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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.

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.

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.

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.

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).

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).

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***.

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.

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.

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

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.

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).

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.

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).

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.

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.

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.

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.

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.

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.

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).

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

United States Department of the Interior

FISH AND WILDLIFE SERVICE

JUL 0 5 2018

In Reply Refer To:
FWS/AES/DRR/BRCPC/068444

Memorandum

To: Assistant Regional Directors, Regions 1-8

From: Acting Assistant Director – Ecological Services Gina Shultz

Subject: Clarification and Revision of Post-Delisting Monitoring Plan Notice Requirements and Guidance

Attached is the revised version of *Section 6.1.2 FWS responsibilities and approval process* of the August 2008 U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service joint *Post-Delisting Monitoring Plan Guidance*. This revised section applies only to the USFWS and supersedes the 2008 version.

We are required by section 4(g) of the Endangered Species Act (ESA) to monitor, in cooperation with the states, any species delisted due to recovery. We are not required to produce a post delisting monitoring (PDM) plan by the ESA or our implementing regulations; publication of a Federal Register notice for review of a PDM plan is also not required. While a formal plan noticed in the Federal Register is not required, we must still document our coordination, planning, and implementation of PDM. Our experiences with the wide variety of circumstances, types of partnerships, and the availability of various means of communicating and collaborating with states and other partners, indicates that noticing draft and final post-delisting monitoring plans in the Federal Register may not be the most effective way to collaborate. This revision clarifies that there is flexibility in the 2008 guidance for announcing the availability of post-delisting monitoring plans in the Federal Register.

This guidance is posted in the Endangered Species Act Document Library at: https://www.fws.gov/endangered/esa-library/index.html. If you have any questions, please contact Ms. Lisa Ellis, Chief, Branch of Recovery, Conservation Planning, and Communication at (703) 358-2307 or lisa_ellis@fws.gov.

Attachments

From: Hamilton, Byron
To: Reid, Rebekah N
Cc: Becker, Drew N
Subject: Re: Next Steps for Hexastylis
Date: Wednesday, August 1, 2018 11:26:21 AM
Attachments: Dwarf-flowered Heartleaf Proposed Rule.docx
Importance: High

Hi Rebekah,

I recently finished the 1st draft of the proposed rule and I'm getting Tim's edits. I've attached it below.

On Wed, Aug 1, 2018 at 11:06 AM, Rebekah Reid <rebekah_reid@fws.gov> wrote:

> Hi Byron and Drew,
>
> I'm just checking in on the next steps for Hexastylis naniflora. Any updates?
>
> 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

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 Wildlife (List) due to recovery. 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 has recovered and 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 Florida Golden Aster 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: Michael Gale, Acting Field Supervisor, U.S. Fish and Wildlife Service, Tennessee Ecological Services Field Office, 446 Neal Street,

Cookeville, TN 38506; telephone 931-528-6481. 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 Wildlife in title 50 of the Code of Federal Regulations (50 CFR 17.11(h)) based on the species' recovery. 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. We may delist a species 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 based on recovery.

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 sought the expert opinions of

seven appropriate specialists regarding the SSA Report, which informed the proposed rule to delist the species. The purpose of peer review is to ensure that our classification 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:

(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 Action

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. The dwarf-flowered heartleaf has been listed as threatened under the Endangered Species Act of 1973, as amended 6 (Act), since 1989 (FR 54 14964-14967). A Recovery Plan for the species was never completed. However, over the last 29 years, the 15 Service has worked closely with partners to make significant progress toward recovery of the 16 species.

Background

A thorough review of the taxonomy, life history, ecology, and overall viability of the Dwarf-flowered Heartleaf is presented in the SSA (USFWS 2018; available at https://www.fws.gov/southeast/).

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, 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.

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.

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.

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 individual life-history needs. The next stage involved an assessment of the historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. The final stage of the SSA involved making 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

occupancy, thereby increasing resiliency of populations.

The species also needs to exhibit some degree of redundancy. We measured redundancy for the Dwarf-flowered heartleaf in terms of 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.

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

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.

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 1.1; 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.

Current Resilience

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). 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. 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.

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.

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).

There are 78 populations of dwarf-flowered heartleaf that have been observed since 2005, 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.

Table 1.1. 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

Site Name	State	County	Last Observed	Total plants	Resilience
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
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

Site Name	State	County	Last Observed	Total plants	Resilience
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 1.2. 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 1.3 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 1.3. 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

Summary of Threats and Conservation Measures that Affect the Species

We completed a comprehensive assessment of the biological status of the Dwarf-flowered Heartleaf, and prepared a report of the assessment, which provides a thorough account of the species' overall viability. 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.

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.

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

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 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).

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 federally listed in 1989, this was not known to be a significant factor 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 provides limited protection from 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. 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 (Appendix B, Table B.9). 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.

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.

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

Invasive exotic plant species are rampantly 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.

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), 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.

As discussed above, the trend for North/South Carolina 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, 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.

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.

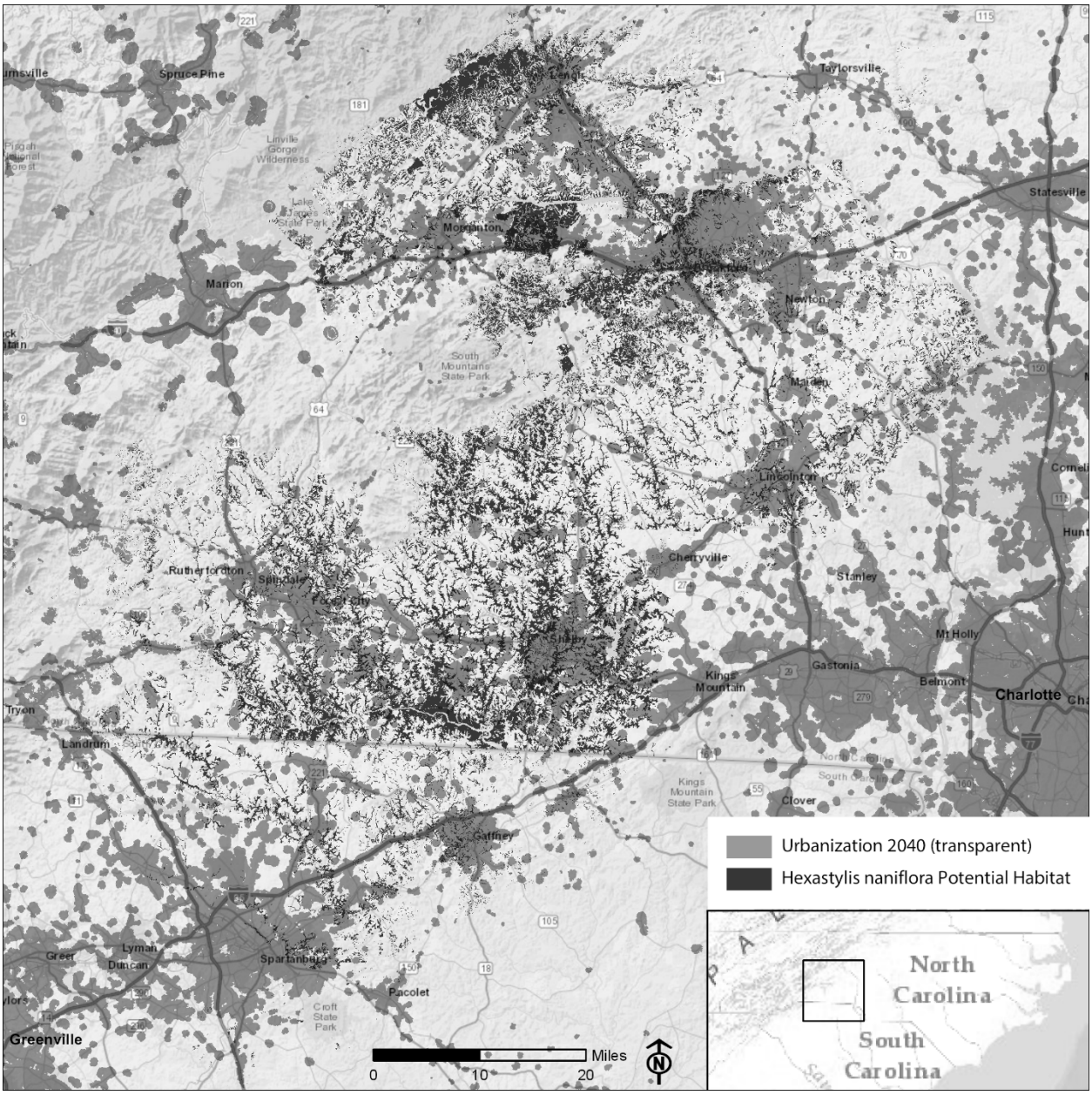
Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. Results of

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 1.4). 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 1.4. 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 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 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 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 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 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 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 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.

Table 1.5. 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. 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).

High Development Scenario

In the High Development scenario, there are predicted to be 72 populations of Dwarf-flowered heartleaf on the landscape in 2040. 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.

Targeted Conservation Scenario

In the Targeted Conservation scenario, there are predicted to be 79 populations of Dwarf-flowered heartleaf on the landscape in 2040. 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).

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 1.6. 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

Section 4 of the Act, and its implementing regulations at 50 CFR part 424, set forth the procedures for listing species, reclassifying species, 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 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.

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 due to recovery. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted due to recovery 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 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, Asheville, North Carolina 28801 (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 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 is staff members of the Service's Southeastern Region Recovery Team and the South Carolina/ 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: Hamilton, Byron
Cc: Becker, Drew N
Subject: Re: Next Steps for Hexastylis
Date: Wednesday, August 1, 2018 2:46:42 PM
Attachments: Draft HENA SSA_07.31.18.docx
Importance: High

Byron,

I looked through this briefly. I have a couple of questions/comments:

1. Has the RO briefing been scheduled?
2. I see that a lot of the information for the proposed rule comes directly from the SSA. I have a more recent version of the SSA that may be helpful (attached - final edits were made yesterday). After our RTM, I spent some quality time going through the document editing for consistency and making sure there were no hold-overs from older versions. For example, there was a Figure # referenced that isn't actually in the document, the US Fish and Wildlife Service is referred to as "USFWS" and "Service", there were some numbers reported that were from an older version, etc. I see that some of this transferred to the proposed rule and should probably be corrected. Let me know how I can help get the updates into the proposed rule.
3. I see the proposed rule references the PDM. I was told I would likely be helping with the PDM but it hasn't been made clear who actually is doing it or when it is due. Any insight on that would be helpful.

I'm here if you need anything. Thanks for all your hard work on Hexastylis!

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, Aug 1, 2018 at 11:27 AM Rebekah Reid <rebekah_reid@fws.gov> wrote:

> Great, Byron. Thanks so much for sharing!
>
> 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, Aug 1, 2018 at 11:26 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Hi Rebekah,
>
> I recently finished the 1st draft of the proposed rule and I'm getting Tim's edits. I've attached it below.
>
> On Wed, Aug 1, 2018 at 11:06 AM, Rebekah Reid <rebekah_reid@fws.gov> wrote:
>
> > Hi Byron and Drew,
> >
> > I'm just checking in on the next steps for Hexastylis naniflora. Any updates?
> >
> > 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.**
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> **Work - (404) 679-4119**
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Species Status Assessment for Dwarf-flowered Heartleaf (*Hexastylis naniflora*)



DRAFT

Prepared by:

Michael E. Marshall
U.S. Fish and Wildlife Service
Ecological Services
Atlanta, Georgia

Version 1.0
July 2018

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.

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

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

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.

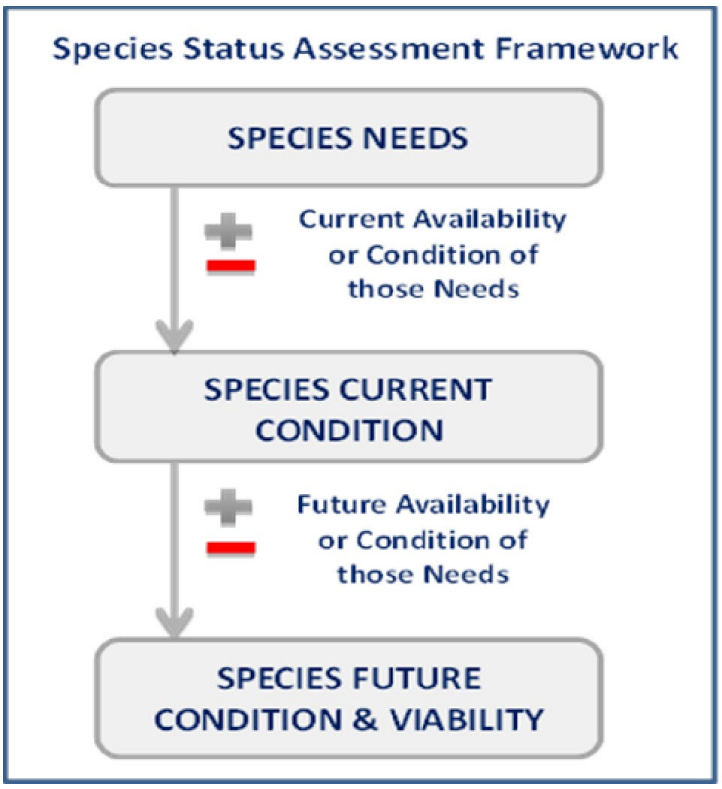


Figure 1.1. Species Status Assessment Framework

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.

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).

