Johnny Randall	NC Botanical Gardens	jrandall@email.unc.edu
Michael Kunz	NC Botanical Gardens	mkunz@email.unc.edu
Alexander Krings	NCSU Herbarium	Alexander_Krings@ncsu.edu
Patrick McMillan	SC Botanical Gardens	pmcmill@clemson.edu
Alan Weakly	UNC Herbarium	weakley@unc.edu
Gill Newberry	USC Upstate	gnewberry@charter.net
Gill Newberry		gnewberry@uscupstate.edu
Benjamin Montgomery	USC Upstate Herbarium	BMONTGOMERY@uscupstate.edu
Doug Rayner	Wofford College	raynerda@wofford.edu

Report of monitoring of Lake Saranac Population
of Hexastylis naniflora,
Fall, 1993

GENERAL OBSERVATIONS:

Hexastylis naniflora, an evergreen perennial with slow growth rate and apparent longevity, blooms from mid-February to the beginning of June. Plants may die back when disturbed but regenerate from underground rhizomes the following spring. Although populations are more numerous on the mid-portions of north facing slopes, the most vigorous growth and perfuse flowering occurs in well hydrated soils with a protected litter layer.

Although this study has divided the study population into upper slope, mid-slope, and basal populations, in the Saranac Lake area Hexastylis naniflora dominates the mid-slope. Hexastylis is not found at the very upper reaches of the slope, in dry more open woods where Vaccinium vacillans is common. It is restricted to the more mesic portions of the slope where shade and litter provide more moisture.

Associated species include Kalmia latiflora, Fagus grandiflora, Quercus alba, Ilex opaca, Carya pallida, Calacanthus floridus, Sassafras albidum, and Corylus cornuta.

STUDY PARAMETERS

The 777 Hexastylis naniflora plants in the Saranac Lake Population were labeled with numbered white plastic flags and numbered metal tags. All visible plants were tagged. During the first week of April from 1990 through the spring of 1993 all tagged plants were relocated and the number of leaves and flowers present were recorded. In July of 1993 in an effort to evaluate actual survival rates, all labeled plants were revisited. 756 of the original 777 plants were relocated (97.3% survival rate) (Table #1). The major plant losses were in the floodplain and on the upper portions of the north facing slope. Heavy rains during the Spring and Fall of '91 eroded the stream bank resulting in the loss of 6 plants. The loss of plants from the upper slope was due to tree falls and was concentrated around a dying Ilex opaca and a fallen Quercus.

TABLE #1 % SURVIVAL

ASPECT	#OF PLANTS		%SURVIVAL
	1990	1993	
Floodplain	86	81	94.2
Base of slope	74	74	100.0
Lower 1/3 of slope	195	192	98.5
Mid-slope	241	235	97.5
Upper 1/3 of slope	181	173	95.5
TOTAL	777	756	97.3

Over the 4 year sampling period the flowering percentage for the population as a whole was 72.4% (Table 2). The floodplain portion of the population consistently produced the largest percentage of plants in flower. A good supply of water throughout the spring of 92 may have contributed to the increased flowering that year.

TABLE #2 FLOWERING PERCENTAGE

ASPECT	% FLOWERING			
	1990	1991	1992	1993
Floodplain	82.6	88.1	79.0	90.1
Base of slope	55.4	67.1	63.5	68.9
Lower 1/3 of slope	73.3	69.2	78.1	70.8
Mid-slope	65.6	67.3	73.2	71.1
Upper 1/3 of slope	54.1	67.2	73.4	65.7
TOTAL	70.0	70.3	75.5	72.3

All segments of the populations showed an increase in average numbers of leaves/plant. (Table #3). The increase in size of the leaf rosettes is slow with the largest clumps and more rapid growth occurring in the floodplain portion of the population. The wide variation is to be expected in a population containing a wide range of clump sizes.

TABLE #3: COMPARISON OF 90, 91, 92, 93 DATA ON #OF LEAVES/PLANT

ASPECT	1990	1991	1992	1993
Floodplain	8.14 ± 10.2	9.47 ± 13.67	9.92 ± 12.47	11.74 ± 12.91
Base of slope	2.91 ± 2.31	3.34 ± 2.44	3.24 ± 2.58	4.19 ± 4.05
Lower 1/3 of slope	3.54 ± 3.53	3.91 ± 4.04	4.92 ± 5.98	5.33 ± 6.60
Mid-slope	3.04 ± 2.87	3.09 ± 2.84	3.94 ± 3.21	4.05 ± 3.92
Upper 1/3 of slope	3.64 ± 41.4	4.04 ± 5.72	4.91 ± 4.36	4.34 ± 4.13

In the population as a whole during this 3 year sampling period 54.1 percent of the plants increased the number of leaves per plant. This

increase was seen throughout the population. However, slightly larger percentages were noted in the floodplain (68% increased in size) and at the base of the slope (58.1% increased in size. (Table * 4)

TABLE * 4: COMPARISON OF 1990 AND 1993 DATA ON *LEAVES/PLANT

ASPECT	%INCREASED	% SAME	% DECREASED
Floodplain	64.2	13.6	22.2
Base of slope	58.1	23.0	18.9
Lower 1/3 of slope	53.6	26.6	19.8
Mid-slope	49.8	30.2	20.0
Upper 1/3 of slope	54.4	21.1	24.5

Plants were grouped into the following size classes: 1-2 leaves/plant, 3-5 leaves/plant, 6-10 leaves/plant, 11-15 leaves/plant, 16-20 leaves/plant, and clumps greater than 20 leaves. The larger plants (those with more than 16 leaves) were more common to the floodplain. Twenty-eight point six (28.6%) percent of all plants found here were in this class and these 24 plants accounted for 42.9 percent of all plants found in this size class. The lower, mid and upper slopes each had 6 plants in this category and the base slope population contained only 3 plants with 16 or more leaves.

Plants with only one or two leaves made up only 17.3% of the floodplain specimens (14 plants) but 45.5% (107 plants) of the mid-slope plants. On the upper 1/3 of the slope 39.3% (68 plants) had two leaves or less while at the base of the slope 39.2% (29 plants) of the plants were in this size class. Thirty-six point five percent (70 plants) of the lower 1/3 plants grouping were in this size class. Plants in the 3-5 leaf/clump class were most abundant at the base of the slope where 40.5% of the plants fell into this size class.

When one looks at clumps that have five or fewer leaves the difference between floodplain and slope populations is even more pronounced. Only 39.5% (32 plants) of the floodplain plants fell within these two groups compared with 79.7% (59 plants) of the slope base plants, 68.8%(132 plants) in the lower 1/3, 79.5% (187 plants) of the mid-slope plants, and 75.7% (131 plants) of the uppers slope plants contained 5 or fewer leaves.

Plants with 6-10 leaves/clump were most common in the floodplain where 28.9% of the plants fell in this size range. At all other locations plants with 6 to 10 leaves made up less than 20% of the population (Table 5). Plants having between 11 to 15 leaves were not abundant anywhere in the population. Only 31 plants of the 777 plants in the

study fell into this category. Fifteen of these were located on the lower 1/3 of the slope but accounted for only 7.8% of the population tagged here.

TABLE # 5: NUMBER OF PLANTS AND PERCENTAGE OF POPULATION IN EACH SIZE CLASS

ASPECT	1-2 LEAVES	3-5 LEAVES	6-10 LEAVES	11-15 LEAVES	16-20 LEAVES	>20 LEAVES
Floodplain	14(17.3%)	18(22.2%)	23(28.4%)	2(02.5%)	11(13.5%)	13(16.1%)
Base of slope	29(39.2%)	30(40.5%)	12(16.2%)	0(00.0%)	2(02.7%)	1(01.4%)
Lower 1/3	70(36.5%)	62(32.3%)	38(19.8%)	15(07.8%)	2(01.0%)	5(02.6%)
Mid-slope	107(45.5%)	80(34.0%)	33(14.0%)	9(03.8%)	4(01.8%)	2(00.9%)
Upper 1/3	68(39.3%)	63(36.5%)	31(17.9%)	5(02.9%)	4(02.3%)	2(01.2%)

The vigor of the Hexastylis plants in the floodplain is probably due to the greater availability of moisture. Seeps are located throughout this floodplain providing soil moisture throughout the year. Runoff slows in the floodplain resulting in an increase in depth of hydration during rains. Decreased winds and increased litter layers in this lowlying area reduce evaporation pressure and contribute to the retention of water.

The soil on the north facing slope is shallow and rocky. Any litter layer that collects occurs around fallen limbs and in the lee of rocks. The slope is also swept by winds that come off Lake Saranac to the west. The base of the slope and the floodplain are in the lee of the dam which forms the lake. In contrast the soil in the floodplain is black loam with a well developed litter layer. These edaphic factors result in a more nutrient rich environment for the floodplain plants

The data for number of flowers/plant and percentage of plants that increased flowers production corresponds with the leaf data. The larger plants in the floodplain produced more flowers. The more favorable water and nutrient availability in the floodplain also contributed to the increase in percentage of plants in flower. The overall increase in flower production reflects the aging of the population as a whole.

TABLE #7: COMPARISON OF 90, 91, 92, 93 DATA ON # OF FLOWERS/PLANT

ASPECT	1990	1991	1992	1993
Floodplain	6.87 ± 8.15	7.41 ± 7.41	8.00 ± 10.43	8.20 ± 8.90
Base of slope	2.12 ± 1.48	2.41 ± 1.41	2.66 ± 2.70	2.71 ± 3.13
Lower 1/3 of slop	3.01 ± 3.31	2.93 ± 2.99	3.42 ± 4.06	3.77 ± 4.90
Mid-slope	2.18 ± 1.82	2.39 ± 2.19	2.88 ± 2.42	2.46 ± 2.30
Upper 1/3 of slope	3.11 + 3.17	3.47 + 3.94	3.49 + 3.47	2.80 + 2.30

TABLE #8: COMPARISON OF 1990 AND 1993 DATA ON # OF FLOWERS/PLANT

ASPECT	% INCREASED	% SAME	% DECREASED
Floodplain	57.6	10.6	30.8
Base of slope	45.9	33.8	20.3
Lower 1/3 of slope	39.0	37.4	23.6
Mid-slope	37.4	39.4	23.2
Upper 1/3 of slope	37.0	34.8	28.2

TRANSPLANTS:

In the spring of 1991, 103 plants were transplanted from a slope heavily impacted by dam repair. Each plant was removed with a trowel, placed with the surrounding dirt in a numbered plastic bag. The bag was tied to prevent the roots from drying. After the flowers and flower buds were removed the plants were replanted in the same ecological aspect on the eastern portion of the slope away from the construction site. The plants were labeled with numbered yellow plastic flags at the time of replanting. All but 8 of these plants were still present in the spring of 1993 (92.2% survival rate). Forty-two percent of these plants flowered in 1993 compared with only thirty-five plants (34.3%) in 1992 and 32 (31.4%) in 1991. Transplanting appears to be a viable option which could be used to preserve endangered populations of Hexastylis naniflora. Care should be taken to prevent the roots from drying and removal of the flowers promotes vegetational growth.

BUDGET

SALARY

5 days at $200.00/day..... 1,000.00

Peter's Creek Dwarf-flowered Heartleaf Site

LOCATION: Spartanburg County, Pacolet 7.5' topo quad: north of US Highway 29 and east of Plainview Drive, just east of Saranac Lake Subdivision, at the east edge of the City of Spartanburg.

AREA: Approximately 150 acres make up the Peter's Creek site. The whole population including the Mineral Springs Creek populations comprises approximately 300 acres.

DESCRIPTION AND SIGNIFICANCE: Peter's Creek and its tributary, Mineral Springs Creek, are sandy bottom streams draining eastward into the Pacolet River just north of the town of Converse in Spartanburg County. Their steep, mesic, north-facing slopes are very well shaded by upland hardwoods, principally, Quercus alba, Q. rubra, Q. marilandica, Carya pallida, C. tomentosa, and, towards the base of the slope, by Fagus grandifolia, and Liriodendron tulipifera. The sparse shrub layer is dominated by Ilex opaca, Kalmia latifolia, Calycanthus floridus, Carpinus caroliniana and Asimina parviflora. Notable in the shrub layer on the upper slopes of Peter's Creek is a small population (circa 25 shoots) of Nestronia umbellula, a federal candidate plant species. Small trees which are well dispersed in the understory include Cornus florida, Amelanchier arborea, Sassafras albidum, and Oxydendrum arboreum. The sparseness of the understory gives the north-facing bluffs a very park-like aspect, particularly along the Mineral Springs Branch.

Although this Oak-Hickory community type is quite common in the Piedmont, very few unaltered examples remain (Nelson, 1986). The restriction of pine to the very edges of the forest and the lack of aggressive, weedy, exotic species attest to the lack of disturbance along these two sheltered ravines.