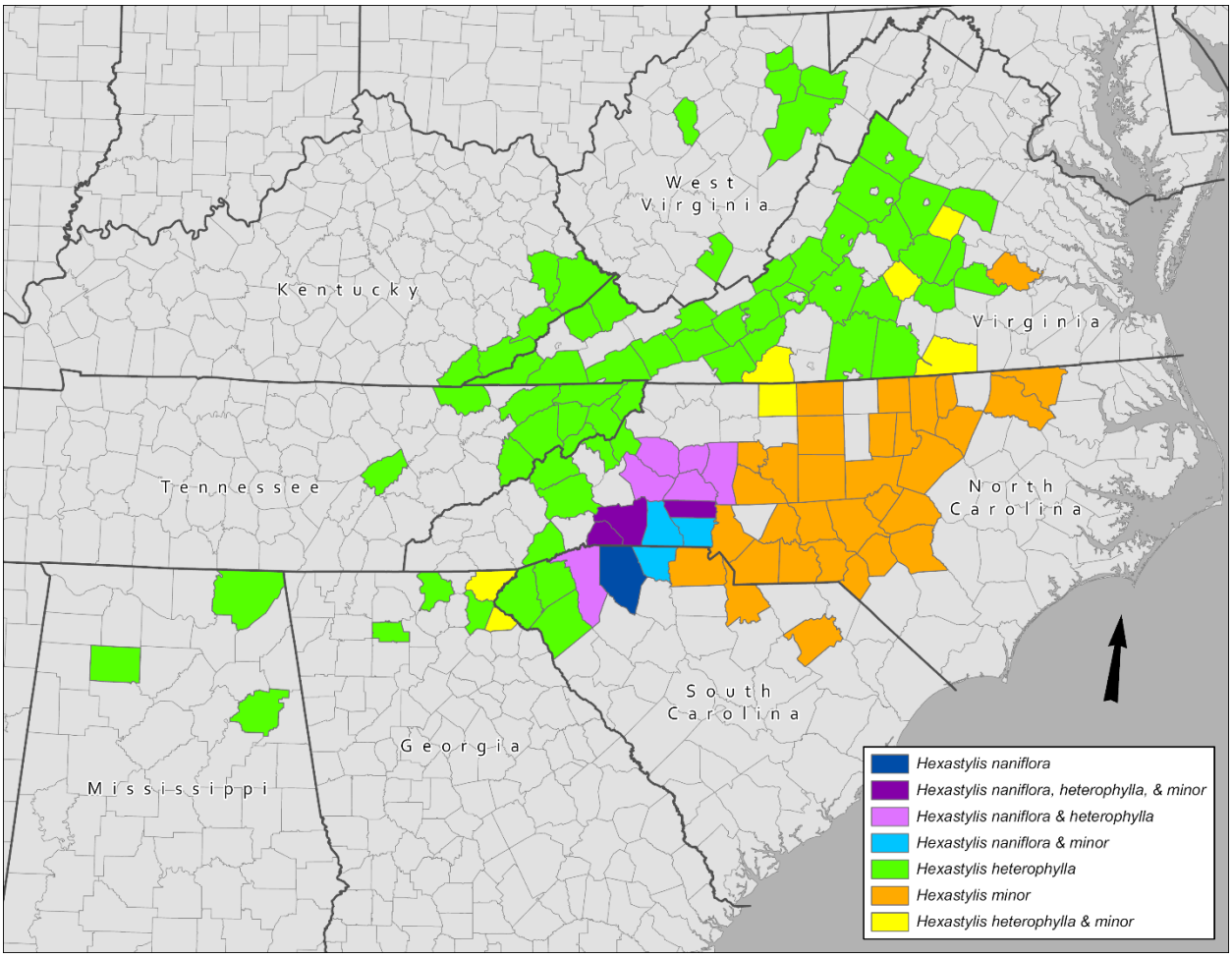


Figure 2.1. Distribution map showing county records for the three species in the Heterophylla complex. Data was gathered from herbarium specimens, element occurrence records and field studies. *Based on Murrell et al. 2007.*

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).

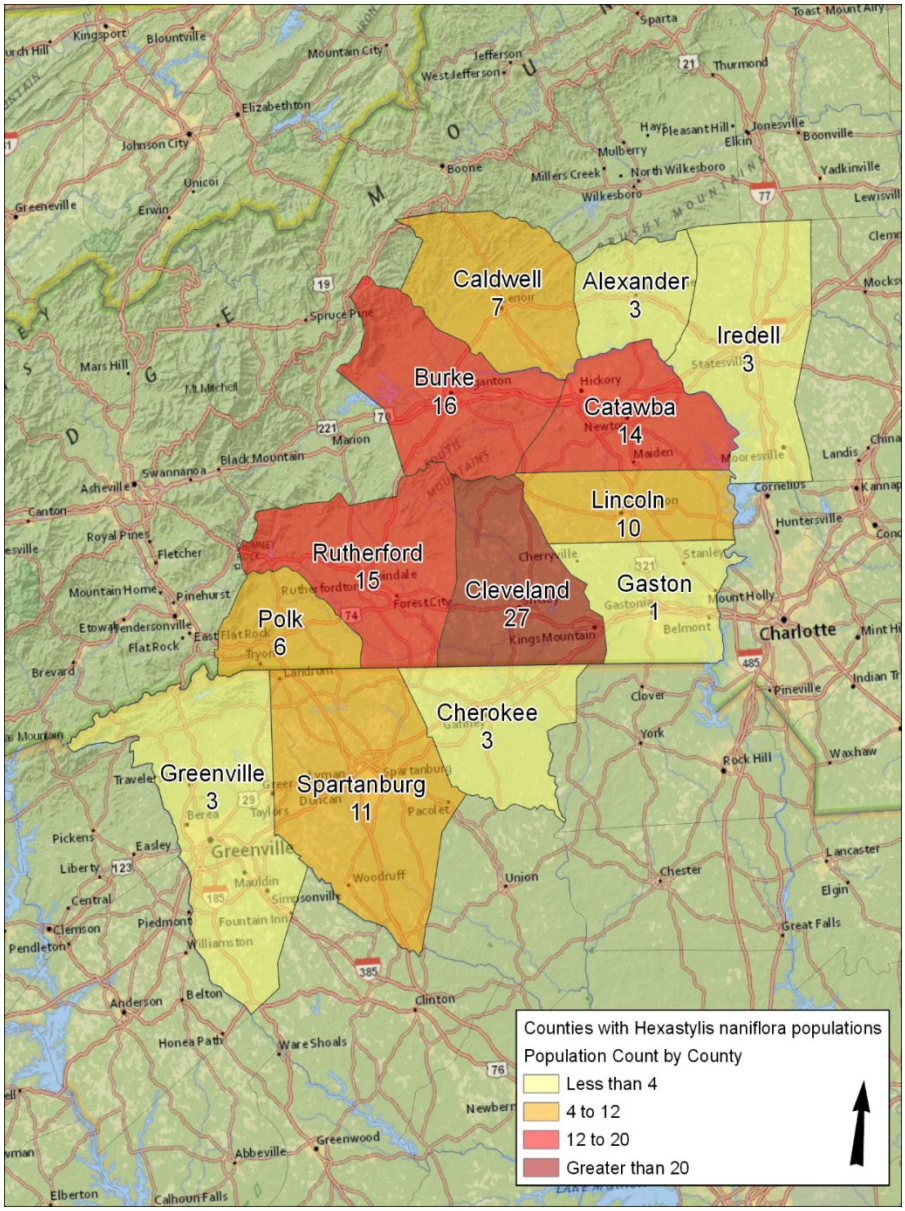


Figure 2.2. Current county distribution for dwarf-flowered heartleaf, with associated number of known populations within each county.

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.

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 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).

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.

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).

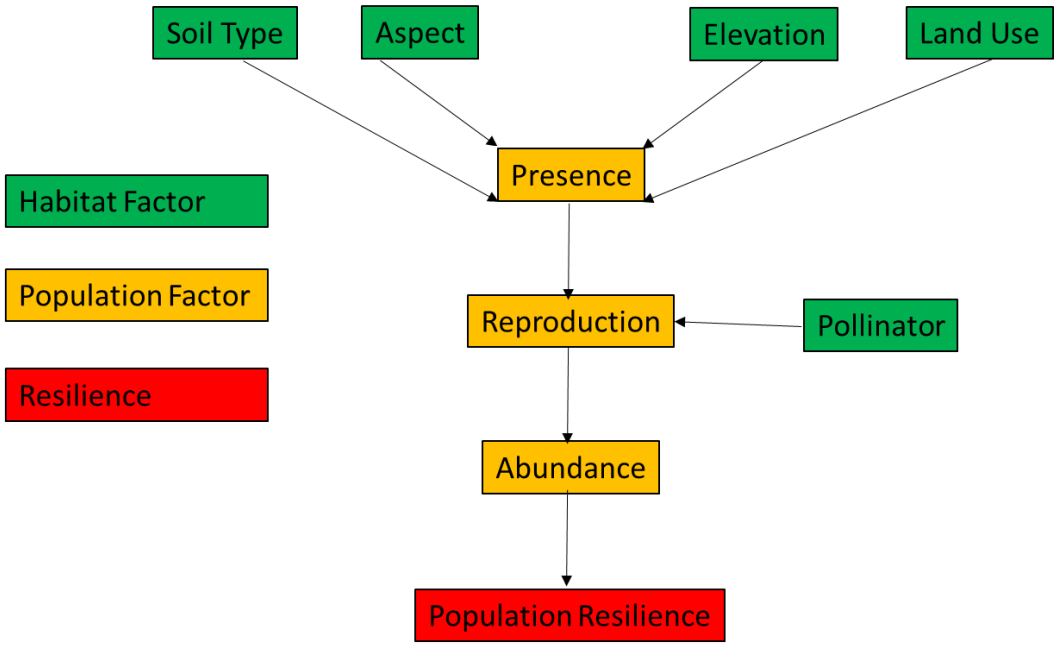


Figure 3.1. Conceptual diagram describing population and habitat factors influencing population resilience for dwarf-flowered heartleaf.

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.

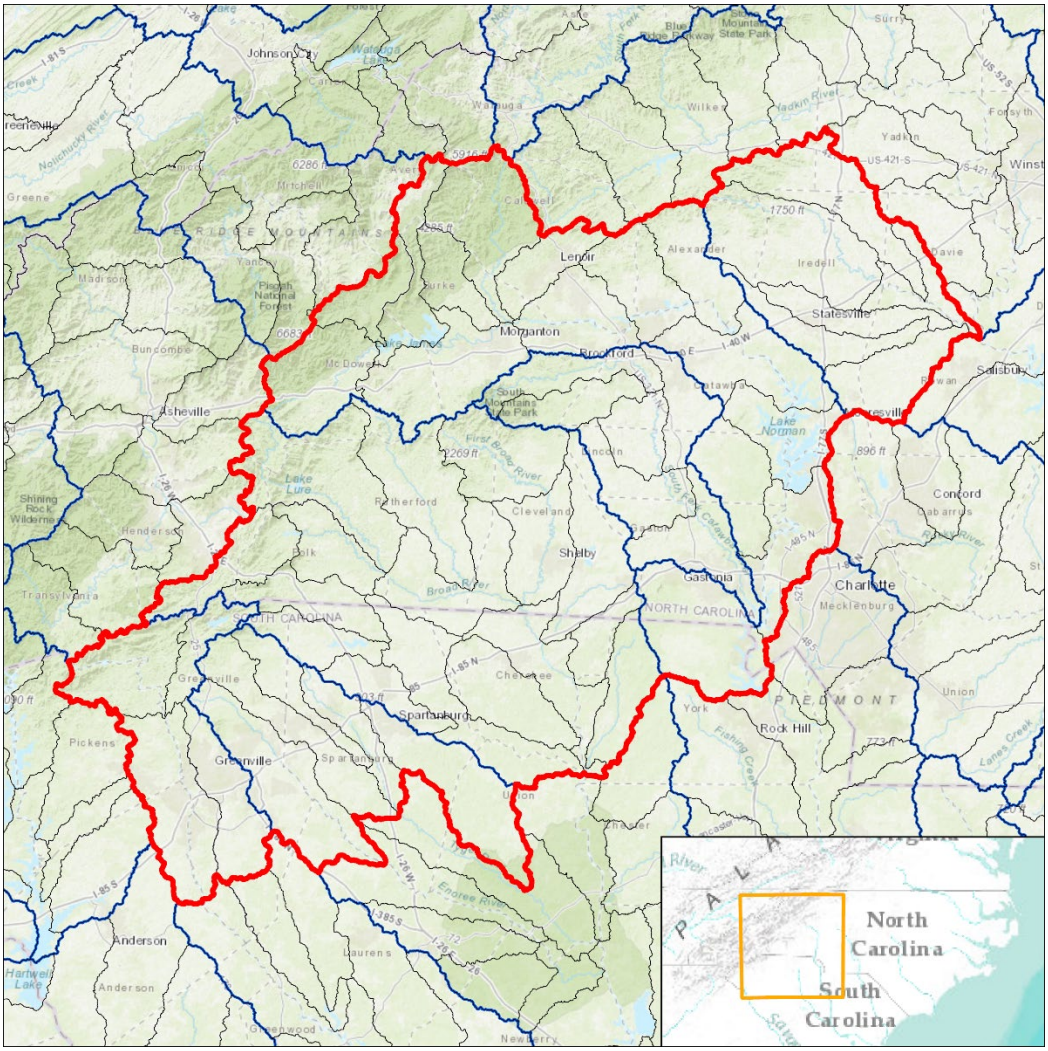


Figure 3.2. Analysis extent of the habitat model for *Hexastylis naniflora.* Red line indicates Maxent analysis extent, blue lines are 8-digit HUC boundaries, black lines are 10-digit HUC boundaries.

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).

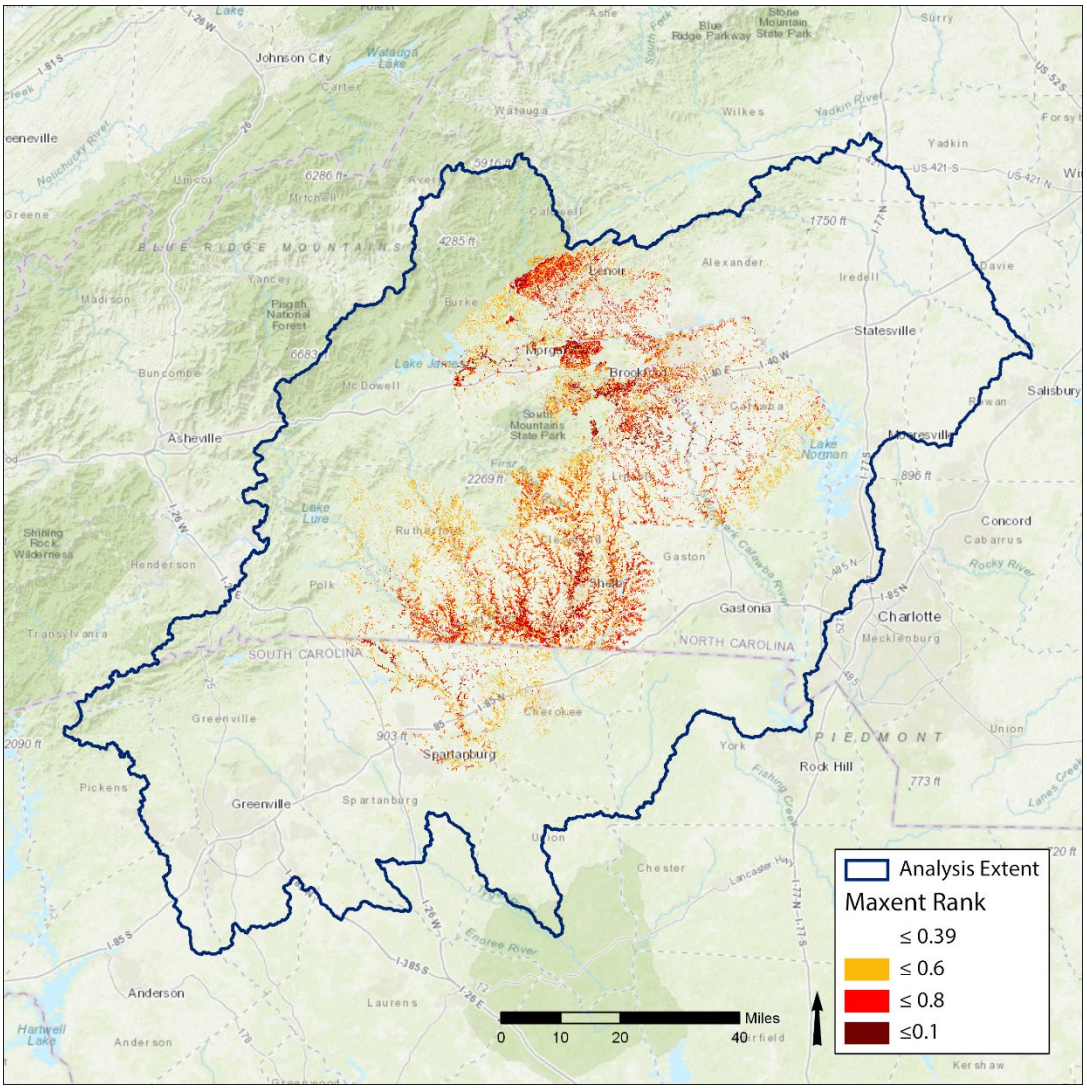


Figure 3.3. Maxent model output map

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 EO 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 (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.

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.

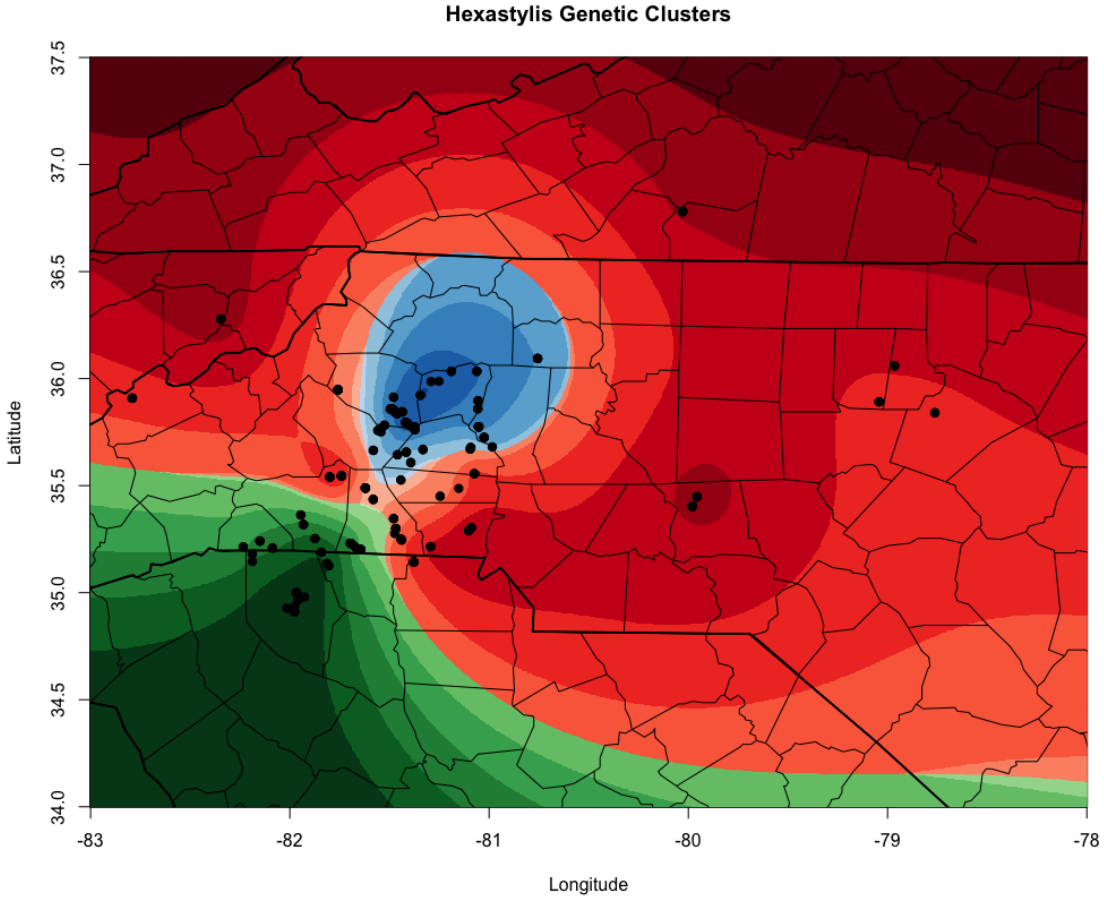


Figure 4.1. Recent genetic analyses detailing clustering of the genus *Hexastylis*. Black dots represent GIS locations of individual plants included in the genetic analysis. Green areas represent "true" *H. naniflora*; Blue represents a possible new species; Red represents other species in the genus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

- 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

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

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

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*	--

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.

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.

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

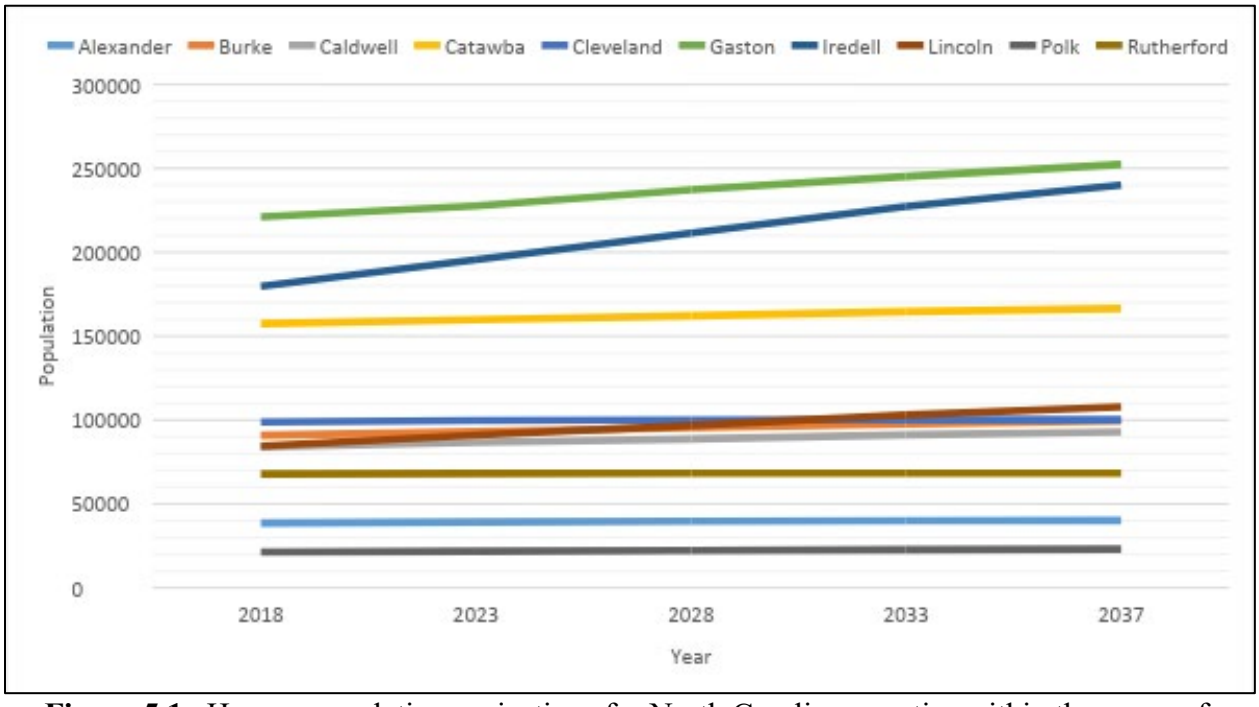


Figure 5.1. Human population projections for North Carolina counties within the range of dwarf-flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

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

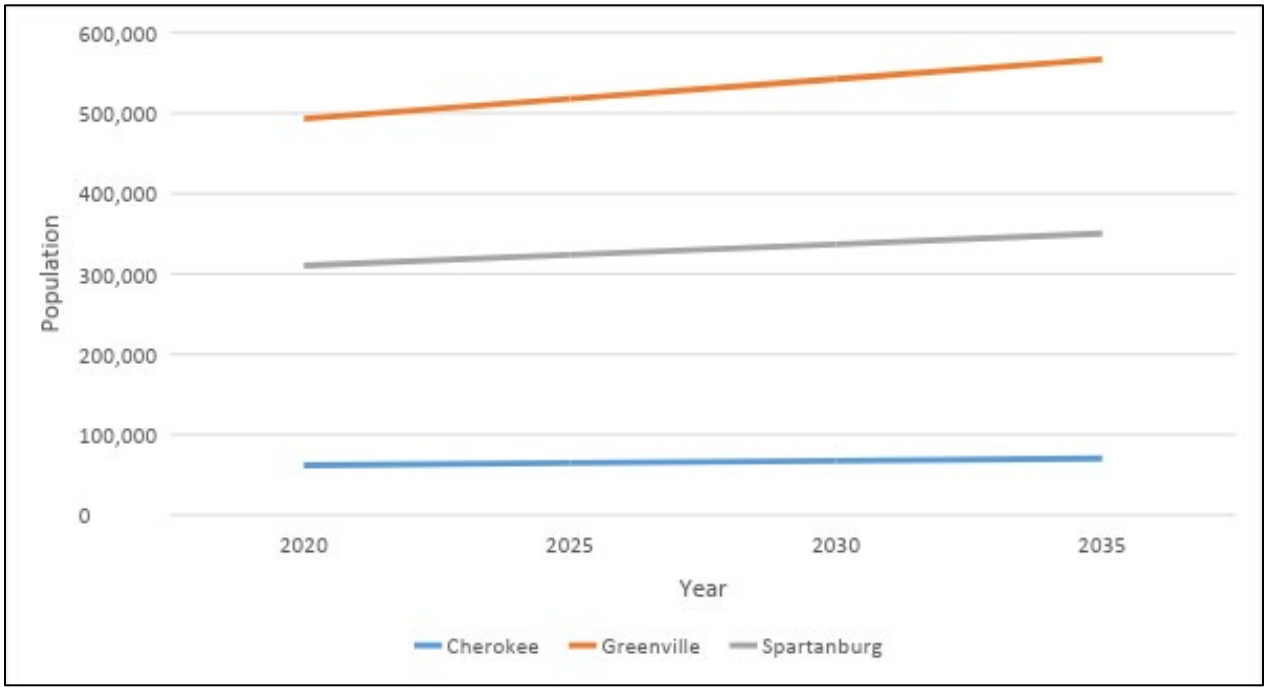


Figure 5.2. Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

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 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 stiltgrass (*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)
- 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.