The most significant conservation consideration of Peter's Creek and Mineral Springs Creek is the 6,000 clumps of Hexastylis naniflora, dwarf-flowered heartleaf, along the north-facing slopes (2,500 in Hull's Woods, 1000 in Ponderosa Gardens, and 2,500 along Peter's Creek west of junction with Mineral Springs Creek (Newberry, 1991). In 1989, this species was listed by the US Fish and Wildlife Service (USF&WS) as a "threatened" species under the authority of the 1973 Endangered Species Act (Federal Register, 1989). An endemic to the Piedmont region of the Carolinas (Radford, and others, 1968), only 24 extant populations as defined by the USF&WS have been documented for this species (Federal Register, 1989). Extensive field searches by the North Carolina and South Carolina Heritage Programs and other local professional botanists indicate that many of these sites have been completely or seriously degraded (Powell, 1990), (Hill, 1992), and (Rayner, 1992). The construction of small ponds, introduction of cattle, road construction and flooding of streams have significantly reduced potential habitat or destroyed whole sites. The populations of Hexastylis naniflora in the Peter's Creek-Mineral Springs Creek

drainage represent the largest population known from South Carolina. The proposed acquisition project to protect the north-facing bluff of Peter's Creek, coupled with conservation easements along Mineral Springs Creek, would effectively insure the long term conservation of this species.

SURROUNDING LAND USE: Saranac Lake Subdivision west of the site and the Ponderosa Gardens Subdivision south of the site are the two main residential areas impending on the site. Both have been developed for over 20 years. Recent tree cutting on the north side of Peter's Creek has not affected the site. Currently the Spartanburg Conservation Endowment (S.P.A.C.E.) has acquired one conservation easement protection circa 1,000 plants and is beginning negotiations on a second easement which will protect an additional 1,000 clumps.

Given the steep topography and the personal and professional interest of Dr. Gillian Newberry, the biological integrity of both sites can be maintained even though the area is confined by the residential development of the city of Spartanburg. The Peter's Creek ravine population may be unique due to the presence of dense stands of dwarf pawpaw (Asimina parviflora) dominating the Ponderosa Gardens site. These pawpaw thickets and dense stands of mountain laurel found on all other slopes are very effective impediments to human foot traffic and will help insure the protection of these slopes in an otherwise urban environment. Finally, the stream corridor itself is free of intensive use except at Saranac Lake upstream of the Mineral Springs Creek population.

THREATS: The only disturbance to the area is a bike trail which cuts along the top of the north facing slopes along Peter's Creek and criss-crosses in the floodplain. Trails also cut down the north- facing slopes just west of Ponderosa Gardens. However, most slopes are too steep and rocky for such traffic.

Horses have access to the creek on Dr. D.C. Hull's property; S.P.A.C.E. is currently negotiating with Dr. Hull to place an easement on this Mineral Springs Creek Population.

MANAGEMENT NEEDS: A minimum buffer is needed for this site. The steep slopes and holly spines serve as a deterrent.

CONCLUSIONS: The ravine bluffs and bottoms of Peter's Creek and Mineral Springs Creek harbor the most significant population of the threatened dwarf-flowered heartleaf anywhere in its range. An additional small population of Nestronia is also significant. The surrounding mesic hardwood ravines are relatively undisturbed and are continuous with the floodplains of the Pacolet River, thus affording protection of this habitat in an otherwise suburban environment. The conservation easements already in place will serve as a platform for additional protection efforts for these rare species and their habitats.

ELEMENTS OF CONCERN

Element	SRANK	GRANK	STATUS
Hexastylis naniflora dwarf-flowered heartleaf	S2	G2G3	FT
Nestronia umbellula nestronia	S2	G3G4	CU
Oak-Hickory forest	S5	G5	
Mesic Mixed Hardwood	S4	G5	

Gillian Newberry, PhD
Professor of Biology
USC-Spartanburg

Albert Pittman, PhD
Botanist, Nongame
& Heritage Trust

February 4, 1993

LITERATURE CITED

Hill, S. 1992. Unpublished Data. Clemson University Herbarium.

Newberry, G. 1991. Progress Report on Monitoring Studies of Hexastylis naniflora. Report submitted to S. C. Wildlife and Marine Resources Department.

Nelson, J. 1986. The Natural Communities of South Carolina . South Carolina Wildlife and Marine Resources Department, Columbia, SC.

Federal Register, 1989. Threatened Status of Hexastylis naniflora (Dwarf-flowered Heartleaf). Vol. 54, No. 71.

Powell, R. 1990. Personal communication. Converse College, Spartanburg, S.C.

Radford, A., H. Ahles, and C. Bell, 1968. Manual of the Vascular Flora of the Carolinas, UNC Press, Chapel Hill.

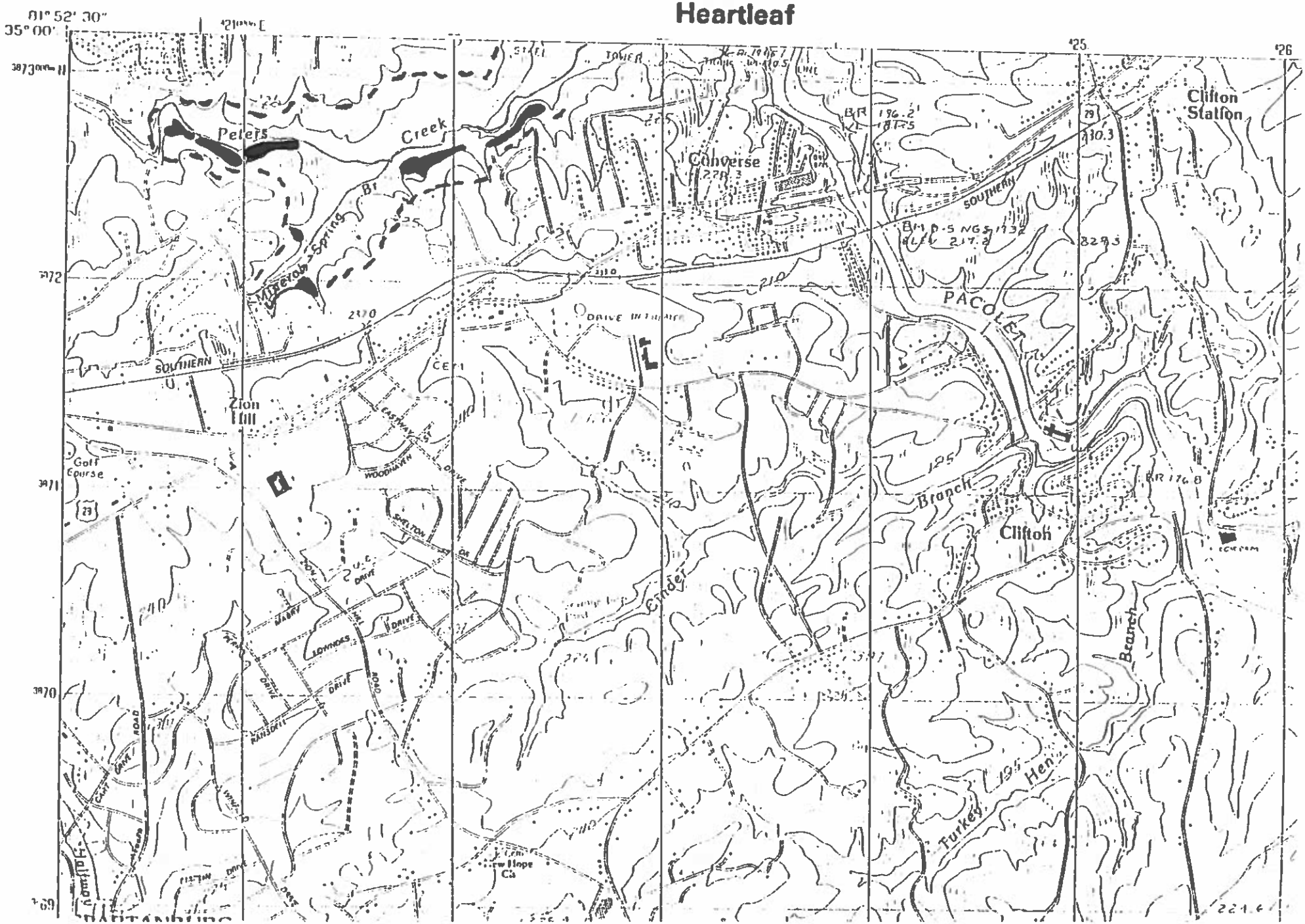
Rayner, D. 1992. Unpublished Data. Wofford College, Biology Dept.

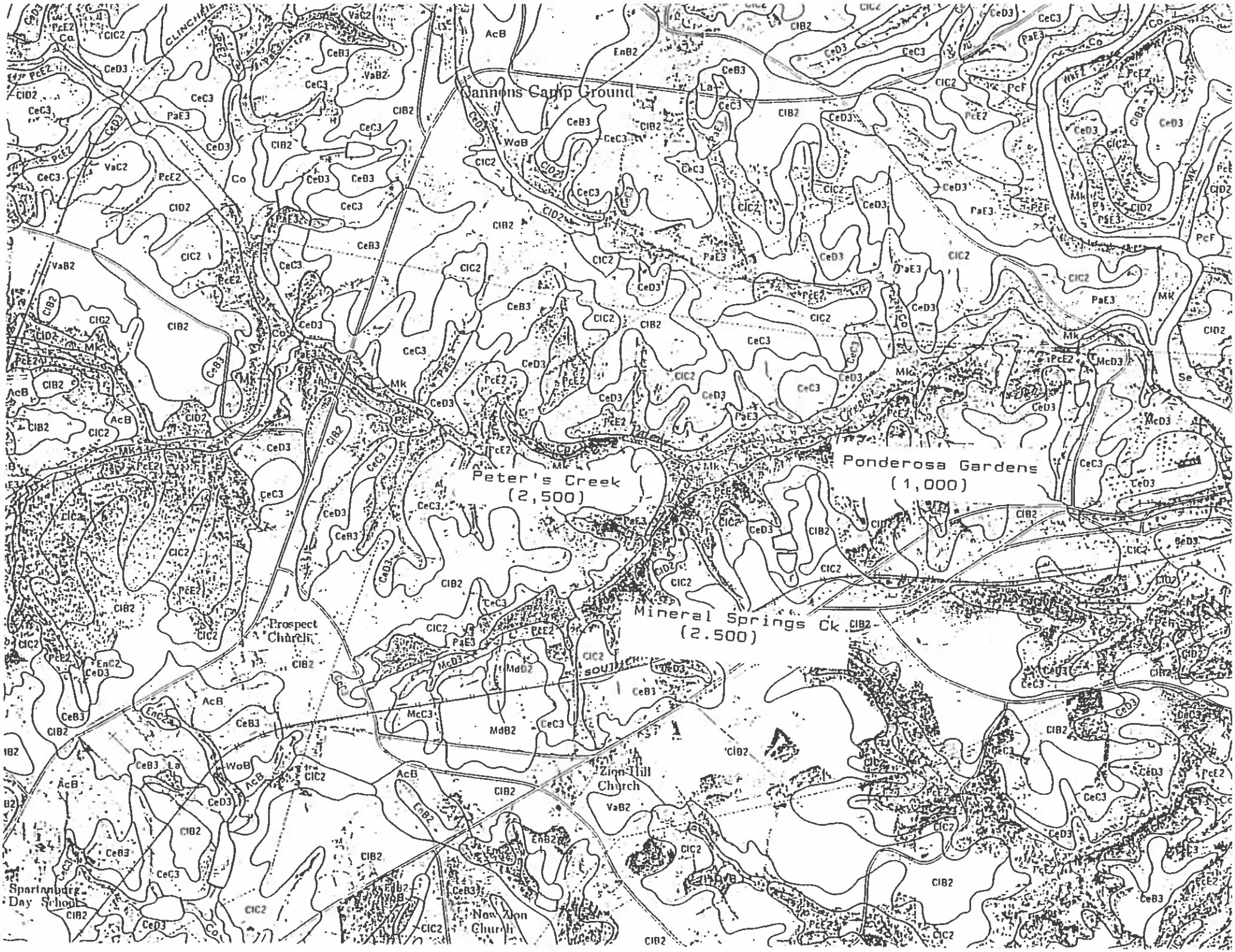
Sutter, R. 1988. Unpublished Data. State of North Carolina Department of Agriculture - Plant Protection Section.