Chapter 6: FUTURE CONDITION

Future Considerations

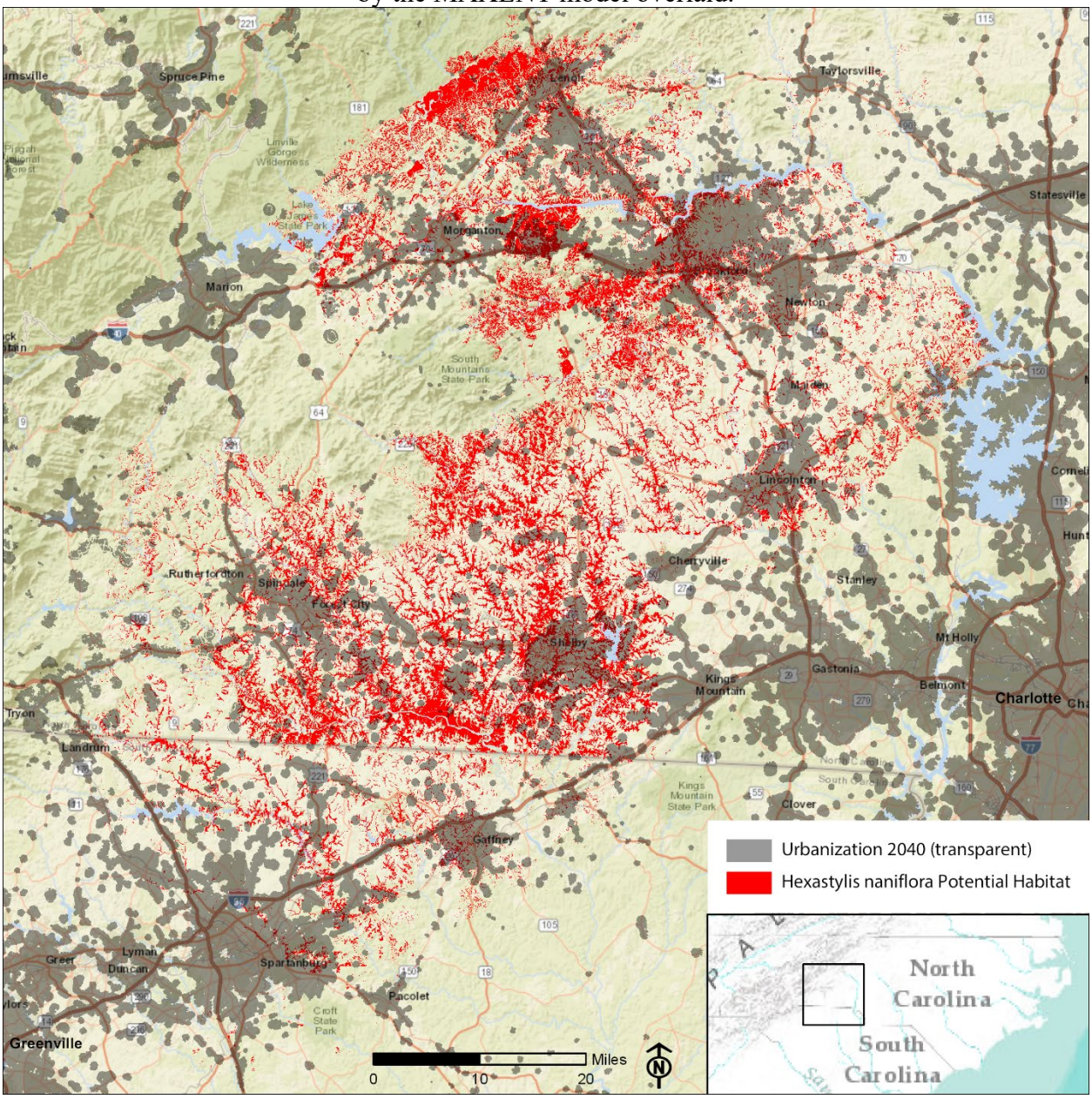
Our analysis of the past, current, and future influences on what the dwarf-flowered heartleaf needs for long term viability revealed that there are several influences that pose risks to future viability of the species. These risks are primarily related to habitat changes from development and long term 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
- % 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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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.

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

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

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

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

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).

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.

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.

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

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

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

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

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.

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.

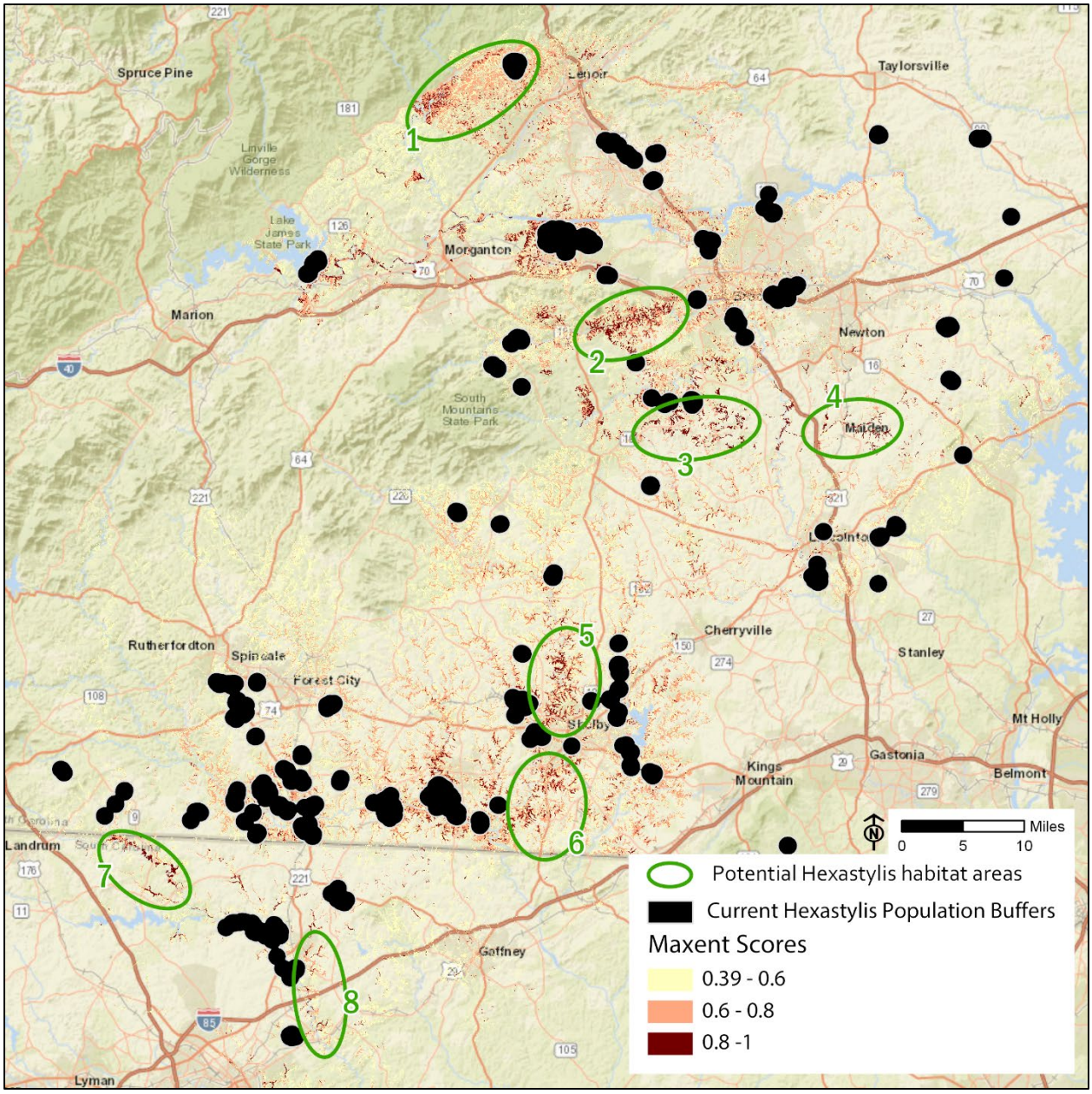


Figure 6.2. Areas identified as high quality potential habitat by Maxent model for *Hexastylis naniflora* that fall outside the immediately known occurrence areas.

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From: Peeples, Gary
To: Reid, Rebekah N
Cc: Mizzi, Janet
Subject: Re: Hexastylis naniflora PDM Plan
Date: Monday, August 20, 2018 8:20:55 AM
Importance: High

Looking forward to it!

On Fri, Aug 17, 2018 at 12:33 PM Rebekah Reid <rebekah_reid@fws.gov> wrote:

> Janet and Gary,
>
> I've been working on the Post-Delisting Monitoring Plan for Hexastylis naniflora. Drew Becker has been my contact in the RO. I'm to the point that I need to have input from NHP and DOT to clarify past monitoring efforts and coordinate future efforts for inclusion in the PDM plan. We are in the weird transition between the RTM and proposed rule. In the past, the RO liked to have the PDM plan when the proposed rule was published which means halfway letting the cat out of the bag with regards to the future of listing for Hexastylis. However, Drew mentioned a new memo that clarifies PDM and had the potential to provide some leeway in that process. If my understanding is correct, he also indicated that the FO would have the freedom to interpret the memo. He also mentioned a couple of examples for communications: Nasheville crayfish and Key deer.
>
> All of that to asked, can we get together in the next week or two to discuss? We can go over what I've pulled together, determine if it is consistent with the new guidance, and talk about how we move forward. I've attached what I think is the updated guidance. If I'm wrong, please let me know.
>
> My Google Calendar is up to date if you want to take a look and pick a date. 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.***

--
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
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fax 828/258-5330

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From: Reid, Rebekah N
To: Robinson, Laura
Subject: Re: [External] Hexastylis naniflora Monitoring
Date: Tuesday, September 11, 2018 2:38:18 PM
Attachments: image002.png
image002.png

Yikes! I hope Flo isn't that bad. I'm still waiting to hear from Tim. If he has availability the end of Sept., we'll try for that. I can check in with ya'll towards the end of next week and if things are a mess we'll push it back.

Thanks and stay safe,

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
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cell: 828-782-0090

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On Tue, Sep 11, 2018 at 12:46 PM Robinson, Laura <Laura.Robinson@ncdcr.gov> wrote:

> Hi Rebekah!
> I just got your voice mail, sorry I missed you and been slow to respond! I've been out of the office several days since last week and still catching up. I just filled in the doodle poll. Next week is questionable with the impending storm. They're saying it could be really bad. I was here during Hurricane Fran and my family was without power for over a week. Let's hope it's not so bad! Later in September might be better.
>
> LAURA ROBINSON
>
> Botanist, N.C. Natural Heritage Program
>
> 121 W Jones St MSC 1651 Raleigh, NC 27699
>
> 919 707 8647 *office*

From: Reid, Rebekah <rebekah_reid@fws.gov>
Sent: Wednesday, September 5, 2018 11:20 AM
To: Robinson, Laura <Laura.Robinson@ncdcr.gov>; Bassette, Tim <tpbassette@ncdot.gov>
Subject: [External] Hexastylis naniflora Monitoring

CAUTION: External email. Do not click links or open attachments unless verified. Send all suspicious email as an attachment to Report Spam.

Hi Laura and Tim,

Would you all have time between now and the end of Sept. to talk about past monitoring and potential future monitoring of Hexastylis naniflora?

Here is a Doodle Poll: https://doodle.com/poll/9ypyafzracxtyd69 I am available anytime on the days listed but DP made me pick times. If Sept. is too busy let me know and we can try for October. Once we pick a date, I will put together a simple agenda.

Thanks.

Rebekah Reid

US Fish and Wildlife Service

Asheville Ecological Services Field Office

160 Zillicoa St.
Asheville, NC 28801

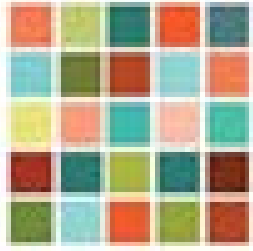
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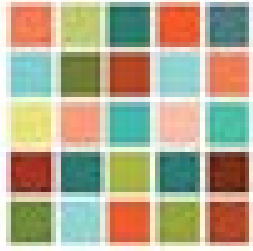




NC DEPARTMENT OF NATURAL AND CULTURAL RESOURCES

NORTH CAROLINA
Natural Heritage Program
SCIENCE GUIDING CONSERVATION





NC DEPARTMENT OF NATURAL AND CULTURAL RESOURCES

From: Reid, Rebekah N
To: Robinson, Laura; Tim Bassette
Subject: Re: Hexastylis naniflora Monitoring
Date: Friday, September 21, 2018 9:19:25 AM

Hi Laura,

Are you still available on the 26th at 10AM? Tim hasn't returned calls or emails. I guessing NCDOT is busy with hurricane issues but if you are still available, I'd like to talk. I can wrap Tim in at a later date.

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

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On Wed, Sep 5, 2018 at 11:19 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Hi Laura and Tim,
>
> Would you all have time between now and the end of Sept. to talk about past monitoring and potential future monitoring of Hexastylis naniflora?
>
> Here is a Doodle Poll: https://doodle.com/poll/9ypyafzracxtyd69 I am available anytime on the days listed but DP made me pick times. If Sept. is too busy let me know and we can try for October. Once we pick a date, I will put together a simple agenda.
>
> Thanks.
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
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> 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.***

From: Reid, Rebekah N
To: Robinson, Laura
Cc: Tim Bassette
Subject: Re: [External] Re: Hexastylis naniflora Monitoring
Date: Friday, September 21, 2018 9:57:24 AM

Thank you! I'll put together a little agenda and send it to you this afternoon or Monday morning.

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, Sep 21, 2018 at 9:47 AM Robinson, Laura <Laura.Robinson@ncdcr.gov> wrote:

> Hi Rebekah,
>
> Yes, I'm available until noon that day. I'll reserve that time for a phone call and if I need to be included in another discussion including Tim at a later date, I'll be happy to participate then also.
>
> Laura
>
> ---
>
> **From:** Reid, Rebekah <rebekah_reid@fws.gov>
> **Sent:** Friday, September 21, 2018 9:19 AM
> **To:** Robinson, Laura <Laura.Robinson@ncdcr.gov>; Bassette, Tim <tpbassette@ncdot.gov>
> **Subject:** [External] Re: Hexastylis naniflora Monitoring
>
> **CAUTION:** External email. Do not click links or open attachments unless verified. Send all suspicious email as an attachment to Report Spam.
>
> Hi Laura,

Are you still available on the 26th at 10AM? Tim hasn't returned calls or emails. I guessing NCDOT is busy with hurricane issues but if you are still available, I'd like to talk. I can wrap Tim in at a later date.

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

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On Wed, Sep 5, 2018 at 11:19 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Hi Laura and Tim,
>
> Would you all have time between now and the end of Sept. to talk about past monitoring and potential future monitoring of Hexastylis naniflora?
>
> Here is a Doodle Poll: https://doodle.com/poll/9ypyafzracxtyd69 I am available anytime on the days listed but DP made me pick times. If Sept. is too busy let me know and we can try for October. Once we pick a date, I will put together a simple agenda.

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

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From: Reid, Rebekah N
To: Robinson, Laura
Subject: Re: HENA Monitoring Call on Sept. 26
Date: Wednesday, September 26, 2018 3:03:57 PM

Hey Laura,

My elementary math skills are not good today...and it's only Wednesday! I think I mentioned 5 sites one year and 6 sites the next. That's 11 and there are 13 sites. Although, if you are looking at that list and want to eliminate something that's OK. I don't think there will be a shortage of sites with DOT sites added in.

Thanks again for you time today.

Rebekah Reid

US Fish and Wildlife Service
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cell: 828-782-0090

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On Tue, Sep 25, 2018 at 2:57 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Laura and Tim,
>
> Below is our conference line info:
>
> Call in: 866-640-9282
> Passcode: 9760757#
>
> I'll talk with you tomorrow (26th) at 2PM. 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
>
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>
> On Fri, Sep 21, 2018 at 3:48 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

Hi Laura,

Below is a list of discussion topics for the 26th. My request to discuss monitoring has been prompted by the SSA process. I can explain more about that during our call.

Discussion items:
-Update on the SSA process and how it relates to monitoring.
-Past monitoring and the possibility of revisiting sites for future monitoring.
  -Resources available for monitoring.
  -Is there anything NHP would change regarding the protocol used for 2012-2016?
  -Frequency and duration of monitoring.
  -Potential monitoring outcomes, outcome thresholds that trigger response, and response.
-Estimated funding requirements and potential sources.

The goal for the call is to start a discussion about what future monitoring might look like and what resources would be required.

I'll call you at 10AM on the 26th. I think an hour will be more than enough time. Thank you.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
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phone: 828-258-3939 x238
cell: 828-782-0090

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From: Robinson, Laura
To: Reid, Rebekah N
Subject: RE: [External] Cost for Monitoring HENA
Date: Friday, October 19, 2018 12:23:19 PM
Importance: High

Ok, that's actually what I figured I'd do too. I just sent something for Misty to look at and I'll get something to you soon!
Laura

From: Reid, Rebekah <rebekah_reid@fws.gov>
Sent: Friday, October 19, 2018 12:22 PM
To: Robinson, Laura <Laura.Robinson@ncdcr.gov>
Subject: Re: [External] Cost for Monitoring HENA

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Hey Laura,

The way our funding is, we would likely be funding year to year instead of all at one time. So, per year cost for 6-7 sites each year would be great.

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

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On Fri, Oct 19, 2018 at 11:35 AM Robinson, Laura <Laura.Robinson@ncdcr.gov> wrote:

> Hi Rebekah,
> Thanks for the reminder! I talked with Misty about this right after our call and it's back on my plate to come up with some numbers. Just for clarification, if we did 6 sites one year and 7 sites the next, would you want an estimate for 6 years total? Or do you want an estimate for per year cost for 6-7 sites each year?

LAURA ROBINSON
Botanist, Natural Heritage Program
Division of Land and Water Stewardship

121 W. Jones St, MSC 1651 Raleigh, NC 27699-1651
919 707 8107 *office*

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From: Reid, Rebekah <rebekah_reid@fws.gov>
Sent: Friday, October 19, 2018 11:29 AM
To: Robinson, Laura <Laura.Robinson@ncdcr.gov>
Subject: [External] Cost for Monitoring HENA

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Hi Laura,

I just wanted to follow-up with you about the ballpark estimate for monitoring HENA at the 13 sites NHP did the baseline for. We talked about not doing all sites each year but instead doing 6-7 per year. A yearly cost is what I'm after. I'm not going to hold NHP to it. I'm just trying to figure out if we could realistically fund the monitoring with our local funds. If not, I need to rethink the proposed plan and modify it to include less sites.

Thanks!

Rebekah Reid

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From:	Robinson, Laura
To:	Reid, Rebekah N
Cc:	Buchanan, Misty
Subject:	FW: [External] Cost for Monitoring HENA
Date:	Friday, October 26, 2018 10:40:13 AM
Attachments:	Estimate on Annual monitoring of Hexastlyis naniflora.xlsx
Importance:	High

Oops! I meant to copy Misty on my email to you. Please reply to both of us if anything comes of this in the near future.
Thanks!

From: Robinson, Laura
Sent: Friday, October 26, 2018 10:38 AM
To: 'Reid, Rebekah' <rebekah_reid@fws.gov>
Subject: RE: [External] Cost for Monitoring HENA

Hi Rebekah,
Misty and I worked on this and came up with a ball park figure to do annual monitoring of 6-7 sites. Please let me know if you have any questions or want to discuss further. I know we'll have to wait to see what happens next with Hexastlyis naniflora.
Thanks,

LAURA ROBINSON

Botanist, Natural Heritage Program
Division of Land and Water Stewardship

121 W. Jones St, MSC 1651 Raleigh, NC 27699-1651
919 707 8107 *office*

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NC DEPARTMENT OF NATURAL AND CULTURAL RESOURCES

NORTH CAROLINA Natural Heritage Program
SCIENCE GUIDING CONSERVATION

From: Reid, Rebekah <rebekah_reid@fws.gov>
Sent: Friday, October 19, 2018 11:29 AM
To: Robinson, Laura <Laura.Robinson@ncdcr.gov>
Subject: [External] Cost for Monitoring HENA

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Hi Laura,

I just wanted to follow-up with you about the ballpark estimate for monitoring HENA at the 13 sites NHP did the baseline for. We talked about not doing all sites each year but instead doing 6-7 per year. A yearly cost is what I'm after. I'm not going to hold NHP to it. I'm just trying to figure out if we could realistically fund the monitoring with our local funds. If not, I need to rethink the proposed plan and modify it to include less sites.

Thanks!

Rebekah Reid

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cell: 828-782-0090

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Yearly Estimate for post delisting montoring of *Hexastlyis naniflora:*			
Activity	Hours	Cost per hour	Total
Landowner contact	32	26	$832.00
Training contract biologist-including data entry, NHP reporting standards and data collection standards	32	26	$832.00
6 days in the field plus travel time from Raleigh	65	26	$1,690.00
Data processing, data entry, and mapping	40	26	$1,040.00
Per diem cost for two trips (6 days total)			$666.00
Annual reporting	40	26	$1,040.00
Grand Total			**$6,100.00**

From:	Buchanan, Misty
To:	Robinson, Laura; Reid, Rebekah N
Subject:	RE: [External] Cost for Monitoring HENA
Date:	Friday, October 26, 2018 10:47:01 AM
Importance:	High

Thanks Laura and Rebekah!

Misty Buchanan

Deputy Director for Natural Heritage
Division of Land and Water Stewardship

121 W. Jones St, MSC 1651 Raleigh, NC 27699-1651
919 707 8107 *office*

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-





From: Robinson, Laura
Sent: Friday, October 26, 2018 10:40 AM
To: Reid, Rebekah <rebekah_reid@fws.gov>
Cc: Buchanan, Misty <misty.buchanan@ncdcr.gov>
Subject: FW: [External] Cost for Monitoring HENA

Oops! I meant to copy Misty on my email to you. Please reply to both of us if anything comes of this in the near future.
Thanks!

From: Robinson, Laura
Sent: Friday, October 26, 2018 10:38 AM
To: 'Reid, Rebekah' <rebekah_reid@fws.gov>
Subject: RE: [External] Cost for Monitoring HENA

Hi Rebekah,
Misty and I worked on this and came up with a ball park figure to do annual monitoring of 6-7 sites. Please let me know if you have any questions or want to discuss further. I know we'll have to wait to see what happens next with Hexastlyis naniflora.
Thanks,

LAURA ROBINSON
Botanist, Natural Heritage Program
Division of Land and Water Stewardship

121 W. Jones St, MSC 1651 Raleigh, NC 27699-1651
919 707 8107 *office*

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From: Reid, Rebekah <rebekah_reid@fws.gov>
Sent: Friday, October 19, 2018 11:29 AM
To: Robinson, Laura <Laura.Robinson@ncdcr.gov>
Subject: [External] Cost for Monitoring HENA

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Hi Laura,

I just wanted to follow-up with you about the ballpark estimate for monitoring HENA at the 13 sites NHP did the baseline for. We talked about not doing all sites each year but instead doing 6-7 per year. A yearly cost is what I'm after. I'm not going to hold NHP to it. I'm just trying to figure out if we could realistically fund the monitoring with our local funds. If not, I need to rethink the proposed plan and modify it to include less sites.

Thanks!

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
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cell: 828-782-0090

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From: Reid, Rebekah N
To: Peeples, Gary
Subject: Re: Dwarf-flowered heartleaf contacts
Date: Monday, February 25, 2019 2:26:18 PM

The last data we have from Heritage says it's still there but it is an old record. It had well over 100 plants at the time so if site conditions remained the same, they should still be there. The camp's website still mentions it...

Rebekah Reid

US Fish and Wildlife Service
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cell: 828-782-0090

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On Mon, Feb 25, 2019 at 2:15 PM Peeples, Gary <gary_peeples@fws.gov> wrote:

> Do you know?
>
> ---------- Forwarded message ---------
> From: **Koches, Jennifer** <jennifer_koches@fws.gov>
> Date: Mon, Feb 25, 2019 at 1:56 PM
> Subject: Re: Dwarf-flowered heartleaf contacts
> To: Peeples, Gary <gary_peeples@fws.gov>
>
> Quick question - do y'all know if the Girl Scout site (Spartanburg County) is still extant?
>
> https://www.gssc-mm.org/en/camp/Mary.html
>
> On Thu, Feb 21, 2019 at 2:25 PM Peeples, Gary <gary_peeples@fws.gov> wrote:
>
> > That works beautifully. There's no rush.
> >
> > Thanks Jen!
> >
> > -G
> >
> > On Thu, Feb 21, 2019 at 2:23 PM Koches, Jennifer <jennifer_koches@fws.gov> wrote:
> >
> > > I'll work on it, run it by April, then forward along...try to get to you early next week...does that work?
> > >
> > > On Thu, Feb 21, 2019 at 2:14 PM Peeples, Gary <gary_peeples@fws.gov> wrote:
> > >
> > > > 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
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--
Jennifer M. Koches, Public Affairs Specialist
U.S. Fish and Wildlife Service
South Carolina Field Office
176 Croghan Spur Rd., Suite 200
Charleston, S.C. 29407
(843) 727-4707 ext. 214 - office
(843) 300-0186 - fax
(843) 670-7902 - mobile
Website: www.fws.gov/charleston
Facebook: www.facebook.com/SouthCarolinaFieldOffice
Twitter: https://twitter.com/USFWS_SC

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--
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--

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--

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From: Reid, Rebekah N
To: Becker, Drew N; Peeples, Gary; Mizzi, Janet
Subject: Post Delisting Monitoring for Dwarf-Flowered Heartleaf
Date: Thursday, April 4, 2019 2:34:04 PM
Attachments: Hexastylis naniflora PDM Draft V1 (04.04.19).docx

---

Janet, Gary, and Drew,

Attached is the draft PDM plan for dwarf-flowered heartleaf for review and comment/feedback. I had an update from Byron Hamilton last week. We is working on solicitor comments received after review of the proposed rule. Once he is finished addressing those comments, the proposed rule will make its way up the chain for review and approval. He would like to include the PDM plan when he sends it up but I don't have a "due date".

This plan still needs to go to NHP and DOT for comment/feedback. Unless I hear otherwise from this group, I will send it to them early next week.

Thank you.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
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U.S. FISH AND WILDLIFE SERVICE

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

April 2019

Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)

April 2019

DRAFT

Recommended Citation:

US Fish and Wildlife Service. 2019. Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*). Asheville Ecological Services Field Office, Asheville, North Carolina. 12 pp.

Acknowledgements

The Draft Post-Delisting Monitoring Plan (Plan) for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) was prepared by the US Fish and Wildlife Service (Service) with participation from Rebekah Reid, Asheville Ecological Services Field Office, and Drew Becker, Southeast Regional Office. The Service acknowledges partners outside our agency who provided input during development of this draft Plan, including the North Carolina Natural Heritage Program and the North Carolina Department of Transportation.

DRAFT

Table of Contents

II. Summary of Species Status at Delisting 1
A. Demographic Parameters 1
B. Discussion of Populations 2
III. Public Review and Comment 3
IV. Monitoring Methods and Locations 4
IV. Definition of Response Triggers for Potential Monitoring Outcomes 5
A. Category I 5
B. Category II 6
C. Category III 6
V. Data Compilation and Reporting Procedures 6
VI. Estimated Funding Requirements and Sources 7
VII. PDM Implementation Schedule 7
VIII. Literature Cited 8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

DRAFT

I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2015), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June. They are small,

DRAFT

inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989). The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).

B. Discussion of Populations

When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2010).

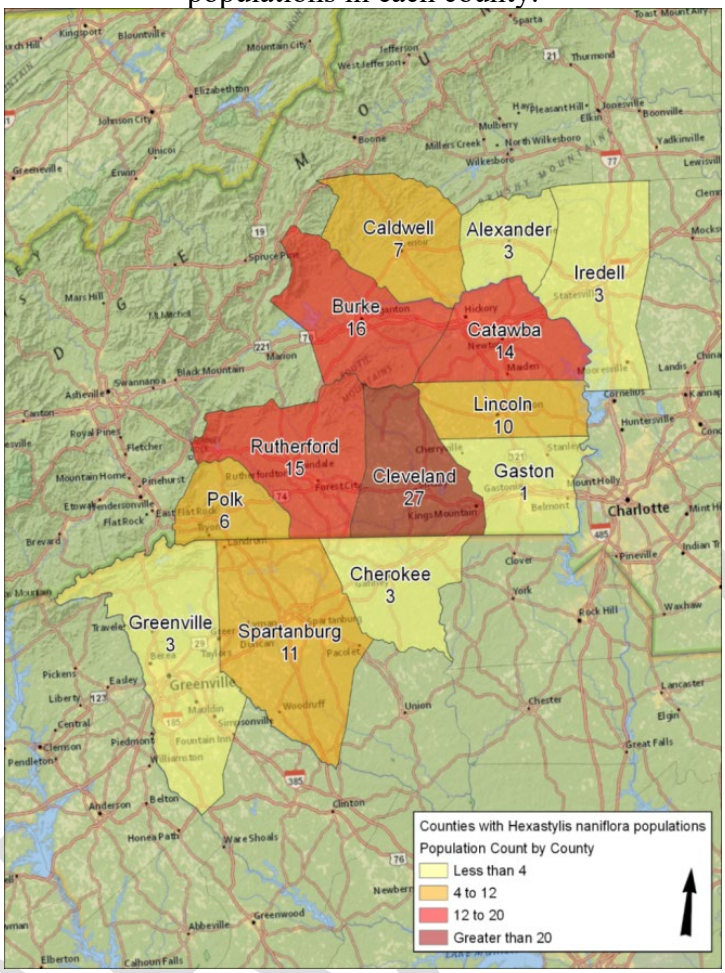
Since listing, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to NCNHP Element Occurrence (EO) records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This generated considerable discrepancies among sources with respect to abundance and distribution of the species, to the extent that data are usually not comparable from one source to the next (Service 2010).