SPARTANBURG COUNTY

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

County: Spartanburg
Quad: PACOLET 7.5
Site: Peter's Creek Dwarf-flowered Heartleaf




Cannons Camp Ground
Peter's Creek
(2,500)
Ponderosa Gardens
(1,000)
Mineral Springs Ck.
(2,500)
Prospect Church
Zion Hill Church
New Zion Church
Spartanburg Day Schools

SITE SUMMARIES FOR HEXASTYLIS NANIFLORA IN SOUTH CAROLINA

COUNTY	LOCATION	IDENTIFIED BY	OLD ESTIMATE OF POPULATION	1992 ESTIMATE OF POPULATION	COMMENTS
Spart. 1	Alverson Grove	Rayner, 1991	74	-	New Alverson Grove Church in in west flowing stream flat
Spart. 2	Arrowwood	Rayner, 1991	13	-	7300 ft. due east of Brooklyn near Rutherford Co. Line, streamside of Arrowwood Branch
Spart. 3	Branch Creek	Rayner, 1991	303	-	1800 ft. NE of jct. of SR-208 & SR-183, N slopes and stream edge
Spart. 4	Camp Mary Elizabeth	Newberry, 1990	100	100	Verbal protection by Girl Scout Camp, on NW slope above Holston Ck, S end of camp
Spart. 5	Chinquapin Ck. City of Spart.	Johnson, 1981*	2	2	Banks of Chinquapin Ck, E of Jct of Magness and Crockett Sts., Spart.
Spart. 6	Christopher	Rayner, 1991	500	-	1.55 mi. due E 5 S From Center of Landrum, flats about seepage bog
Spart. 7	Fairview Farms	Pierce, 1970*	75	75	Cattle impacting population, site ravine east of Fairview Farms Rd. 2 small populations
Spart. 8	Glenwood City of Spart.	Powell, 1990	50	?	Some plants still there overgrown with poison ivy. At stream edge near Jct. of Elmwood & Hawthorne
Spart. 9	Hull woods	McMilian, Voyles, 1967*	700	2500	Slope with 1000 plants protected with easement with SPACE, E of Saranac L. dam on N facing slope
Spart. 10	Harris	Rayner, 1992	56	-	1.35 miles NW of Fairview Church in Little Africa NE bluff of Bear Ck
Spart. 11	Ingleside Seeps and Bluff	Rayner, 1991	1,000 +	-	3800 ft. NW from jct. SR-209 & US 176 in Ingleside along unnamed branch of Spivey Creek. SPACE will seek easement.
Spart. 12	Ingleside #4	Rayner, 1991	66	-	1 mi. WSW from Jct of SR-209 & US 176 in Ingleside, N-NW bluff
Spart. 13	Ingleside #5	Rayner, 1991	221	-	0.6 mi. W 5 S from jct. SR-209 & US 176 in Inglesides,lower slopes N facing bluff above unnamed branch of Branch Creek
Spart. 14	Lake Blalock	Gaddy, 1980*	1,454	1,500	Fishing trails, and raising of lake level threaten population, on bluffs S side of lake and along Buck Creek
Spart. 15	Lake Bowen	Newberry, 1990	10	circa 20	North of Fagan road, opposite Green property, N facing bluff
Spart. 16	Little Buck Ck.	Biggs, Newberry, 1990	10-50	same	Close to Blalock population, N of Ridings Rd and E of Burnett Rd. on N facing slope and river edge
Spart. 17	Lyman Lake	Rollins, Newberry 1990	50-100	same	2 small clusters along Tyger R. tributary S of Spenser Rd.
Spart. 18	Metlow Creek	Rollins, Newberry,1990	50-100	same	West edge of Metlow Ck NE of Metlow Ck. Road

Spart. 19	Page Creek	Rayner,1991	155	-	At Landrum High School
Spart. 20	Peter's Creek	Newberry,1991	2500	2500	In 3 pop along creek, N facing slope W of Mineral Spring Creek
Spart. 21	Ponderosa Gardens Sub.	Newberry, 1992	1000	-	North facing slope on Mineral Springs Creek 2 mi E of lake
Spart. 22	Raintree Subdivision	Newberry, 1988	700	700	Environmental Easment with Nature Conservancy protects site in floodplain west edge of City of Spartanburg
Spart. 23	Rayner #12	Rayner, 1991	51-100	-	Just NE of Jct of High Farm Rd and SC 14, in seeps an on slope steam stream
Spart. 24	Rayner #15	Rayner, 1991	8	-	0.1 mi. NE from jct. of SC 14 & SR-340 on both sides of 340. seepage stream
Spart. 25	S. Pacolet River	Rayner, 1991	198	-	.25 mi due E from Jct. of SC 14 & South Pacolet River with Rhododendron maximum
Spart. 26	USCS	Newberry, 1989	25	25	Verbal protection with USCS, nature trail on campus,floodplain
Chrk. 1	NE Cowpens Battleground	Hill, 1989	-	125	8.7 mi. NW of Gaffnee, S side highway ll, floodplain
Chrk. 2	Cowpens Battleground	Newberry, 1990	175	175	3 populations, Creek base of Picnic ground slope largest with 100 clumps
Chrk. 3	McKee Drive	Hill, 1989	-	20	Atypical, slope back of 184 Mc-Kee Dr., T. Kiser owner
Chrk. 4	Type locality	Ahles, 1956*	150	200	Surveying in area north of Hwy 11 impacting 1/3 of population, but both sides of highway in ravine, 5.45 NW of RT. 85
Gnv. 1	Beaverdam Ck.	Rayner,1981*	-	150	Many large clumps on hummock SE of Jct of SC 903 & SC 290 tributary of Beaverdam Ck.
Gnv. 2	Beaverdam Ck. West	Rayner, 1981*	-	75-100	Hummocks, cattle have access to site, 800 Ft. S of Jct of S-173 & S-263
Gnv. 3	Blue Ridge Rd.	Rayner, 1981*	-	150-200	Development on west side & run-off from Blue Ridge road are impacting population on N edge of road in east most tributary of Enoree River
Gnv. 4	Gowensville	Rayner, 1991	168	-	2100 ft. NW of Jct of Hwy 11 & 14 N and NW slopes of intermittent stream
Gnv. 5	Jackson Grove	Vernon, 1964*			Could not relocate
Gnv. 6	Mark Hall Farms (north of	Newberry powerlines)	1	1	1 sq. foot patch In Heritage Trust Preserve
Gnv. 7	Mark Hall Farms S of Power line	Rayner, 1981*	-	25	In Heritage Trust Preserve
Gnv. 8	Gowensville	Freeman, 1956*	50	150	Stream flat of tributary of Tyger R. west edge of US 14 1.5 mi S of Gowensville

* Information from Sutter, 1988

Conservation of Hexastylis naniflora in South Carolina

32 Sites ≤ 500 individual clumps..... (84%)

4 Formal Protection

3 Informal Protection

25 No Protection

38 Total Number of Sites

6 Sites > 500 individual clumps..... (16%)

2 Formal Protection

1 Informal Protection

3 No Protection

Name	Affiliation	Address 1	Address 2	Address 3	City, State Zip	Emails	Phone	Notes
Jennifer Robertson	Atlas Environmental	712 English Tutor Lane			Charlotte, NC 28211	jrobertson@atlasenvi.com	704-512-1206	
Grant Lewis	Axiom Environmental	218 Snow Avenue			Raleigh, NC 27603	glewis@axiomenvironmental.org	919-215-1693	
Brian Smith	Carolina Ecosystems, Inc.	3040 NC-42			Clayton, NC 27520	info@carolinaeco.com	919-359-1102	President
Greg Antemann	Carolina Wetland Services	550 E. Westinghouse Blvd			Charlotte, NC 28273	gregg@cws-inc.net	704-527-1177	
Clement Riddle	ClearWater Environmental Consultants	32 Clayton Street			Asheville, NC 28801	clement@cwenv.com	828-698-9800	
Cory Darnell	ECS Carolinas, LLP	1812 Center Park Drive, Suite D			Charlotte, NC 28217	cdarnell@ecslimited.com		
Kevin Markham	Environmental Services Inc.	4901 Trademark Drive			Raleigh, NC 27603	kmarkham@esinc.cc	919-212-1760	
Karri Cecil Blackmon	Habitat Assessment and Restoration Professionals	301 McCullough Drive, 4th Floor			Charlotte, NC 28262	info@habitatassessment.com	704-841-2841	President
Jarrod Karl	Hazen and Sawyer	9101 Southern Pine Boulevard, Suite 250			Charlotte, NC 28273	jkarl@hazenandsawyer.com	704-357-3150	
Kevin Mosteller	HDR	440 S. Church Street	Suites 800, 900, & 1000		Charlotte, NC 28202	kevin.mosteller@hdrinc.com	704-338-6760	
Kenneth Smith	HW Lochner	2840 Plaza Place, Suite 202			Raleigh, NC 27612	ksmith@hwlochner.com	919-571-7111	
Chris Tinklenberg	Kimley-Horn and Associates, Inc.	200 South Tryon, Suite 200			Charlotte, NC 28202	chris.tinklenberg@kimley-horn.com	704-409-1802	
Kevin Thomas	Kleinfelder	9009 Perimeter Woods Drive, Suite H			Charlotte, NC 28216	kthomas@kleinfelder.com	704-598-1049	
Seth Ryan	Maser Consulting	9307 Monroe Road, Suites M & N			Charlotte, NC 28270	sryan@maserconsulting.com	732-383-1950	
Frank Curti	Michael Baker International	101 N. Main Street, Suite 810			Greenville, SC 29601	fcurti@mbakerintl.com	864-670-2747	Local Office Supervisor
Jake Byers	Michael Baker International	797 Haywood Road, Suite 201			Asheville, NC 28806	jbyers@mbakerintl.com	828-350-1408	Local Office Supervisor
Dave Willoughby	RK&K Consulting Engineers	125 Floyd Smith Drive, Suite 140			Charlotte, NC 28262		980-235-0011	
Bob Zarzecki	S&EC	8412 Falls of the Neuse Road	Suite 104		Raleigh, NC 27612	bzarzecki@sandec.com	919-256-4517	
	S&ME	9751 Southern Pine Blvd			Charlotte, NC 28273		704-523-4726	
Mary Frazer	Three Oaks Engineering					mary.frazer@threeoaksengineering.com	919-215-5724	NCDOT contractor
Tamp Bandy	Wetlands & Waters, Inc.	4108 LB Propst Drive			Conover, NC 28613	jtampbandy@gmail.com	828-302-3437	
Len Rindner	Wetlands and Environmental Planning Group	10612-D Providence Road, PMB 550			Charlotte, NC 28277	len.rindner@wetlands-epg.com	704-904-2277	

Name	Affiliation	Address 1	Address 2	Address 3	City, State Zip	Emails	Phone	Notes
Larry Putnam	Burke County School System	PO Drawer 989			Morganton, NC 28655	lputnam@burke.k12.nc.us	828-439-4312	Superintendent
Rich Caplan	City of Landrum	100 North Shamrock Avenue			Landrum, SC 29356	rich.caplan@cityoflandrumsc.com	864-457-3000	City Administrator
Rick Howell	City of Shelby	300 S Washington Street			Shelby, NC 28150	rick.howell@cityofshelby.com	704-484-6801	City Manager
Nancy Gutherie	Clean Water Management Trust Fund	1651 Mail Service Center			Raleigh, NC 27699	nancy.gutherie@ncdcr.gov	919-707-9126	Acquisition Program Manager
Jeff Richardson	Cleveland County	PO Box 1210			Shelby, NC 28151	Jeff.Richardson@clevelandcounty.com	704-484-4800	County Manager
Barry Calloway	Foothills Environmental Landfill	1385 Fairview Dr SW			Lenoir, NC 28645	bcalloway@caldwellcountync.org	828-757-5758	Supervisor
Mack McLeod	Hickory Parks and Recreation	1451 8th Street Drive NE			Hickory, NC 28601	mmcleod@hickorync.gov	828-322-7046	
John Slaughter	National Park Service - Cowpens National Battlefield	338 New Pleasant Road			Gaffney, SC 29341	John_Slaughter@nps.gov		
Tim Bassette	NC Department of Transportation	1598 Mail Service Center			Raleigh, NC 27699	tpbassette@ncdot.gov	919-707-6135	Environmental Program Consultant
Jared Gray	NC Department of Transportation	1599 Mail Service Center			Raleigh, NC 27699	jgray@ncdot.gov	919-707-6120	Environmental Program Supervisor II
Mike Murphy	NC Division of Parks and Recreation - State Parks					michael.murphy@ncparks.gov		
Laura Robinson	NC Natural Heritage Program	1651 Mail Service Center			Raleigh, NC 27699	laura.robinson@ncdcr.gov	919-707-8647	Botanist, worked on the monitoring and range-wide status assessment for NHP
Jame Amoroso	NC Natural Heritage Program	1651 Mail Service Center			Raleigh, NC 27699	jame.amoroso@ncdcr.gov	919-707-8621	Conservation Information Specialist
Misty Buchanan	NC Natural Heritage Program	1651 Mail Service Center			Raleigh, NC 27699	misty.buchanan@ncdcr.gov	919-707-8621	Director, can disturbute to NHP staff
Wesley Knapp	NC Natural Heritage Program	1651 Mail Service Center			Raleigh, NC 27699	wesley.knapp@ncdcr.gov	828-296-7230 x228	Western Regional Ecologist/Botanist
Suzanne Mason	NC Natural Heritage Program	1651 Mail Service Center			Raleigh, NC 27699	suzanne.mason@ncdcr.gov	919-707-8637	Conservation Data Manager & NCDOT Project Specialist
Mike Shafale	NC Natural Heritage Program	1651 Mail Service Center			Raleigh, NC 27699	michael.schafale@ncdcr.gov		Terrestial Biologist
James Padgett	New Home United Methodist Church	544 Moriah School Road			Casar, NC 28150		828-429-2908	former employee of NCNHP
Harry LeGrand	NC Natural Heritage Program					hlegrandjr@gmail.com		retired
Bruce Sorrie	NC Natural Heritage Program					basorrie@gmail.com		retired
Cheryl Gregory	NC Plant Conservation Program	1060 Mail Service Center			Raleigh, NC 27603	cheryl.gregory@ncagr.gov	919-707-3760	Program Administrator, can distrubute to PCP staff
Lesley Starke	NC Plant Conservation Program	1060 Mail Service Center			Raleigh, NC 27603	lesley.starke@ncagr.gov		
Jenny Stanley	NC Plant Conservation Program	1060 Mail Service Center			Raleigh, NC 27603	jennifer.stanley@ncagr.gov		
Steve Garrison	Rutherford County	289 N. Main Street			Rutherfordton, NC 28139	steve.garrison@rutherfordcountync.gov	828-287-6060	County Manager
Herrick Brown	SC Department of Natural Resources - Heritage Trust Program	PO Box 167			Columbia, SC 29202	brownh@dnr.sc.gov	803-734-4320	Assistant Botanist
Bert Pittman	SC Department of Natural Resources - Heritage Trust Program	PO Box 167			Columbia, SC 29202	pittmanb@dnr.sc.gov	803-734-3920	Botanist
Kathy Boyle	SC Department of Natural Resources - Heritage Trust Program	PO Box 167			Columbia, SC 29202	boylek@dnr.sc.gov		
Pat Cloninger	SC Department of Natural Resources - Heritage Trust Program					cloningerp@dnr.sc.gov		Preserve manager
Mary Bunch	SC Department of Natural Resources - Heritage Trust Program							Preserve manager, retired, also associated with Clemson
Chad Long	SC Department of Transportation					longcc@scdot.org	803-737-1396	
Nathan McNeilly	Self McNeilly Landfill - Cleveland County	250 Fielding Road			Cherryville, NC 28021	Nathan.McNeilly@clevelandcounty.com	704-447-8200	
Tom Hart	Town of Boiling Springs	PO Box 1014			Boiling Springs, NC 28017	tom.hart@boilingspringsnc.net	704-434-2358	Town Manager
(b)(6) PII	US Army Corps of Engineers - Asheville Regulatory Field Office	Wilmington District	151 Patton Avenue, Room 208		Asheville, NC 28801	(b)(6) PII(b)(6) PII	(b)(6) PII	
	US Army Corps of Engineers - Columbia Regulatory Field Office	Charleston District	Strom Thurmond Federal Building	1835 Assembly Street, Room 865 B-1	Columbia, SC 29201		(b)(6) PII	
April Punsalan	US Fish and Wildlife Service - Charleston	176 Croghan Spur Road, Suite 200			Charleston, SC 29407	april_punsalan@fws.gov	843-727-4707 x218	SC FWS botanist
Dale Suiter	US Fish and Wildlife Service - Raleigh	PO Boc 33726			Raleigh, NC 27636	dale_suiter@fws.gov	919-856-4520 x18	