NatureServe and its member Natural Heritage Programs (NHP) 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 into meaningful units of conservation interest that may approximate biological populations (NatureServe 2004). The Service does not maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards the NHP databases as the best repository for this information.

As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).

DRAFT

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.



The listing rule placed emphasis on populations containing more than 1,000 rosettes. This threshold has been used in subsequent reports to call attention to particularly large populations. Populations with greater than 1,000 rosettes increased from three in 1989 to 26 in 2016 (Robinson 2016). This is approximately 23% of the total known populations and many contain well over 1,000 rosettes. Twenty-five of the largest known populations have been monitored for at least 5 years by NCNHP (13 populations) and NCDOT (12 populations).

III. Public Review and Comment

The Service will announce the availability of the draft Plan for public review and comment in the publication of the proposed rule to delist dwarf-flowered heartleaf. At conclusion of the comment period, the Service will review each comment and prepare responses to substantive comments.

IV. Monitoring Methods and Locations

The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). A second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants that occur at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data to determine the size of the entire population was used. The supplemental acreage from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals, when every tract could not be visited. The estimated extrapolated size of each population for each year was determined with the following formula:

$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

The PDM will be a continuation of the monitoring described above and occur within at least 13 previously monitored populations (Appendix A).

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A. Procedures to Assure Consistency

The following practices will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked (unless population is small enough for a complete census).
- A field data sheet, developed prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
- Threats will be assessed at each location using NCPCP guidelines (Appendix B).
- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 13 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6-7 sites are monitored each year for six years (three complete monitoring cycles).

IV. Definition of Response Triggers for Potential Monitoring Outcomes

Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios.

After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

A. Category I

<u>PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections</u>.
This would be true if:

1) Population numbers are within the standard deviation of the mean or above, and

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2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

B. Category II

PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, all actions from Category II will be implemented. Additionally, the Service will initiate a formal status review and determine whether a proposal for relisting is appropriate.

V. Data Compilation and Reporting Procedures

Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be

negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

If response triggers in Section IV are met or exceeded, the Service will consult with NCNHP, NCDOT, and other partners to determine whether to conclude the PDM process or pursue management actions. The determination will also include, if necessary, an evaluation of the threats to dwarf-flowered heartleaf using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state and tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of dwarf-flowered heartleaf following removal from protections of the Act. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this draft Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

As staff resources and funding allow, the primary entities conducting the PDM and preparing reports will be NCNHP and/or NCDOT. Based on a funding estimate received from NCNHP, monitoring 6-7 sites each year would require approximately $6,100 in funding. A complete monitoring cycle of two years would require approximately $12,200 and the entire six years of monitoring (three monitoring cycles) would require approximately $36,600. The NCNHP funding estimates do not apply to NCDOT and NCDOT is unable to provide an estimate for monitoring additional sites at this time. The Service will provide assistance as needed and as resources permit.

VII. PDM Implementation Schedule

A schedule will be developed in coordination with NCNHP and/or NCDOT in order to ensure that it is feasible to accomplish PDM activities at all sites scheduled for a given year. An example schedule is shown below:

Sites	Year	Monitoring Cycle	Reporting
1-6	1	1	
7-13	2	1	Cycle 1 (end of year)
1-6	3	2	
7-13	4	2	Cycle 2 (end of year)
1-6	5	3	
7-13	6	3	Cycle 1-3 Final Report (end of year)

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VIII. Literature Cited

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Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:
Blalock Reservoir (SC EO 007, 031)
Broad River: Cleghorn Creek, US 221 (EO 176)
Broad River: Floyds Creek, Long Branch (EO 177)
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop (EO 099)
Cliffside Steam Station (EO 276)
Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Love Lady Site (EO 029)
Mills Creek Forest and Seep (EO 023)
New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
Rhyne Preserve (EO 302)
Second Broad River (Forest City Industrial Complex) (EO 154)
South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)

NCDOT Sites:
Broad River Greenway (EO 049-051, 073-074, 149, 233, 238-241)
Buffalo Shoals Creek (EO 275)
Catawba County (EO 158, 162)
Extension of 15th Avenue (EO 031)
Gunpowder Creek (EO 077)
Little Gunpowder Creek (EO 044)
Longview (EO 032)
Micol Creek (EO 159)
Murray's Mill (EO 184)
Shelby Bypass Site 7 (EO 191)
Tate Boulevard Extension (EO 030)
Tate Conservation Area (EO 106, 286)

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Appendix B – Threats Assessment Guidance

This methodology was originally developed by the NC Plant Conservation Program (NCPCP) Scientific Committee in 2008 for the purpose of assessing the rarest and most imperiled plant species. This protocol was applied to individual populations of *Hexastylis naniflora*, during baseline monitoring, for the purpose of developing a standardized assessment of threats and trends.

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species. Each threat is assigned a ranking for its severity, scope, and immediacy, as described below:

Threat Severity

- High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long-term recovery (>100 yr.).
- Moderate: Major reduction of species population or long-term degradation or reduction of habitat in area affected, requiring 50–100 yr. for recovery.
- Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.
- Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yrs.) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations is generally considered Insignificant as defined here.

Scope

- High: >60% of total population, occurrences, or area affected.
- Moderate: 20–60% of total population, occurrences, or area affected.
- Low: 5–20% of total population, occurrences, or area affected.
- Insignificant: <5% of total population or area affected.

Immediacy

- High: Threat is operational (happening now) or imminent (within a year).
- Moderate: Threat is likely to be operational within 2–5 yr.
- Low: Threat is likely to be operational within 5–20 yr.
- Insignificant: Threat not likely to be operational within 20 yr.

DRAFT

From: Reid, Rebekah N
To: Mizzi, Janet
Subject: Re: Post Delisting Monitoring for Dwarf-Flowered Heartleaf
Date: Friday, April 5, 2019 7:18:20 AM

Hi Janet,

I haven't seen it yet. Let me see if we can get 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.

On Thu, Apr 4, 2019 at 6:27 PM Janet Mizzi <janet_mizzi@fws.gov> wrote:

> Hey Rebekah. Thanks for sharing. Have you gotten to see the draft rule yet. If you do have a copy I would love to see that too. Thanks.
>
> Sent from my iPhone
>
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>
> > Janet, Gary, and Drew,
> >
> > Attached is the draft PDM plan for dwarf-flowered heartleaf for review and comment/feedback. I had an update from Byron Hamilton last week. We is working on solicitor comments received after review of the proposed rule. Once he is finished addressing those comments, the proposed rule will make its way up the chain for review and approval. He would like to include the PDM plan when he sends it up but I don't have a "due date".
> >
> > This plan still needs to go to NHP and DOT for comment/feedback. Unless I hear otherwise from this group, I will send it to them early next week.
> >
> > Thank you.
> >
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> >
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> > Asheville Ecological Services Field Office
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<Hexastylis naniflora PDM Draft V1 (04.04.19).docx>

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<Hexastylis naniflora PDM Draft V1 (04.04.19).docx>

From: Peeples, Gary
To: Reid, Rebekah N
Subject: Monitoring plan
Date: Monday, April 8, 2019 1:43:41 PM
Attachments: Hexastylis naniflora PDM Draft V1 (04.04.19)-GEP comments.docx
Importance: High

My very limited comments are in the attached document. Nice job.

--
Gary Peeples
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U.S. FISH AND WILDLIFE SERVICE

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

April 2019

Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)

April 2019

DRAFT

Recommended Citation:

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Acknowledgements

The Draft Post-Delisting Monitoring Plan (Plan) for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) was prepared by the US Fish and Wildlife Service (Service) with participation from Rebekah Reid, Asheville Ecological Services Field Office, and Drew Becker, Southeast Regional Office. The Service acknowledges partners outside our agency who provided input during development of this draft Plan, including the North Carolina Natural Heritage Program and the North Carolina Department of Transportation.

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Table of Contents

II. Summary of Species Status at Delisting 1
A. Demographic Parameters 1
B. Discussion of Populations 2
III. Public Review and Comment 3
IV. Monitoring Methods and Locations 4
IV. Definition of Response Triggers for Potential Monitoring Outcomes 5
A. Category I 5
B. Category II 6
C. Category III 6
V. Data Compilation and Reporting Procedures 6
VI. Estimated Funding Requirements and Sources 7
VII. PDM Implementation Schedule 7
VIII. Literature Cited 8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

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I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2015), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June. They are small,

inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989). The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).

B. Discussion of Populations

When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2010).

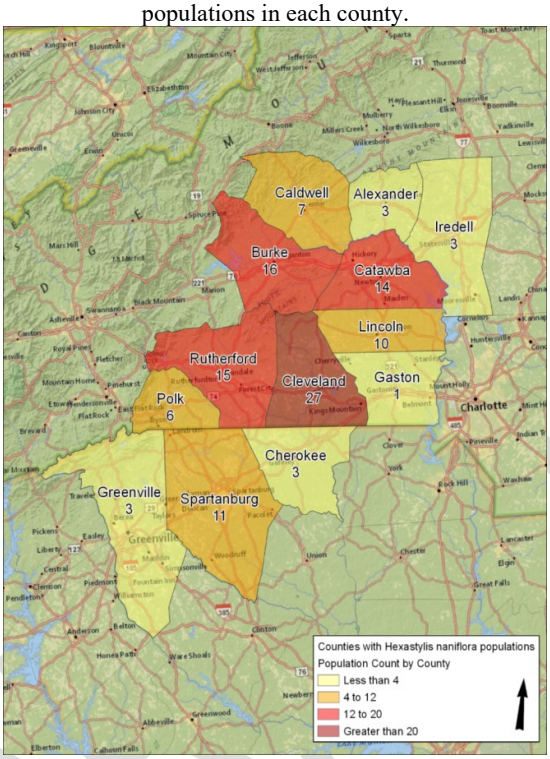
Since listing, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to NCNHP Element Occurrence (EO) records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This generated considerable discrepancies among sources with respect to abundance and distribution of the species, to the extent that data are usually not comparable from one source to the next (Service 2010).

NatureServe and its member Natural Heritage Programs (NHP) 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 into meaningful units of conservation interest that may approximate biological populations (NatureServe 2004). The Service does not maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards the NHP databases as the best repository for this information.

As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).

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Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.



The listing rule placed emphasis on populations containing more than 1,000 rosettes. This threshold has been used in subsequent reports to call attention to particularly large populations. Populations with greater than 1,000 rosettes increased from three in 1989 to 26 in 2016 (Robinson 2016). This is approximately 23% of the total known populations and many contain well over 1,000 rosettes. Twenty-five of the largest known populations have been monitored for at least 5 years by NCNHP (13 populations) and NCDOT (12 populations).

III. Public Review and Comment

The Service will announce the availability of the draft Plan for public review and comment in the publication of the proposed rule to delist dwarf-flowered heartleaf. At conclusion of the comment period, the Service will review each comment and prepare responses to substantive comments.

IV. Monitoring Methods and Locations

The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). A second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants occurring at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data were used to determine the size of the entire population. The supplemental acreage from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals, when every tract could not be visited. The estimated extrapolated size of each population for each year was determined with the following formula:

Deleted: that occur

Deleted: was used

$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

The PDM will be a continuation of the monitoring described above and occur within at least 13 previously monitored populations (Appendix A).

DRAFT

A. Procedures to Assure Consistency

The following practices will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked (unless population is small enough for a complete census).
- A field data sheet, developed prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
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- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

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PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 13 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6-7 sites are monitored each year for six years (three complete monitoring cycles).

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Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios.

After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

A. Category I

PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections.
This would be true if:

1) Population numbers are within the standard deviation of the mean or above, and

DRAFT

2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

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PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, all actions from Category II will be implemented. Additionally, the Service will initiate a formal status review and determine whether a proposal for relisting is appropriate.

V. Data Compilation and Reporting Procedures

Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be

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negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

If response triggers in Section IV are met or exceeded, the Service will consult with NCNHP, NCDOT, and other partners to determine whether to conclude the PDM process or pursue management actions. The determination will also include, if necessary, an evaluation of the threats to dwarf-flowered heartleaf using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state and tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of dwarf-flowered heartleaf following removal from protections of the Act. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this draft Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

As staff resources and funding allow, the primary entities conducting the PDM and preparing reports will be NCNHP and/or NCDOT. Based on a funding estimate received from NCNHP, monitoring 6-7 sites each year would require approximately $6,100 in funding. A complete monitoring cycle of two years would require approximately $12,200 and the entire six years of monitoring (three monitoring cycles) would require approximately $36,600. The NCNHP funding estimates do not apply to NCDOT and NCDOT is unable to provide an estimate for monitoring additional sites at this time. The Service will provide assistance as needed and as resources permit.

VII. PDM Implementation Schedule

A schedule will be developed in coordination with NCNHP and/or NCDOT in order to ensure that it is feasible to accomplish PDM activities at all sites scheduled for a given year. An example schedule is shown below:

Sites	Year	Monitoring Cycle	Reporting
1-6	1	1	
7-13	2	1	Cycle 1 (end of year)
1-6	3	2	
7-13	4	2	Cycle 2 (end of year)
1-6	5	3	
7-13	6	3	Cycle 1-3 Final Report (end of year)

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VIII. Literature Cited

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Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:
Blalock Reservoir (SC EO 007, 031)
Broad River: Cleghorn Creek, US 221 (EO 176)
Broad River: Floyds Creek, Long Branch (EO 177)
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop (EO 099)
Cliffside Steam Station (EO 276)
Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Love Lady Site (EO 029)
Mills Creek Forest and Seep (EO 023)
New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
Rhyne Preserve (EO 302)
Second Broad River (Forest City Industrial Complex) (EO 154)
South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)

NCDOT Sites:
Broad River Greenway (EO 049-051, 073-074, 149, 233, 238-241)
Buffalo Shoals Creek (EO 275)
Catawba County (EO 158, 162)
Extension of 15th Avenue (EO 031)
Gunpowder Creek (EO 077)
Little Gunpowder Creek (EO 044)
Longview (EO 032)
Micol Creek (EO 159)
Murray's Mill (EO 184)
Shelby Bypass Site 7 (EO 191)
Tate Boulevard Extension (EO 030)
Tate Conservation Area (EO 106, 286)

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Appendix B – Threats Assessment Guidance

This methodology was originally developed by the NC Plant Conservation Program (NCPCP) Scientific Committee in 2008 to assess the rarest and most imperiled plant species. This protocol was applied to individual populations of *Hexastylis naniflora*, during baseline monitoring, to develop a standardized assessment of threats and trends.