Name	Affiliation	Address 1	Address 2	Address 3	City, State Zip	Emails	Phone	Notes
	Catawba County Wildlife Club	PO Box 544			Hickory, NC 28603			
Jim Matthews	Dr. James F. Matthews Center for Biodiversity Studies	2900 Rocky River Road			Charlotte, NC 28215	centerforbiodiversitystudies@mecklenburgcountync.gov	704-599-8465	Director, also affiliated with HARP
Steve Hodges	Duke Energy					Steve.Hodges@Duke-Energy.com		Cliffside Steam Station
	Girl Scouts of America - Camp Mary Elizabeth	330 Scout Drive			Spartanburg, SC 29301			
Janie Marlow	NameThatPlant				Travelers Rest, SC	webmaster@namethatplant.net		Webmaster
Nell Allen	NC Zoo					nell.allen@nczoo.org		Rare Plant Curator
Jeff Beacham	SC Native Plant Society	PO Box 491			Norris, SC 29667	jeffbeacham@gmail.com		
Sue Schneider	Spartanburg Water	200 Commerce Street			Spartanburg, SC 29306	sschneider@spartanburgwater.org	864-583-7361	Chief Executive Officer
Eddie Dearybury	Spartanburg Water - Lake Blalock Warden's Office	1925 Sandy Ford Road			Chesnee, SC 29323	eddied@spartanburgwater.org	864-578-5442	Reservoir Manager
Chick Gaddy						llgaddy2@gmail.com	803-629-6128	
Moni Bates						batesmojo@gmail.com		Contract Botanist
Robert and Carolyn Tate		4411 US 221 South			Forest City, NC 28043			Property owners for Tate Conservation Area, NCDOT holds easement

Name	Affiliation	Address 1	Address 2	Address 3	City, State Zip	Emails	Phone	Notes
Sean Bloom	Catawba Lands Conservancy	4530 Park Road, Suite 420			Charlotte, NC 28209	sean@catawbalands.org	704-342-3330	Rhyne Preserve
Mary Walter	Conestee Foundation - Lake Conestee Nature Park	PO Box 9111			Greenville, SC 29604	mary@lakeconesteenaturepark.com	864-277-2004	Director of Development and Communication, retired from SPACE
Pam Torlina	Conserving Carolinas	2060 Lynn Road, Suite 1			Columbus, NC 28722	pam@conservingcarolina.org		Southeast Stewardship Manager, Conserving Carolinas was Pacolet Area Conservancy and CMLC
Andrew Kota	Foothills Conservancy NC	PO Box 3023			Morganton, NC 28680	akota@foothillsconservancy.org	828-437-9930	Executive Director, can distribute to staff
Ryan Sparks	Foothills Conservancy of NC	PO Box 3023			Morganton, NC 28680	rsparks@foothillsconservancy.com	828-437-9930	Conservation Associate
Alvin Braswell	Friends of Plant Conservation	1402 Bearhollow			Greensboro, NC 27410	alvin.braswell@naturalsciences.org		Friends group to PCP
Frank Hollemon	Naturaland Trust	148 River Street, Suite 110			Greenville, SC 29601	frankholleman@naturalandtrust.org	864-979-9431	President
Frederick Parrish	Spartanburg Area Conservancy (SPACE)					fmpiii@bellsouth.net	864-590-6943	
Andrew Waters	Spartanburg Area Conservancy (SPACE)	100 E. Main Street, Suite 7B			Spartanburg, SC 29306	andrew@spartanburgconservation.org	864-948-0000	
Brenda Wichmann	The Nature Conservancy - NC	334 Blackwell Street, Suite 300			Durham, NC 27701	brenda.wichmann@tnc.org	919-794-8868	Conservation Coordinator
Kristen Austin	The Nature Conservancy - SC	27 Cleveland Street, Suite 203			Greenville, SC 29601	kaustin@tnc.org	864-233-4988	Upstate Conservation Direstor
Andrea Cooper	Upstate Forever	507 Pettigru Street			Greenville, SC 29601	acooper@upstateforever.org	864-250-0500 x24	Executive Director

Name	Affiliation	Address 1	Address 2	Address 3	City, State Zip	Email	Phone	Notes
Matt Estep	Appalachian State University	Department of Biology	573 Rivers Street, ASU Box 32027		Boone, NC 28609	estepmc@appstate.edu	828-262-8058	Assistant Professor , Evolutionary Genetics and Genomics
Zack Murrell	Appalachian State University	Department of Biology	572 Rivers Street, ASU Box 32027		Boone, NC 28608	murrellze@appstate.edu	828-262-2674	Professor and Chair, Plant Systematics, Speciation and Hybridization & Southern Appalachian Floristics and Biogeography, worked on genetics for DOT
Thomas Jones	Gardner-Webb University	Department of Biology	PO Box 997		Boiling Springs, NC 28017	tjones@gardner-webb.edu	704-406-4369	Professor of Biology
Johnny Randall	NC Botanical Gardens	University of North Carolina at Chapel Hill	CB 3376		Chapel Hill, NC 27600	jrandall@email.unc.edu	919-962-2380	Director of Conservation Programs
Michael Kunz	NC Botanical Gardens	University of North Carolina at Chapel Hill	CB 3375		Chapel Hill, NC 27599	mkunz@email.unc.edu	919-962-2378	Conservation Ecologist
Alexander Krings	NCSU Herbarium	Department of Plant and Microbial Biology	2106 Gardner Hall, Campus Box 7612		Raleigh, NC 27695	Alexander_Krings@ncsu.edu	919-515-2700	Director
Patrick McMillan	SC Botanical Gardens	150 Discovery Lane			Clemson, SC 29634	pmcmill@clemson.edu	864-656-0203	Director
Alan Weakly	UNC Herbarium	UNC Department of Biology	CB 3280, Coker Hall	120 South Road	Chapel Hill, NC 27599	weakley@unc.edu	919-962-6931	Director
Gill Newberry	USC Upstate					gnewberry@charter.net		Retired
Gill Newberry						gnewberry@uscupstate.edu		
Benjamin Montgomery	USC Upstate Herbarium	800 University Way			Spartanburg, SC 29303	BMONTGOMERY@uscupstate.edu	864.503.5764	Director
Doug Rayner	Wofford College	Department of Biology	CPO Box 56		Spartanburg, SC 29304	raynerda@wofford.edu	864-597-4624	Professor of Biology

Name	Organization 1 - Name	Email 1 - Value
Jennifer Robertson	Atlas Environmental	jrobertson@atlasenvi.com
Grant Lewis	Axiom Environmental	glewis@axiomenvironmental.org
Brian Smith	Carolina Ecosystems, Inc.	info@carolinaeco.com
Greg Antemann	Carolina Wetland Services	gregg@cws-inc.net
Clement Riddle	ClearWater Environmental Consultants	clement@cwenv.com
Cory Darnell	ECS Carolinas, LLP	cdarnell@ecslimited.com
Kevin Markham	Environmental Services Inc.	kmarkham@esinc.cc
Karri Cecil Blackmon	Habitat Assessment and Restoration Professionals	info@habitatassessment.com
Jarrod Karl	Hazen and Sawyer	jkarl@hazenandsawyer.com
Kevin Mosteller	HDR	kevin.mosteller@hdrinc.com
Kenneth Smith	HW Lochner	ksmith@hwlochner.com
Chris Tinklenberg	Kimley-Horn and Associates, Inc.	chris.tinklenberg@kimley-horn.com
Kevin Thomas	Kleinfelder	kthomas@kleinfelder.com
Seth Ryan	Maser Consulting	sryan@maserconsulting.com
Frank Curti	Michael Baker International	fcurti@mbakerintl.com
Jake Byers	Michael Baker International	jbyers@mbakerintl.com

Name	Organization 1 - Name	Email 1 - Value
Bob Zarzecki	S&EC	bzarzecki@sandec.com
Joey Lawler	S&ME	jlawler@smeinc.com
Mary Frazer	Three Oaks Engineering	mary.frazer@threeoaksengineering.com
Tamp Bandy	Wetlands & Waters, Inc.	jtampbandy@gmail.com
Len Rindner	Wetlands and Environmental Planning Group	len.rindner@wetlands-epg.com
Larry Putnam	Burke County School System	lputnam@burke.k12.nc.us
Rich Caplan	City of Landrum	rich.caplan@cityoflandrumsc.com
Rick Howell	City of Shelby	rick.howell@cityofshelby.com
Nancy Gutherie	Clean Water Management Trust Fund	nancy.gutherie@ncdcr.gov
Jeff Richardson	Cleveland County	Jeff.Richardson@clevelandcounty.com
Barry Calloway	Foothills Environmental Landfill	bcalloway@caldwellcountync.org
Mack McLeod	Hickory Parks and Recreation	mmcleod@hickorync.gov
John Slaughter	National Park Service - Cowpens National Battlefield	John_Slaughter@nps.gov
Tim Bassette	NC Department of Transportation	tpbassette@ncdot.gov
Jared Gray	NC Department of Transportation	jgray@ncdot.gov
Mike Murphy	NC Division of Parks and Recreation - State Parks	michael.murphy@ncparks.gov

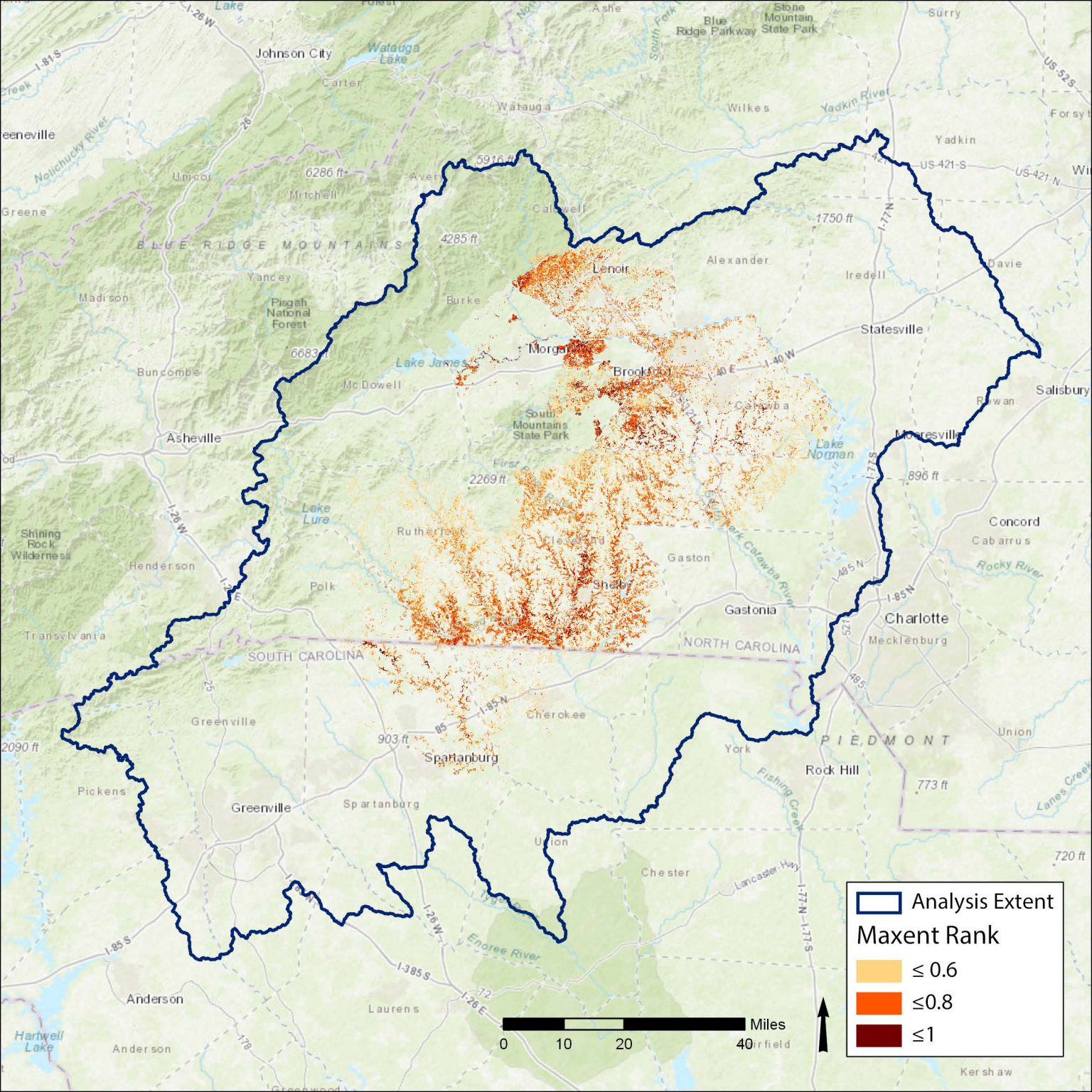
Name	Organization 1 - Name	Email 1 - Value
Misty Buchanan	NC Natural Heritage Program	misty.buchanan@ncdcr.gov
Harry LeGrand	NC Natural Heritage Program	hlegrandjr@gmail.com
Bruce Sorrie	NC Natural Heritage Program	basorrie@gmail.com
Cheryl Gregory	NC Plant Conservation Program	cheryl.gregory@ncagr.gov
Steve Garrison	Rutherford County	steve.garrison@rutherfordcountync.gov
Herrick Brown	SC Department of Natural Resources - Heritage Trust Program	brownh@dnr.sc.gov
Bert Pittman	SC Department of Natural Resources - Heritage Trust Program	pittmanb@dnr.sc.gov
Kathy Boyle	SC Department of Natural Resources - Heritage Trust Program	boylek@dnr.sc.gov
Pat Cloninger	SC Department of Natural Resources - Heritage Trust Program	cloningerp@dnr.sc.gov
Chad Long	SC Department of Transportation	longcc@scdot.org
Nathan McNeilly	Self McNeilly Landfill - Cleveland County	Nathan.McNeilly@clevelandcounty.com
Tom Hart	Town of Boiling Springs	tom.hart@boilingspringsnc.net
(b)(6) PII	US Army Corps of Engineers - Asheville Regulatory Field Office	(b)(6) PII(b)(6) PII
April Punsalan	US Fish and Wildlife Service - Charleston	april_punsalan@fws.gov
Dale Suiter	US Fish and Wildlife Service - Raleigh	dale_suiter@fws.gov

Name	Organization 1 - Name	Email 1 - Value
Jim Matthews	Dr. James F. Matthews Center for Biodiversity Studies	centerforbiodiversitystudies@mecklenburgcountync.gov
Steve Hodges	Duke Energy	Steve.Hodges@Duke-Energy.com
Janie Marlow	NameThatPlant	webmaster@namethatplant.net
Nell Allen	NC Zoo	nell.allen@nczoo.org
Jeff Beacham	SC Native Plant Society	jeffbeacham@gmail.com
Sue Schneider	Spartanburg Water	sschneider@spartanburgwater.org
Eddie Dearybury	Spartanburg Water - Lake Blalock Warden's Office	eddied@spartanburgwater.org
Chick Gaddy		llgaddy2@gmail.com
Moni Bates		batesmojo@gmail.com
Sean Bloom	Catawba Lands Conservancy	sean@catawbalands.org
Mary Walter	Conestee Foundation - Lake Conestee Nature Park	mary@lakeconesteenaturepark.com
Pam Torlina	Conserving Carolinas	pam@conservingcarolina.org
Andrew Kota	Foothills Conservancy NC	akota@foothillsconservancy.org
Alvin Braswell	Friends of Plant Conservation	alvin.braswell@naturalsciences.org
Frank Hollemon	Naturaland Trust	frankholleman@naturalandtrust.org
Frederick Parrish	Spartanburg Area Conservancy (SPACE)	fmpiii@bellsouth.net

Name	Organization 1 - Name	Email 1 - Value
Andrew Waters	Spartanburg Area Conservancy (SPACE)	andrew@spartanburgconservation.org
Brenda Wichmann	The Nature Conservancy - NC	brenda.wichmann@tnc.org
Kristen Austin	The Nature Conservancy - SC	kaustin@tnc.org
Andrea Cooper	Upstate Forever	acooper@upstateforever.org
Matt Estep	Appalachian State University	estepmc@appstate.edu
Zack Murrell	Appalachian State University	murrellze@appstate.edu
Thomas Jones	Gardner-Webb University	tjones@gardner-webb.edu
Johnny Randall	NC Botanical Gardens	jrandall@email.unc.edu
Michael Kunz	NC Botanical Gardens	mkunz@email.unc.edu
Alexander Krings	NCSU Herbarium	Alexander_Krings@ncsu.edu
Patrick McMillan	SC Botanical Gardens	pmcmill@clemson.edu
Alan Weakly	UNC Herbarium	weakley@unc.edu
Gill Newberry	USC Upstate	gnewberry@charter.net
Gill Newberry		gnewberry@uscupstate.edu
Benjamin Montgomery	USC Upstate Herbarium	BMONTGOMERY@uscupstate.edu
Doug Rayner	Wofford College	raynerda@wofford.edu

Name	Organization 1 - Name	Email 1 - Value
Mary Bunch	SCDNR	BunchM@scdnr.org

Name	Affiliation	Address 1	Address 2	Address 3	City, State Zip
Dave Willoughby	RK&K Consulting Engineers	125 Floyd Smith Drive, Suite 140			Charlotte, NC 28262
James Padgett	New Home United Methodist Church	544 Moriah School Road			Casar, NC 28150
	US Army Corps of Engineers - Columbia Regulatory Field Office	Charleston District	Strom Thurmond Federal Building	1835 Assembly Street, Room 865 B-1	Columbia, SC 29201
	Catawba County Wildlife Club	PO Box 544			Hickory, NC 28603
	Girl Scouts of America - Camp Mary Elizabeth	330 Scout Drive			Spartanburg, SC 29301
Robert and Carolyn Tate		4411 US 221 South			Forest City, NC 28043


Analysis Extent
Maxent Rank
≤ 0.6
≤0.8
≤1
Miles
0
10
20
40
Johnson City
Watauga Lake
Boone
Lenoir
Morganton
Hickory
Statesville
Asheville
Brevard
Rutherfordton
Shelby
Gastonia
Charlotte
Concord
Salisbury
Spartanburg
Greenville
Anderson
Rock Hill
York
Chester
Laurens
Union
Cherokee
Pickens
Transylvania
Henderson
Polk
McDowell
Burke
Caldwell
Alexander
Iredell
Davie
Rowan
Cabarrus
Mecklenburg
Gaston
Lincoln
Catawba
Wilkes
Yadkin
Surry
Ashe
Watauga
Avery
Mitchell
Yancey
Madison
Buncombe
Greene
Unicoi
Carter
Pisgah National Forest
South Mountains State Park
Lake James
Lake Norman
Lake Lure
Shining Rock Wilderness
Hartwell Lake
Blue Ridge Parkway
Stone Mountain State Park
BLUE RIDGE MOUNTAINS
PIEDMONT
SOUTH CAROLINA
NORTH CAROLINA
Nolichucky River
Yadkin River
Catawba River
Rocky River
Fishing Creek
Lanes Creek
Enoree River
First Broad River
5916 ft
6286 ft
4285 ft
6683
2269 ft
1750 ft
896 ft
773 ft
720 ft
903 ft
2090 ft
I-26 W
I-81 S
I-40 W
I-77 N
I-77 S
I-85 N
I-85 S
I-485 N
I-385 S
I-26 E
US-421 S
US-421 N
US-52 S
Lancaster Hwy

Notes on the status of populations of *Hexastylis naniflora*

Jan 20, 2018

I have been observing and studying populations of *Hexastylis naniflora* in North and South Carolina for the past thirty years.

In the Tryon area of N C and in Greenville and Spartanburg Counties of SC Dwarf Flowered Heartleaf can be found on north-facing slopes along steams usually associated with stands of *Kalmia*. In Catawba county of North Carolina, the *Hexastylis* populations are probably *Hexastylis heterophylla*. The differences between *H. naniflora* and *H. heterophylla* are as follows:

H. naniflora	*H. heterophylla*
Leave rounded without terminal tip	Leaves larger, heart-shaped often with terminal tip
Flowers less than 1 cm long	Flowers more than 1 cm long
Flowers as long as broad	Flowers longer than broad

The SC populations of *H. naniflora* are showing some decline due to drought stress on the upper slopes.

Preserve have been set up to protect large population at Peter Creek, Saranac like SPACE preserve, Lake Blalock, and along the Pacolet River at USC Upstate. A few smaller populations are also under some protection.

There is no doubt that these two species are closely related and may be varieties of the same species.

However, I feel that before it is delisted that a DNA analysis be done comparing the NC and SC populations. This will add much light to the distinctiveness of these two populations.

I have included photos of plants that are unquestionably *H. naniflora*. These were all taken from plants in the Pacolet drainage, Tryon NC.

I hope this information helps with your reevaluation of this species.

I will be in Iceland until January 30. I will check my e-mail when I return. My phone (which has an answering machine) is 864-579-4471.

Thank you for your concern for the diversity of our upstate.

Sincerely,

Gillian Newberry

#

J loddq#Q hz ehuu|#

Wesley Knapp
NC Natural Heritage Program
wesley.knapp@ncdcr.gov

Tim Bassette
NC Department of Transportation
tpbassette@ncdot.gov

Dr. Gillian Newberry
University of South Carolina – Upstate (retired)
gnewberry@charter.net
gnewberry@uscupstate.edu

Dr. Doug Rayner
Wofford College
raynerda@wofford.edu

Dr. LL "Chick" Gaddy
Terra Incognita
llgaddy2@gmail.com

Dr. Zack Murrell
Appalachian State University
murrellze@appstate.edu

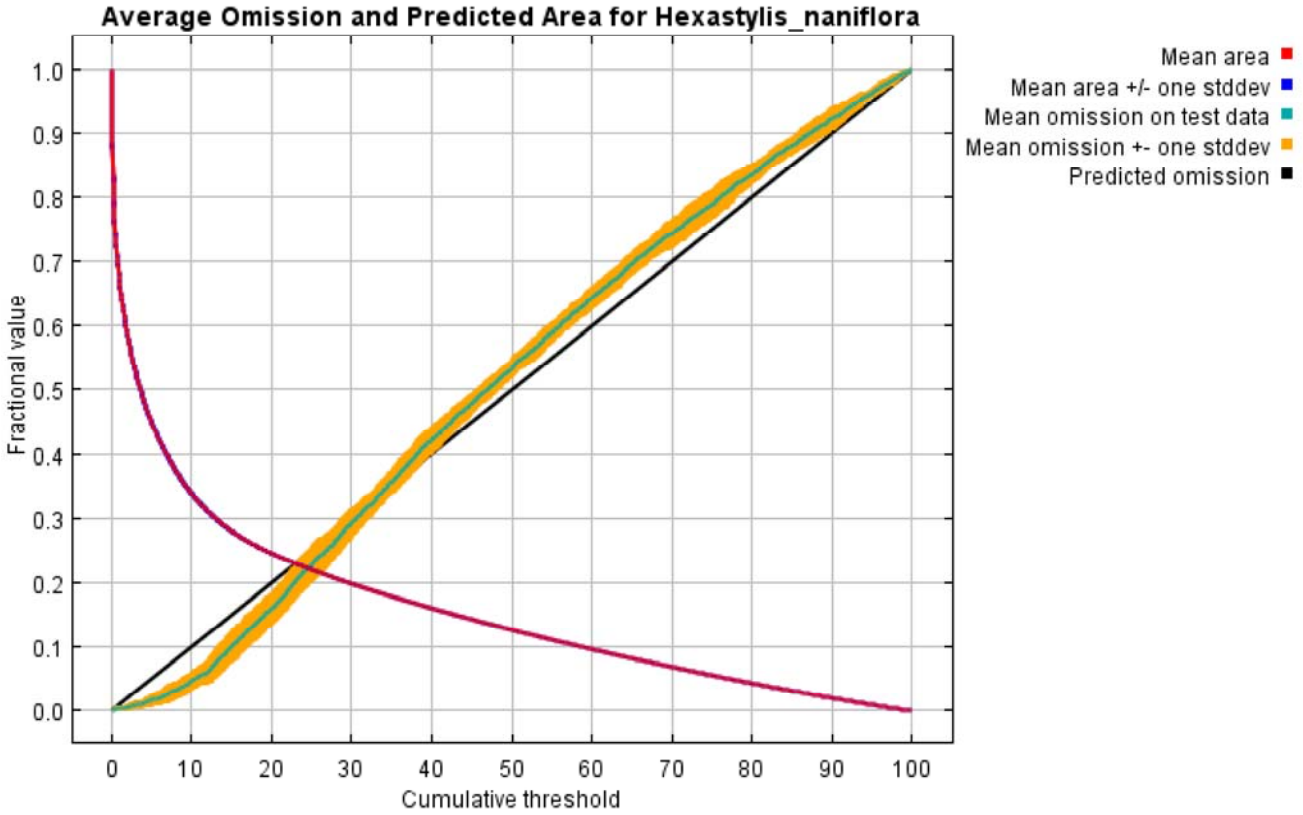
Bert Pittman or Herrick Brown
SC Heritage Trust Program
pittmanb@dnr.sc.gov
brownh@dnr.sc.gov