Deleted: for the purpose of assessing

Deleted: for the purpose of developing

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species. Each threat is assigned a ranking for its severity, scope, and immediacy, as described below:

Threat Severity

- High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long-term recovery (>100 yr.).
- Moderate: Major reduction of species population or long-term degradation or reduction of habitat in area affected, requiring 50–100 yr. for recovery.
- Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.
- Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yrs.) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations is generally considered Insignificant as defined here.

Scope

- High: >60% of total population, occurrences, or area affected.
- Moderate: 20–60% of total population, occurrences, or area affected.
- Low: 5–20% of total population, occurrences, or area affected.
- Insignificant: <5% of total population or area affected.

Immediacy

- High: Threat is operational (happening now) or imminent (within a year).
- Moderate: Threat is likely to be operational within 2–5 yr.
- Low: Threat is likely to be operational within 5–20 yr.
- Insignificant: Threat not likely to be operational within 20 yr.

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From: Reid, Rebekah N
To: Becker, Drew N
Cc: Peeples, Gary; Mizzi, Janet
Subject: Re: Post Delisting Monitoring for Dwarf-Flowered Heartleaf
Date: Tuesday, April 9, 2019 10:11:37 AM

Thanks, Drew,

I have asked NHP and DOT to review the plan. I'll let you know when I receive comments.

As for your question about level of monitoring. I'll answer in two parts since NHP and DOT would really be monitoring independently:

NHP monitored 13 sites, every year from 2012 to 2016. The PDM would pick up this monitoring (with the same protocol); however, the monitoring would be done in 2-year cycles instead of every year. We did this to make funding requests and time required each year more reasonable. There would be six years of monitoring with each site monitored every other year. The intention is that all 13 sites would be monitored. I think we can say this is the same level of monitoring, we just tweaked the timeline a bit.

DOT monitors sites on the 6-year, every-other-year cycle as standard practice. However, not all of these sites started the same year - some monitoring obligations are complete for some sites and some may have time left or we are still waiting on final reports. They have monitored or are finishing up at 12 sites (these 12 were originally agreed upon in a BO from 2009-ish, they also add sites, associated with different projects, almost yearly that we could include or trade out). The intention is to monitor as many of the 12 sites as DOT can get approval to monitor...the kicker is we need to link their monitoring to a Section 7 action. I think this can be worked out but timing will be critical. Because of this, I tried to leave wiggle room in how/if/when DOT can monitor sites. Whether or not this level of monitoring is consistent with past monitoring will depend on what Section 7 actions are planned for the future and what approval they can get to monitor.

Let me know if we need to discuss this further. Thanks!

Glad you were able to get out to Big Creek. It's an awesome place, especially this time of year.

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, Apr 8, 2019 at 1:08 PM Becker, Drew <drew_becker@fws.gov> wrote:

Hi Rebekah,

Good job on the plan, I don't have any substantive comments at this time. Please forward on to others who need to provide input, and then let me know when I can route for regional surname so the PDM can be included in the rule. We are meeting with Kristi the new deputy chief of classification next week and hope to better refine a due date.

One comment/question on the plan: Is the proposed monitoring more, less, or the same level of monitoring currently being conducted? That is a question that I often get asked.

Lastly, thanks for the pro tip on the Big Creek trail, it had more flowers and less people than many of the others. We made it just past the bridge so did get to see the waterfall.

Drew

Drew Becker
Recovery Coordinator
U.S. Fish and Wildlife Service
Southeast Region
1875 Century Boulevard
Atlanta, GA 30345
404-679-7226
drew_becker@fws.gov

Our Mission is to w*ork with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people.*

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On Thu, Apr 4, 2019 at 2:34 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Janet, Gary, and Drew,
>
> Attached is the draft PDM plan for dwarf-flowered heartleaf for review and comment/feedback. I had an update from Byron Hamilton last week. We is working on solicitor comments received after review of the proposed rule. Once he is finished addressing those comments, the proposed rule will make its way up the chain for review and approval. He would like to include the PDM plan when he sends it up but I don't have a "due date".
>
> This plan still needs to go to NHP and DOT for comment/feedback. Unless I hear otherwise from this group, I will send it to them early next week.
>
> Thank you.
>
> 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

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From: Reid, Rebekah N
To: Robinson, Laura; Tim Bassette
Subject: Fwd: Hexastylis naniflora Monitoring
Date: Tuesday, April 16, 2019 2:31:25 PM
Attachments: Hexastylis naniflora PDM Draft V1 (04.08.19).docx

---

Laura and Tim,

I received a very delayed "delivery has failed" message regarding this email. I'm just re-sending to make sure you received it.

Thanks.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
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cell: 828-782-0090

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---------- Forwarded message ---------
From: **Reid, Rebekah** <rebekah_reid@fws.gov>
Date: Tue, Apr 9, 2019 at 9:31 AM
Subject: Hexastylis naniflora Monitoring
To: Robinson, Laura <Laura.Robinson@ncdcr.gov>, Tim Bassette <tpbassette@ncdot.gov>

Hi Laura and Tim,

I am following up on our call last Summer regarding *Hexastylis naniflora*. As a quick refresher, we discussed the potential paths forward for the species: Recovery Plan vs. delisting. No decision has been made to date but I have been asked what a monitoring plan would look like for the species in the event of delisting. Attached is a draft monitoring plan for your review. I would appreciate any comments or feedback since info in the plan was compiled from previous reports by both agencies and input during our call. I don't have a specific due date but if you all have the time in the next couple of weeks to review, that would be great.

Because this is a draft document and no decision has been made regarding listing status, I ask that you keep this plan confidential and do not distribute to others.

Please do not hesitate to contact me if you have any questions. If a call is in order, just let me know and I'll be happy to schedule it.

Thank you.

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

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U.S. FISH AND WILDLIFE SERVICE

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

April 2019

NOT FOR DISTRIBUTION

Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)

April 2019

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Recommended Citation:

US Fish and Wildlife Service. 2019. Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*). Asheville Ecological Services Field Office, Asheville, North Carolina. 12 pp.

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Acknowledgements

The Draft Post-Delisting Monitoring Plan (Plan) for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) was prepared by the US Fish and Wildlife Service (Service) with participation from Rebekah Reid, Asheville Ecological Services Field Office, and Drew Becker, Southeast Regional Office. The Service acknowledges partners outside our agency who provided input during development of this draft Plan, including the North Carolina Natural Heritage Program and the North Carolina Department of Transportation.

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Table of Contents

II. Summary of Species Status at Delisting 1
A. Demographic Parameters 1
B. Discussion of Populations 2
III. Public Review and Comment 3
IV. Monitoring Methods and Locations 4
IV. Definition of Response Triggers for Potential Monitoring Outcomes 5
A. Category I 5
B. Category II 6
C. Category III 6
V. Data Compilation and Reporting Procedures 6
VI. Estimated Funding Requirements and Sources 7
VII. PDM Implementation Schedule 7
VIII. Literature Cited 8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

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I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2015), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June. They are small,

inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989). The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).

B. Discussion of Populations

When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2010).

Since listing, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to NCNHP Element Occurrence (EO) records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This generated considerable discrepancies among sources with respect to abundance and distribution of the species, to the extent that data are usually not comparable from one source to the next (Service 2010).

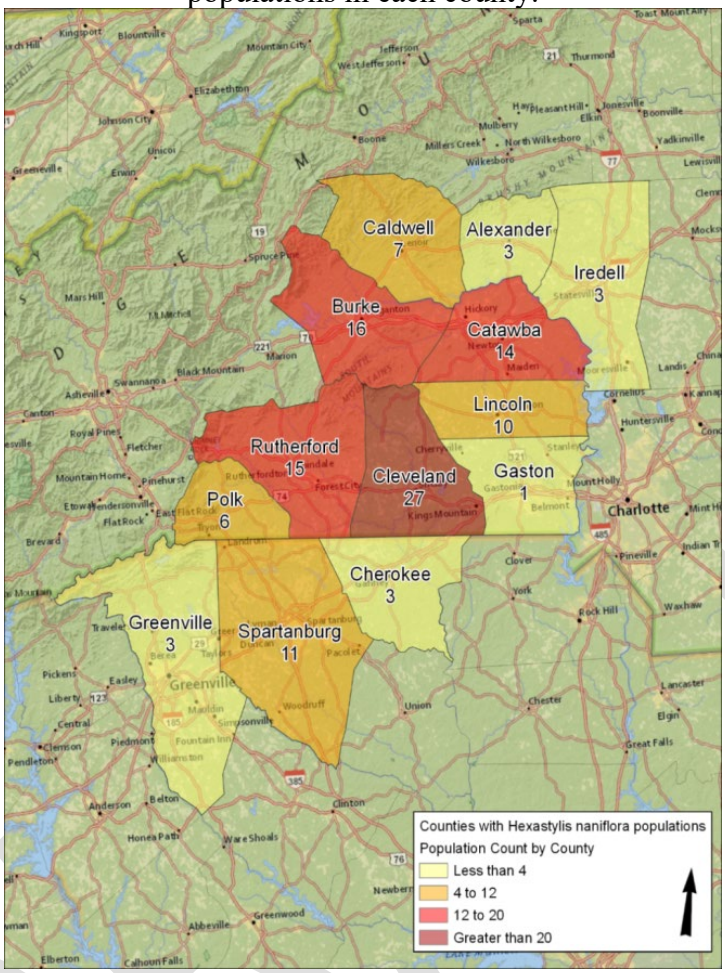
NatureServe and its member Natural Heritage Programs (NHP) have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records into meaningful units of conservation interest that may approximate biological populations (NatureServe 2004). The Service does not maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards the NHP databases as the best repository for this information.

As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).

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Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.



The listing rule placed emphasis on populations containing more than 1,000 rosettes. This threshold has been used in subsequent reports to call attention to particularly large populations. Populations with greater than 1,000 rosettes increased from three in 1989 to 26 in 2016 (Robinson 2016). This is approximately 23% of the total known populations and many contain well over 1,000 rosettes. Twenty-five of the largest known populations have been monitored for at least 5 years by NCNHP (13 populations) and NCDOT (12 populations).

III. Public Review and Comment

The Service will announce the availability of the draft Plan for public review and comment in the publication of the proposed rule to delist dwarf-flowered heartleaf. At conclusion of the comment period, the Service will review each comment and prepare responses to substantive comments.

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IV. Monitoring Methods and Locations

The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). A second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants occuring at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data were used to determine the size of the entire population. The supplemental acreage from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals, when every tract could not be visited. The estimated extrapolated size of each population for each year was determined with the following formula:

$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

The PDM will be a continuation of the monitoring described above and occur within at least 13 previously monitored populations (Appendix A).

A. Procedures to Assure Consistency

The following practices will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked (unless population is small enough for a complete census).
- A field data sheet, developed prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
- Threats will be assessed at each location using NCPCP guidelines (Appendix B).
- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 13 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6-7 sites are monitored each year for six years (three complete monitoring cycles).

IV. Definition of Response Triggers for Potential Monitoring Outcomes

Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios.

After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

A. Category I

<u>PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections</u>.
This would be true if:

1) Population numbers are within the standard deviation of the mean or above, and

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2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

B. Category II

PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, all actions from Category II will be implemented. Additionally, the Service will initiate a formal status review and determine whether a proposal for relisting is appropriate.

V. Data Compilation and Reporting Procedures

Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be

negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

If response triggers in Section IV are met or exceeded, the Service will consult with NCNHP, NCDOT, and other partners to determine whether to conclude the PDM process or pursue management actions. The determination will also include, if necessary, an evaluation of the threats to dwarf-flowered heartleaf using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state and tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of dwarf-flowered heartleaf following removal from protections of the Act. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this draft Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

As staff resources and funding allow, the primary entities conducting the PDM and preparing reports will be NCNHP and/or NCDOT. Based on a funding estimate received from NCNHP, monitoring 6-7 sites each year would require approximately $6,100 in funding. A complete monitoring cycle of two years would require approximately $12,200 and the entire six years of monitoring (three monitoring cycles) would require approximately $36,600. The NCNHP funding estimates do not apply to NCDOT and NCDOT is unable to provide an estimate for monitoring additional sites at this time. The Service will provide assistance as needed and as resources permit.

VII. PDM Implementation Schedule

A schedule will be developed in coordination with NCNHP and/or NCDOT in order to ensure that it is feasible to accomplish PDM activities at all sites scheduled for a given year. An example schedule is shown below:

Sites	Year	Monitoring Cycle	Reporting
1-6	1	1	
7-13	2	1	Cycle 1 (end of year)
1-6	3	2	
7-13	4	2	Cycle 2 (end of year)
1-6	5	3	
7-13	6	3	Cycle 1-3 Final Report (end of year)

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Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:
Blalock Reservoir (SC EO 007, 031)
Broad River: Cleghorn Creek, US 221 (EO 176)
Broad River: Floyds Creek, Long Branch (EO 177)
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop (EO 099)
Cliffside Steam Station (EO 276)
Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Love Lady Site (EO 029)
Mills Creek Forest and Seep (EO 023)
New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
Rhyne Preserve (EO 302)
Second Broad River (Forest City Industrial Complex) (EO 154)
South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)

NCDOT Sites:
Broad River Greenway (EO 049-051, 073-074, 149, 233, 238-241)
Buffalo Shoals Creek (EO 275)
Catawba County (EO 158, 162)
Extension of 15th Avenue (EO 031)
Gunpowder Creek (EO 077)
Little Gunpowder Creek (EO 044)
Longview (EO 032)
Micol Creek (EO 159)
Murray's Mill (EO 184)
Shelby Bypass Site 7 (EO 191)
Tate Boulevard Extension (EO 030)
Tate Conservation Area (EO 106, 286)

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Appendix B – Threats Assessment Guidance

This methodology was originally developed by the NC Plant Conservation Program (NCPCP) Scientific Committee in 2008 to assess the rarest and most imperiled plant species. This protocol was applied to individual populations of *Hexastylis naniflora*, during baseline monitoring, to develop a standardized assessment of threats and trends.