Replicated maxent model for Hexastylis_naniflora

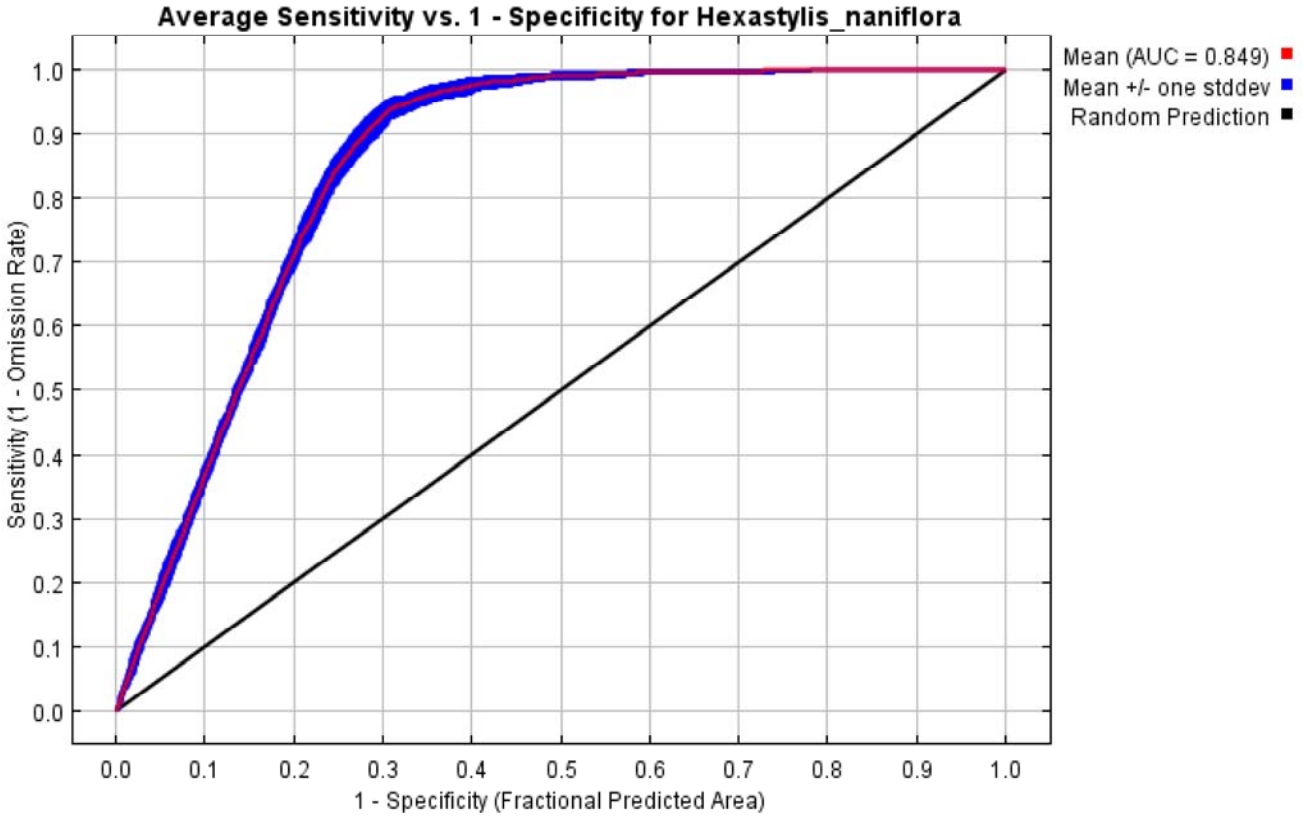
This page summarizes the results of 10-fold cross-validation for Hexastylis_naniflora, created Wed Feb 14 17:50:27 EST 2018 using Maxent version 3.4.1. The individual models are here: [0] [1] [2] [3] [4] [5] [6] [7] [8] [9]

Analysis of omission/commission

The following picture shows the test omission rate and predicted area as a function of the cumulative threshold, averaged over the replicate runs. The omission rate should be close to the predicted omission, because of the definition of the cumulative threshold.



The next picture is the receiver operating characteristic (ROC) curve for the same data, again averaged over the replicate runs. Note that the specificity is defined using predicted area, rather than true commission (see the paper by Phillips, Anderson and Schapire cited on the help page for discussion of what this means). The average test AUC for the replicate runs is 0.849, and the standard deviation is 0.006.



Analysis of variable contributions

The following table gives estimates of relative contributions of the environmental variables to the Maxent model. To determine the first estimate, in each iteration of the training algorithm, the increase in regularized gain is added to the contribution of the corresponding variable, or subtracted from it if the change to the absolute value of lambda is negative. For the second estimate, for each environmental variable in turn, the values of that variable on training presence and background data are randomly permuted. The model is reevaluated on the permuted data, and the resulting drop in training AUC is shown in the table, normalized to percentages. As with the variable jackknife, variable contributions should be interpreted with caution when the predictor variables are correlated. Values shown are averages over replicate runs.

Variable	Percent contribution	Permutation importance
ssurgo_mukey	23.3	40.7
temp_min	20.7	23.9
precip_annual	14.6	16.6
landcover	13	4.8
landcovermajority	9.5	1.5
landcoverreidgrp	7.3	0.6
geomorp05110	6.4	1.3
elevation	5.2	10.7

Command line to repeat this species model: java density.MaxEnt nowarnings noprefixes -E "" -E Hexastylis_naniflora nopictures outputdirectory=D:\Users\mendries\DataRequests\ReidR\HENA\Maxent\Output\CellCenterpoint_Replicate samplesfile=D:\Users\mendries\DataRequests\ReidR\HENA\Maxent\EOData\RasterCenterpointEOsPlus.csv environmentallayers=D:\Users\mendries\DataRequests\ReidR\HENA\Maxent\EnvironmentalLayers replicates=10 maximumiterations=5000 -N aspect -N aspect_simple -N landcoverdiversity -N slope -N ssurgo_drainage -N ssurgo_hydro -N temp_max -t geomorp05110 -t landcover -t landcovermajority -t landcoverreidgrp -t ssurgo_mukey

Site Name	State	County	Last Observed	Total plants	Resilience	Poplation/EO Number
Glade Creek, Alex County	North Carolina	Alexander	2017	>1000	very high	308
Catawba River: Hoyle Crk-Micol Crk	North Carolina	Burke	2013	>1000	very high	178
Island Creek Heath Bluff	North Carolina	Burke	2016	>1000	very high	29
Gunpowder Creek: South of Hudson	North Carolina	Caldwell	2012	>1000	very high	321
Peaked Top Rare Plant Site/Foothills Landfill	North Carolina	Caldwell	2014	>1000	very high	227
Jacob Fork West Corridor	North Carolina	Catawba	2012	>1000	very high	243
Murrays Mill/Upper Balls Creek NA	North Carolina	Catawba	2013	>1000	very high	96
NCDOT TIP: R-2824	North Carolina	Catawba	2015	>1000	very high	31
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	North Carolina	Catawba	2013	>1000	very high	179
Cowpens NBF - Site 1	South Carolina	Cherokee	2016	>1000	very High	3
Cliffside Steam Station	North Carolina	Clev/Ruth	2016	>1000	very high	276
Broad River/Sandy Run NA	North Carolina	Cleveland	2012	>1000	very high	100
Broad River: Brushy Creek	North Carolina	Cleveland	2016	>1000	very high	217
Buffalo Creek: Kings Mountain Res	North Carolina	Cleveland	2016	>1000	very high	216
Buffalo Creek: Tributaries N and S of SR 2047	North Carolina	Cleveland	2012	>1000	very high	214
Rhyne Conservation Preserve	North Carolina	Lincoln	2016	>1000	very high	302
Mill Creek Forest and Seep	North Carolina	Polk	2016	>1000	very high	23
New Hope Springhead Swamp	North Carolina	Polk	2016	>1000	very high	125
Big Horse Creek Rare Plant Site	North Carolina	Rutherford	2015	>1000	very high	99
Broad River: Floyds Creek	North Carolina	Rutherford	2016	>1000	very high	177
Davenport Road/Mountain View Rare Plant Site	North Carolina	Rutherford	2016	>1000	very high	176
Facebook Site	North Carolina	Rutherford	2016	>1000	very high	154
Floyds Creek Tributray Rare Plant Site	North Carolina	Rutherford	2012	>1000	very high	245
New Bethel Rare Plant Site	North Carolina	Rutherford	2015	>1000	very high	247
Richardson Creek trib above Toms Lake	North Carolina	Rutherford	2016	>1000	very high	312
DNR Peters Creek Heritage Preserve	South Carolina	Spartanburg	2016	>1000	very High	2
Taylor Blalock Res	South Carolina	Spartanburg	2016	>1000	very High	1
Little Gunpowder Creek Rare Plant Site 1	North Carolina	Caldwell	2015	500-1000	high	44
Little Gunpowder Creek Rare Plant Site 2	North Carolina	Caldwell	2015	500-1000	high	77
Northern Catawba County	North Carolina	Catawba	2017	500-1000	high	316
Rock Barn Solar Farm	North Carolina	Catawba	2010-2011	500-1000	high	9999
Buffalo Creek Rare Plant Site	North Carolina	Cleveland	2012	500-1000	high	232
Third Creek Rare Plant Site	North Carolina	Alexander	2010	100-500	moderate	59
Hickory Area	North Carolina	Burk/Cata/Cald	2016	100-500	moderate	295
Burke County - Drowning Creek UT	North Carolina	Burke	2017	100-500	moderate	318
Simms Hill/Little River Uplands	North Carolina	Burke	2015	100-500	moderate	304
Smith Cliff/Henry Fork River	North Carolina	Burke	2015	100-500	moderate	303
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	North Carolina	Catawba	2016	100-500	moderate	158
NCDOT TIP R-2824	North Carolina	Catawba	2015	100-500	moderate	32
South Fork Catawba River, Henry Fork	North Carolina	Catawba	2007	100-500	moderate	252
Broad River/Sandy Run NA	North Carolina	Cleveland	2012	100-500	moderate	274
Brushy Creek Headwaters	North Carolina	Cleveland	2014	100-500	moderate	298
First Broad River: Crooked Run Creek	North Carolina	Cleveland	2010	100-500	moderate	157
No Business Creek, Boyd Tract	North Carolina	Cleveland	2007	100-500	moderate	272
West Shelby Mesic Slope	North Carolina	Cleveland	2016	100-500	moderate	93
UT of Kings Mountain Res	North Carolina	Gaston	2012	100-500	moderate	296
Buffalo Shoals Creek	North Carolina	Iredell	2014	100-500	moderate	275
Cat Square Heartleaf Forest	North Carolina	Lincoln	2012	100-500	moderate	98
Collinsville (Hughes) Creek Slopes	North Carolina	Polk	2016	100-500	moderate	311
Fox Knoll Farm	North Carolina	Polk	2016	100-500	moderate	287
Forest City: Adj to Isothermal CC	North Carolina	Rutherford	2010	100-500	moderate	292
Jonas Road Rare Plant Site	North Carolina	Rutherford	2014	100-500	moderate	248
NCDOT TIP R-3603A	North Carolina	Alexander	2017	<100	low	317
South Mountains Pleasant Grove Uplands	North Carolina	Burke	2016	<100	low	309
Gunpowder Creek	North Carolina	Caldwell	2012	<100	low	291
Killian Crossroads	North Carolina	Catawba	2010	<100	low	293
Pott Creek	North Carolina	Catawba	2012	<100	low	271
Beaverdam Crk at First Broad River	North Carolina	Cleveland	2011	<100	low	297
Buffalo Creek: Potts Creek	North Carolina	Cleveland	2012	<100	low	208
Buffalo Creek: Ravine	North Carolina	Cleveland	2007	<100	low	206
Hickory Creek - UT (Shelby High School)	North Carolina	Cleveland	2016	<100	low	320
Boulder Creek Subdivision - Jordan Road	South Carolina	Greenville	2016	<100	low	4

County	Very High	High	Moderate	Low	Totals
Alexander	1		1	1	3
Burk/Cata/Cald			1		1
Burke	2		3	1	6
Caldwell	2	2		1	5
Catawba	4	2	3	2	11
Cherokee	1				1
Clev/Ruth	1				1
Cleveland	4	1	5	4	14
Gaston			1		1
Greenville				2	2
Iredell			1	2	3
Lincoln	1		1	2	4
Polk	2		2		4
Rutherford	7		2		9
Spartanburg	2				2
Totals	27	5	20	15	67

% of Total	40	7	30	22	100
Cumulative %	40	48	78	100	

Site Name	State	County	Last Observed	Total plants	Resilience	Poplation/EO Number
Gateway Elementary School	South Carolina	Greenville	2017	<100	low	5
Fanjoy Road Site	North Carolina	Iredell	2015	<100	low	306
Levan Family Farm	North Carolina	Iredell	2013	<100	low	300
Lincoln County, SR-1314	North Carolina	Lincoln	2014	<100	low	299
Northeast Lincolnton: UT Walker Branch	North Carolina	Lincoln	2009	<100	low	279

County	Very High	High	Moderate	Low	Totals

Site Name	State	County	Last Observed	Total plants	Resilience
Glade Creek, Alex County	North Carolina	Alexander	2017	>1000	very high
Catawba River: Hoyle Crk-Micol Crk	North Carolina	Burke	2013	>1000	very high
Island Creek Heath Bluff	North Carolina	Burke	2016	>1000	very high
Gunpowder Creek: South of Hudson	North Carolina	Caldwell	2012	>1000	very high
Peaked Top Rare Plant Site/Foothills Landfill	North Carolina	Caldwell	2014	>1000	very high
Jacob Fork West Corridor	North Carolina	Catawba	2012	>1000	very high
Murrays Mill/Upper Balls Creek NA	North Carolina	Catawba	2013	>1000	very high
NCDOT TIP: R-2824	North Carolina	Catawba	2015	>1000	very high
South Fork Catawba R: Clark Crk, Miller Br, Cata Mem Hos	North Carolina	Catawba	2013	>1000	very high
Cowpens NBF - Site 1	South Carolina	Cherokee	2016	>1000	very High
Cliffside Steam Station	North Carolina	Clev/Ruth	2016	>1000	very high
Broad River/Sandy Run NA	North Carolina	Cleveland	2012	>1000	very high
Broad River: Brushy Creek	North Carolina	Cleveland	2016	>1000	very high
Buffalo Creek: Kings Mountain Res	North Carolina	Cleveland	2016	>1000	very high
Buffalo Creek: Tributaries N and S of SR 2047	North Carolina	Cleveland	2012	>1000	very high
Rhyne Conservation Preserve	North Carolina	Lincoln	2016	>1000	very high
Mill Creek Forest and Seep	North Carolina	Polk	2016	>1000	very high
New Hope Springhead Swamp	North Carolina	Polk	2016	>1000	very high
Big Horse Creek Rare Plant Site	North Carolina	Rutherford	2015	>1000	very high
Broad River: Floyds Creek	North Carolina	Rutherford	2016	>1000	very high
Davenport Road/Mountain View Rare Plant Site	North Carolina	Rutherford	2016	>1000	very high
Facebook Site	North Carolina	Rutherford	2016	>1000	very high
Floyds Creek Tributray Rare Plant Site	North Carolina	Rutherford	2012	>1000	very high
New Bethel Rare Plant Site	North Carolina	Rutherford	2015	>1000	very high
Richardson Creek trib above Toms Lake	North Carolina	Rutherford	2016	>1000	very high
DNR Peters Creek Heritage Preserve	South Carolina	Spartanburg	2016	>1000	very High
Taylor Blalock Res	South Carolina	Spartanburg	2016	>1000	very High
Little Gunpowder Creek Rare Plant Site 1	North Carolina	Caldwell	2015	500-1000	high
Little Gunpowder Creek Rare Plant Site 2	North Carolina	Caldwell	2015	500-1000	high
Northern Catawba County	North Carolina	Catawba	2017	500-1000	high
Rock Barn Solar Farm	North Carolina	Catawba	2010-2011	500-1000	high
Buffalo Creek Rare Plant Site	North Carolina	Cleveland	2012	500-1000	high
Third Creek Rare Plant Site	North Carolina	Alexander	2010	100-500	moderate
Hickory Area	North Carolina	Burk/Cata/Cald	2016	100-500	moderate
Burke County - Drowning Creek UT	North Carolina	Burke	2017	100-500	moderate
Simms Hill/Little River Uplands	North Carolina	Burke	2015	100-500	moderate
Smith Cliff/Henry Fork River	North Carolina	Burke	2015	100-500	moderate
NCDOT non-TIP Div 12 road const at SR 1115 South Fork Catawba River Jacobs Fork and Camp Creek	North Carolina	Catawba	2016	100-500	moderate
NCDOT TIP R-2824	North Carolina	Catawba	2015	100-500	moderate
South Fork Catawba River, Henry Fork	North Carolina	Catawba	2007	100-500	moderate
Broad River/Sandy Run NA	North Carolina	Cleveland	2012	100-500	moderate
Brushy Creek Headwaters	North Carolina	Cleveland	2014	100-500	moderate
First Broad River: Crooked Run Creek	North Carolina	Cleveland	2010	100-500	moderate
No Business Creek, Boyd Tract	North Carolina	Cleveland	2007	100-500	moderate
West Shelby Mesic Slope	North Carolina	Cleveland	2016	100-500	moderate
UT of Kings Mountain Res	North Carolina	Gaston	2012	100-500	moderate
Buffalo Shoals Creek	North Carolina	Iredell	2014	100-500	moderate
Cat Square Heartleaf Forest	North Carolina	Lincoln	2012	100-500	moderate
Collinsville (Hughes) Creek Slopes	North Carolina	Polk	2016	100-500	moderate
Fox Knoll Farm	North Carolina	Polk	2016	100-500	moderate
Forest City: Adj to Isothermal CC	North Carolina	Rutherford	2010	100-500	moderate
Jonas Road Rare Plant Site	North Carolina	Rutherford	2014	100-500	moderate
NCDOT TIP R-3603A	North Carolina	Alexander	2017	<100	low
South Mountains Pleasant Grove Uplands	North Carolina	Burke	2016	<100	low
Gunpowder Creek	North Carolina	Caldwell	2012	<100	low
Killian Crossroads	North Carolina	Catawba	2010	<100	low
Pott Creek	North Carolina	Catawba	2012	<100	low
Beaverdam Crk at First Broad River	North Carolina	Cleveland	2011	<100	low
Buffalo Creek: Potts Creek	North Carolina	Cleveland	2012	<100	low

County	Very High	High	Moderate	Low	Totals
Alexander	1		1	1	3
Burk/Cata/Cald			1		1
Burke	2		3	1	6
Caldwell	2	2		1	5
Catawba	4	2	3	2	11
Cherokee	1				1
Clev/Ruth	1				1
Cleveland	4	1	5	4	14
Gaston			1		1
Greenville				2	2
Iredell			1	2	3
Lincoln	1		1	2	4
Polk	2		2		4
Rutherford	7		2		9
Spartanburg	2				2
Totals	27	5	20	15	67

Site Name	State	County	Last Observed	Total plants	Resilience
Buffalo Creek: Ravine	North Carolina	Cleveland	2007	<100	low
Hickory Creek - UT (Shelby High School)	North Carolina	Cleveland	2016	<100	low
Boulder Creek Subdivision - Jordan Road	South Carolina	Greenville	2016	<100	low
Gateway Elementary School	South Carolina	Greenville	2017	<100	low
Fanjoy Road Site	North Carolina	Iredell	2015	<100	low
Levan Family Farm	North Carolina	Iredell	2013	<100	low
Lincoln County, SR-1314	North Carolina	Lincoln	2014	<100	low
Northeast Lincolnton: UT Walker Branch	North Carolina	Lincoln	2009	<100	low

County	Very High	High	Moderate	Low	Totals

United States Department of the Interior

FISH AND WILDLIFE SERVICE
176 Croghan Spur Road, Suite 200
Charleston, South Carolina 29407

April 11, 2006

FILE

Ms. Laura Belanger
Environmental Permitting Consultants
PO Box 3744
Greenville, SC 29608

Re: Boulder Creek Subdivision
Greenville County, South Carolina
FWS Log No: 2006-I-0420

Dear Ms. Belanger:

The U.S. Fish and Wildlife Service (Service) has reviewed the proposal for Boulder Creek (Jordan Road) Subdivision. The subject property is located on Jordan Road in Greenville County, South Carolina. The following comments are provided in accordance with section 7 of the Endangered Species Act (Act), as amended (16 U.S.C. 1531-1543).

Extant populations of the endangered *Hexastylis naniflora* have been identified on the proposed property along two of the creeks within the project boundary. No direct impacts to the population are anticipated. The developers of this site are aware of the H. naniflora population and assume responsibility for maintaining suitable habitat conditions for the species. As per our discussion on the March 27, 2006, site visit and follow-up letter from Laura Belanger dated March 28, 2006, a 25-foot protective buffer will be fenced and maintained in restrictive covenant to protect both populations. Twice annual monitoring will be conducted for the two years of construction, with monitoring reports submitted to the Service's Charleston Field Office. At the completion of construction, the final monitoring report will include detailed information regarding long-term monitoring and protection plans of the two *Hexastylis* populations.

Based on information provided, proposed conservation measures for the on-site population of *Hexastylis naniflora*, it is the opinion of the Service that the proposed action is not likely to adversely affect listed species.

Your interest in ensuring the protection of endangered species is appreciated. If you have further questions or require additional information, please contact Lora Zimmerman of this office at (843) 727-4707 ext. 226. In future correspondence concerning this project, please reference FWS Log No. 2006-I-0420.

Sincerely,

Catherine D. Duncan
Acting Field Supervisor

CDD/LLZ

cc:

Mr. Les Parker, USACOE, Columbia, SC

RECEIVED MAR 3 1 2006

Environmental Permitting Consultants, Inc.

US Fish and Wildlife Service
Charleston Field Office
176 Croghan Spir Road
Suite 200
Charleston, SC 29407

March 28, 2006

Attention: Lora Zimmerman

Dear Ms. Zimmerman,

This letter is in regards to the Boulder Creek NWP permit application submitted to Les Parker at the US Army Corps of Engineers January 30, 2006. The property contains two populations of *Hexastylis naniflora*. The first population is located in the far southwestern corner of the property and the second population is located near the southernmost property boundary.

As per our site meeting on March 27, 2006, propose to do the following:

- Place a 25 foot protective buffer around each population of *Hexastylis naniflora.*
- Include these buffered areas in the restrictive covenants proposed for the project.
- Place protective fencing around the populations of *Hexastylis naniflora.*
- Monitor the populations for two years, submitting to FWS four letter reports with photos documenting the populations.
- Upon completetion of construction and formation of the Homeowners Association, hosting a meeting with the Homeowners Association making them aware of the *Hexastylis naniflora* populations, potential impacts to the populations and how they can be avoided, and the terms of the restrictive covenants.

The populations and their approximate locations are provided in Figure 2 of the Protected Species Habitat Assessment preformed by Environmental Permitting consultants in January 2006. Please feel free to contact me (864) 271-3040 regarding any questions or concerns.

Sincerely,

Laura H. Belanger

Laura H. Belanger

Cc: Chip Fogleman, Fant Reichert & Fogleman, Inc.
Les Parker, USACE
Jed Aho, Midland Builders

P.O. Box 3744 • Greenville, South Carolina 29608 • (864) 271-3040 • Fax (864) 235-9299
P.O. Box 2346 • Hendersonville, North Carolina 28793 • Phone/Fax (828) 891-8414

PHONE LOG

FWS Contact: Morgan Wolf **Date:** 7/8/13

Time: 10:25 am

File No. 2006-I-0420

Received From: M. Wolf
Call Made To: Launa Belanger

Organization: EPC

Telephone #: 864-271-3040

Subject: Boulder Creek Subdivision, Ft. Hamilton pop'n. Greenville, SC

Discussion: Launa stated that the last contact EPC had w/ the builders (Midland Inc) or Midland Builders regarding this project was May 21, 2012, when they sent a monitoring proposal for Ft. Hamilton to the builders. She is not sure if they contracted w/ someone else to do the monitoring & restrictive covenants.

- Launa gave Midland contact as Jed Aho (-) FAX 864-848-7173
- I have researched Midland Builders and Midland Inc.; & Les Parker - Corps Contact cannot find a working telephone number

▷ but as of NOV 25, 2012, the development has been built.

- Last address/phone = 514 E North street, Greenville, SC 29601 / 864-[illegible] 5997

3:55 pm - spoke w/ Les Parker; he remembers project & will try to locate monitoring reports & restrictive cov.

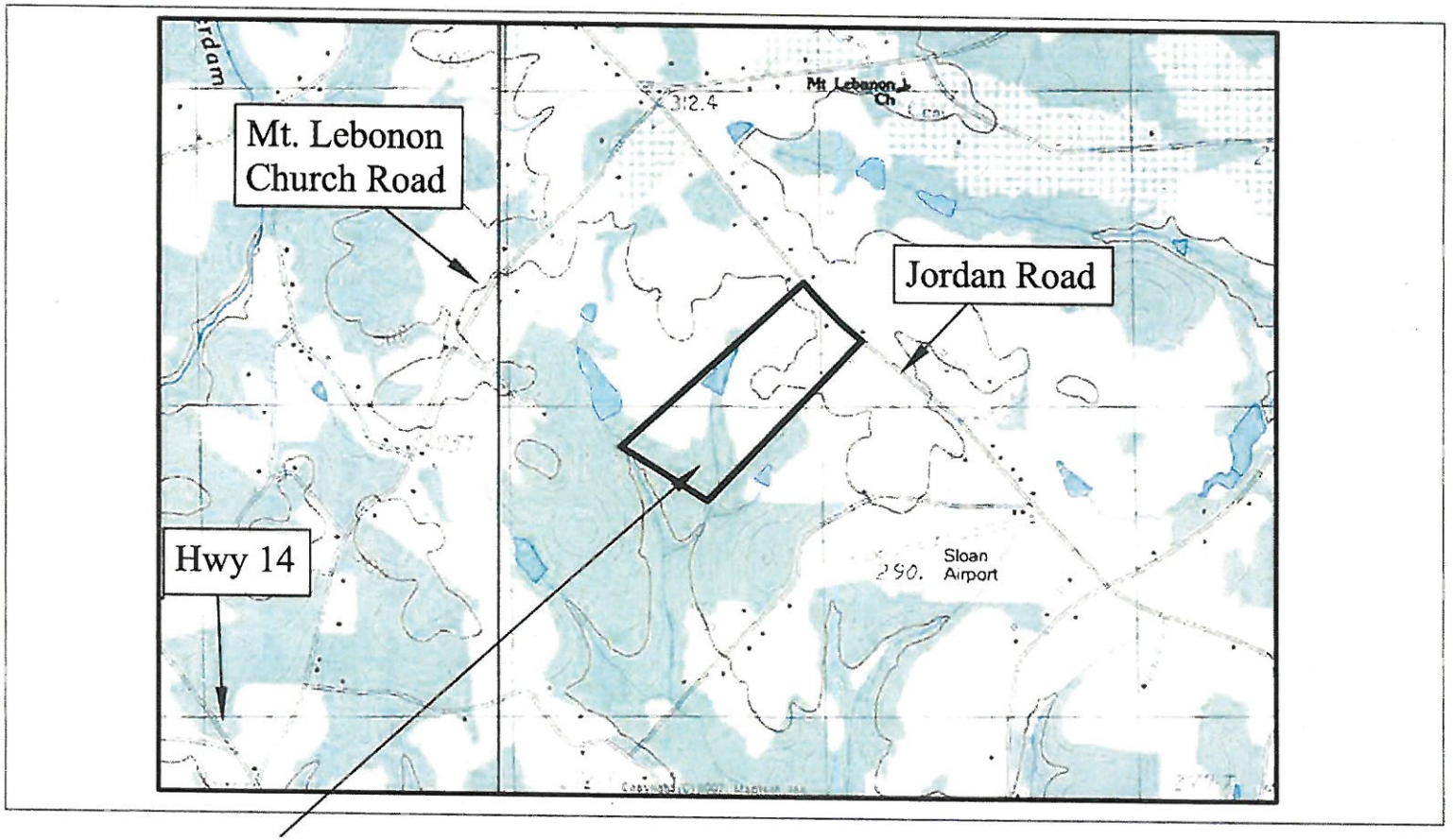
Signature:

Img 11/05/12 printed 11/8/13 MKW

Google earth

feet 1000

meters 500



Source: USGS Topographic Series, Paris Mt. Quadrant
Greenville County, South Carolina

hear

Silver Jeep Liberty
828-553-9548

ENVIRONMENTAL PERMITTING CONSULTANTS, INC.	GRAPHIC SCALE 500 0 500 1000 — 1 inch = 1000 feet	REVISIONS (NO. / DRAWN BY: / COMMENTS:)	Boulder Creek Site Location Midland Builders Greenville County	SHEET NO. 1 OF 1
Post Office Box 3744 Greenville, SC 29608 Phone: (864) 271-3040 Fax: (864) 235-9299	DRAWN BY: lhb DATE: 23jan2006 EPC PROJECT NO.: 05pcn131		USACE P/N:.	

→ How far off the stream are the plants?
How wide of a buffer do we need to put in basement?

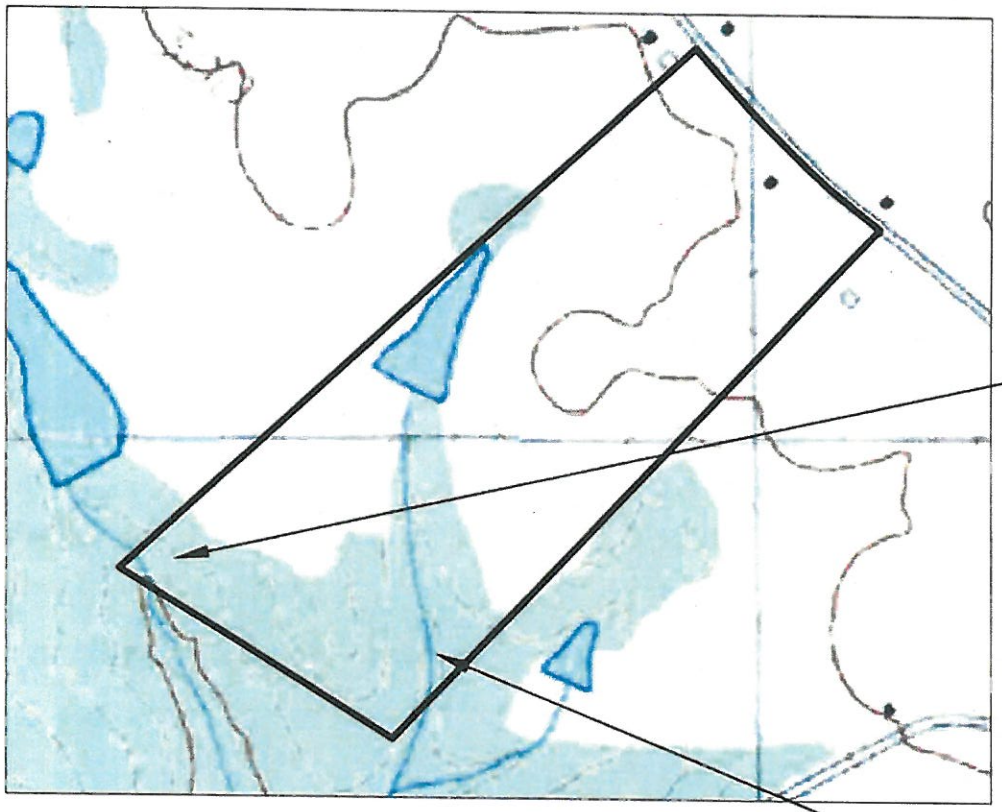
→ Plants will not be w/in lot lines

→ Annual monitoring reports during construction & beyond including habitat conditions & stem count.

→ will fence

→ 10 ft. buffer from plants
walking trails
plants/native vegetation
remove dead & down

Nationwide 39



Populations of *Hexastylis naniflora* found on target property.

ENVIRONMENTAL PERMITTING CONSULTANTS, INC.

Post Office Box 3744
Greenville, SC 29608
Phone: (864) 271-3040
Fax: (864) 235-9299

GRAPHIC SCALE

300 0 300 600

1 inch = 600 feet

DRAWN BY:	lhb
DATE:	23jan2006
EPC PROJECT NO.:	05pcn131

REVISIONS

NO.:	DRAWN BY:	COMMENTS:

Boulder Creek

Species Location Map

Midland Builders

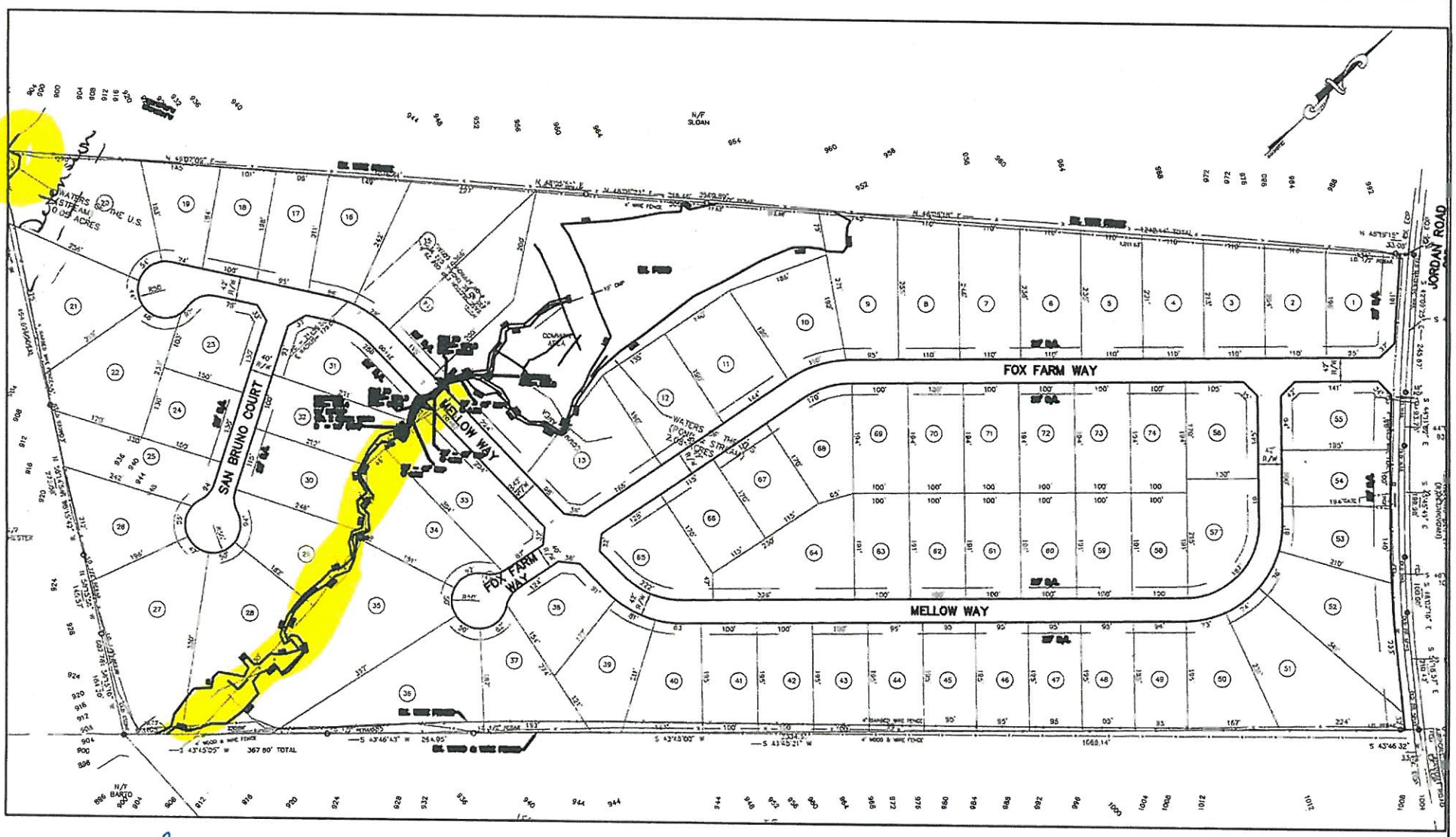
Greenville County

USACE P/N:.

SHEET NO.

2

OF 2



Balanger

Laura Balanger

ENVIRONMENTAL PERMITTING -CONSULTANTS, INC.	GRAPHIC SCALE 125 0 125 250 1 inch = 250 feet	REVISIONS NO. / DRAWN BY / COMMENTS	Boulder Creek Overview Midland Builders Greenville County USACE P/N:.	SHEET NO. 3 OF 5

Post Office Box 3744
Greenville, SC 29608
Phone: (864) 271-3040
Fax: (864) 235-9299

DRAWN BY: lhb
DATE: 23jan2006
EPC PROJECT NO.: 05pcn131

Photo 1: Representative photo of the cleared area on the target property.

Photo 2: Representative photo of the stream on the target property.

Photo 3: Area north of the pond, potential habitat for bunched arrowhead

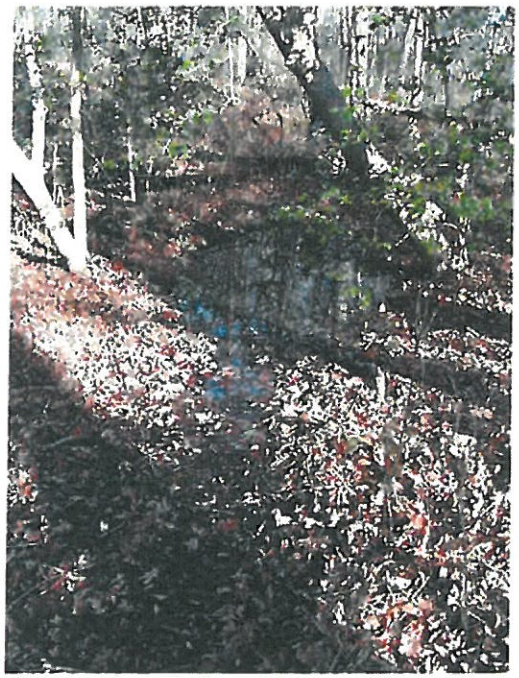


Photo 4: *Hexastylis naniflora* habitat

Hexastylis naniflora located on target property