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species. Each threat is assigned a ranking for its severity, scope, and immediacy, as described below:

Threat Severity

- High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long-term recovery (>100 yr.).
- Moderate: Major reduction of species population or long-term degradation or reduction of habitat in area affected, requiring 50–100 yr. for recovery.
- Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.
- Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yrs.) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations is generally considered Insignificant as defined here.

Scope

- High: >60% of total population, occurrences, or area affected.
- Moderate: 20–60% of total population, occurrences, or area affected.
- Low: 5–20% of total population, occurrences, or area affected.
- Insignificant: <5% of total population or area affected.

Immediacy

- High: Threat is operational (happening now) or imminent (within a year).
- Moderate: Threat is likely to be operational within 2–5 yr.
- Low: Threat is likely to be operational within 5–20 yr.
- Insignificant: Threat not likely to be operational within 20 yr.

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From:	Robinson, Laura
To:	Reid, Rebekah N; Bassette, Tim
Subject:	RE: [External] Fwd: Hexastylis naniflora Monitoring
Date:	Wednesday, April 17, 2019 9:53:06 AM
Importance:	High

Hi Rebekah,
Thanks, I received the email. I'll take a look at it and send you comments as soon as possible.

LAURA ROBINSON
Botanist, Natural Heritage Program
Division of Land and Water Stewardship

121 W. Jones St, MSC 1651 Raleigh, NC 27699-1651
919 707 8647 *office*

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From: Reid, Rebekah <rebekah_reid@fws.gov>
Sent: Tuesday, April 16, 2019 2:31 PM
To: Robinson, Laura <Laura.Robinson@ncdcr.gov>; Bassette, Tim <tpbassette@ncdot.gov>
Subject: [External] Fwd: Hexastylis naniflora Monitoring

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Laura and Tim,

I received a very delayed "delivery has failed" message regarding this email. I'm just re-sending to make sure you received it.

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

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---------- Forwarded message ---------
From: **Reid, Rebekah** <rebekah_reid@fws.gov>
Date: Tue, Apr 9, 2019 at 9:31 AM
Subject: Hexastylis naniflora Monitoring
To: Robinson, Laura <Laura.Robinson@ncdcr.gov>, Tim Bassette <tpbassette@ncdot.gov>

Hi Laura and Tim,

I am following up on our call last Summer regarding *Hexastylis naniflora*. As a quick refresher, we discussed the potential paths forward for the species: Recovery Plan vs. delisting. No decision has been made to date but I have been asked what a monitoring plan would look like for the species in the event of delisting. Attached is a draft monitoring plan for your review. I would appreciate any comments or feedback since info in the plan was compiled from previous reports by both agencies and input during our call. I don't have a specific due date but if you all have the time in the next couple of weeks to review, that would be great.

Because this is a draft document and no decision has been made regarding listing status, I ask that you keep this plan confidential and do not distribute to others.

Please do not hesitate to contact me if you have any questions. If a call is in order, just let me know and I'll be happy to schedule it.

Thank you.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
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phone: 828-258-3939 x238
cell: 828-782-0090

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From: Robinson, Laura
To: Reid, Rebekah N
Subject: RE: [External] Fwd: Hexastylis naniflora Monitoring
Date: Tuesday, April 23, 2019 1:22:03 PM
Attachments: Hexastylis naniflora PDM Draft V1 (04.08.19)-LGR edits.docx
Importance: High

Hi Rebekah,
I've looked over the draft monitoring plan and it looks good to me. I made very few minor edits, in track changes in the attached document. I ran it by Misty once again to make sure the cost estimate was still on track and she said it was fine. Please let me know if you need anything else.

LAURA ROBINSON

Botanist, Natural Heritage Program
Division of Land and Water Stewardship

121 W. Jones St, MSC 1651 Raleigh, NC 27699-1651
919 707 8647 *office*

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NC DEPARTMENT OF NATURAL AND CULTURAL RESOURCES

NORTH CAROLINA Natural Heritage Program
SCIENCE GUIDING CONSERVATION

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Please do not hesitate to contact me if you have any questions. If a call is in order, just let me know and I'll be happy to schedule it.

Thank you.

Rebekah Reid

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U.S. FISH AND WILDLIFE SERVICE

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

April 2019

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Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)

April 2019

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Recommended Citation:

US Fish and Wildlife Service. 2019. Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*). Asheville Ecological Services Field Office, Asheville, North Carolina. 12 pp.

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Acknowledgements

The Draft Post-Delisting Monitoring Plan (Plan) for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) was prepared by the US Fish and Wildlife Service (Service) with participation from Rebekah Reid, Asheville Ecological Services Field Office, and Drew Becker, Southeast Regional Office. The Service acknowledges partners outside our agency who provided input during development of this draft Plan, including the North Carolina Natural Heritage Program and the North Carolina Department of Transportation.

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Table of Contents

II. Summary of Species Status at Delisting 1
A. Demographic Parameters 1
B. Discussion of Populations 2
III. Public Review and Comment 3
IV. Monitoring Methods and Locations 4
IV. Definition of Response Triggers for Potential Monitoring Outcomes 5
A. Category I 5
B. Category II 6
C. Category III 6
V. Data Compilation and Reporting Procedures 6
VI. Estimated Funding Requirements and Sources 7
VII. PDM Implementation Schedule 7
VIII. Literature Cited 8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

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I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2015), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June. They are small,

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inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989). The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).

B. Discussion of Populations

When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2010).

Since listing, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to NCNHP Element Occurrence (EO) records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This generated considerable discrepancies among sources with respect to abundance and distribution of the species, to the extent that data are usually not comparable from one source to the next (Service 2010).

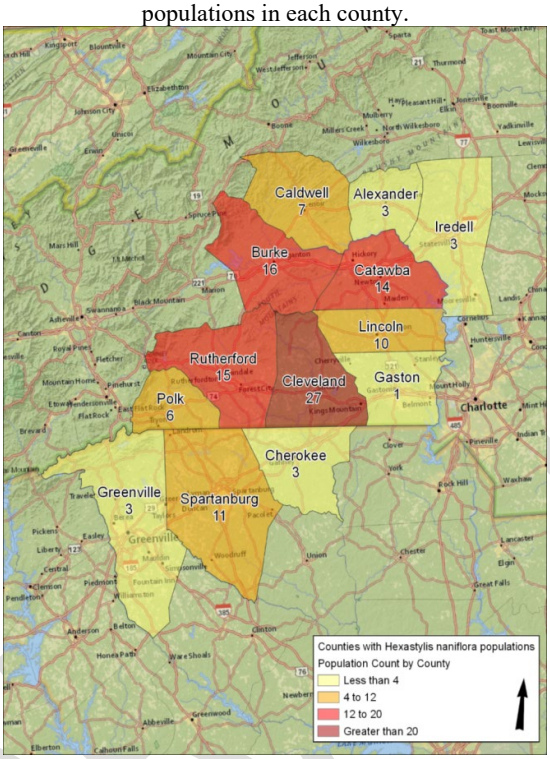
NatureServe and its member Natural Heritage Programs (NHP) have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records into meaningful units of conservation interest that may approximate biological populations (NatureServe 2004). The Service does not maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards the NHP databases as the best repository for this information.

As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).

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Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.



The listing rule placed emphasis on populations containing more than 1,000 rosettes. This threshold has been used in subsequent reports to call attention to particularly large populations. Populations with greater than 1,000 rosettes increased from three in 1989 to 26 in 2016 (Robinson 2016). This is approximately 23% of the total known populations and many contain well over 1,000 rosettes. Twenty-five of the largest known populations have been monitored for at least 5 years by NCNHP (13 populations) and NCDOT (12 populations).

III. Public Review and Comment

The Service will announce the availability of the draft Plan for public review and comment in the publication of the proposed rule to delist dwarf-flowered heartleaf. At conclusion of the comment period, the Service will review each comment and prepare responses to substantive comments.

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IV. Monitoring Methods and Locations

The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). The second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps provided for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

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Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants occurring at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data were used to determine the size of the entire population. The supplemental acreage from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals, when every tract could not be visited. The estimated extrapolated size of each population for each year was determined with the following formula:

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$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

The PDM will be a continuation of the monitoring described above and occur within at least 13 previously monitored populations (Appendix A).

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A. Procedures to Assure Consistency

The following practices will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked (unless population is small enough for a complete census).
- A field data sheet, developed prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
- Threats will be assessed at each location using NCPCP guidelines (Appendix B).
- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 13 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6-7 sites are monitored each year for six years (each site receives three complete monitoring cycles).

IV. Definition of Response Triggers for Potential Monitoring Outcomes

Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios.

After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

A. Category I

PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections.
This would be true if:

1) Population numbers are within the standard deviation of the mean or above, and

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2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

B. Category II

PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, all actions from Category II will be implemented. Additionally, the Service will initiate a formal status review and determine whether a proposal for relisting is appropriate.

V. Data Compilation and Reporting Procedures

Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be

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negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

If response triggers in Section IV are met or exceeded, the Service will consult with NCNHP, NCDOT, and other partners to determine whether to conclude the PDM process or pursue management actions. The determination will also include, if necessary, an evaluation of the threats to dwarf-flowered heartleaf using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state and tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of dwarf-flowered heartleaf following removal from protections of the Act. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this draft Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

As staff resources and funding allow, the primary entities conducting the PDM and preparing reports will be NCNHP and/or NCDOT. Based on a funding estimate received from NCNHP, monitoring 6-7 sites each year would require approximately $6,100 in funding. A complete monitoring cycle of two years would require approximately $12,200 and the entire six years of monitoring (three monitoring cycles) would require approximately $36,600. The NCNHP funding estimates do not apply to NCDOT and NCDOT is unable to provide an estimate for monitoring additional sites at this time. The Service will provide assistance as needed and as resources permit.

VII. PDM Implementation Schedule

A schedule will be developed in coordination with NCNHP and/or NCDOT in order to ensure that it is feasible to accomplish PDM activities at all sites scheduled for a given year. An example schedule is shown below:

Sites	Year	Monitoring Cycle	Reporting
1-6	1	1	
7-13	2	1	Cycle 1 (end of year)
1-6	3	2	
7-13	4	2	Cycle 2 (end of year)
1-6	5	3	
7-13	6	3	Cycle 1-3 Final Report (end of year)

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VIII. Literature Cited

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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.

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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.

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

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South Carolina Department of Natural Resources (SCDNR) Heritage Trust. 2018. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: February 1, 2018.

US Fish and Wildlife Service. 1989. Threatened status of *Hexastylis naniflora* (Dwarf-flowered Heartleaf), Federal Register: 14964-14967.

-----. 2010. Dwarf-flowered heartleaf (Hexastylis naniflora) 5-year review: Summary and Evaluation. US Fish and Wildlife Service Southeast Region, Asheville Ecological Services Field Office, Asheville, NC.

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

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.

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Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:
Blalock Reservoir (SC EO 007, 031)
Broad River: Cleghorn Creek, US 221 (EO 176)
Broad River: Floyds Creek, Long Branch (EO 177)
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop (EO 099)
Cliffside Steam Station (EO 276)
Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Love Lady Site (EO 029)
Mills Creek Forest and Seep (EO 023)
New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
Rhyne Preserve (EO 302)
Second Broad River (Forest City Industrial Complex) (EO 154)
South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)

NCDOT Sites:
Broad River Greenway (EO 049-051, 073-074, 149, 233, 238-241)
Buffalo Shoals Creek (EO 275)
Catawba County (EO 158, 162)
Extension of 15th Avenue (EO 031)
Gunpowder Creek (EO 077)
Little Gunpowder Creek (EO 044)
Longview (EO 032)
Micol Creek (EO 159)
Murray's Mill (EO 184)
Shelby Bypass Site 7 (EO 191)
Tate Boulevard Extension (EO 030)
Tate Conservation Area (EO 106, 286)

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Appendix B – Threats Assessment Guidance

This methodology was originally developed by the NC Plant Conservation Program (NCPCP) Scientific Committee in 2008 to assess the rarest and most imperiled plant species. This protocol was applied to individual populations of *Hexastylis naniflora*, during baseline monitoring, to develop a standardized assessment of threats and trends.

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species. Each threat is assigned a ranking for its severity, scope, and immediacy, as described below:

Threat Severity

- High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long-term recovery (>100 yr.).
- Moderate: Major reduction of species population or long-term degradation or reduction of habitat in area affected, requiring 50–100 yr. for recovery.
- Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.
- Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yrs.) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations is generally considered Insignificant as defined here.

Scope

- High: >60% of total population, occurrences, or area affected.
- Moderate: 20–60% of total population, occurrences, or area affected.
- Low: 5–20% of total population, occurrences, or area affected.
- Insignificant: <5% of total population or area affected.

Immediacy

- High: Threat is operational (happening now) or imminent (within a year).
- Moderate: Threat is likely to be operational within 2–5 yr.
- Low: Threat is likely to be operational within 5–20 yr.
- Insignificant: Threat not likely to be operational within 20 yr.

DRAFT

From: Robinson, Laura
To: Reid, Rebekah N
Subject: RE: [External] Fwd: Hexastylis naniflora Monitoring
Date: Friday, April 26, 2019 10:31:04 AM
Importance: High

Thanks, you too, Rebekah!

LAURA ROBINSON

Botanist, Natural Heritage Program
Division of Land and Water Stewardship

121 W. Jones St, MSC 1651 Raleigh, NC 27699-1651
919 707 8647 *office*

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From: Reid, Rebekah <rebekah_reid@fws.gov>
Sent: Friday, April 26, 2019 9:43 AM
To: Robinson, Laura <Laura.Robinson@ncdcr.gov>
Subject: Re: [External] Fwd: Hexastylis naniflora Monitoring

CAUTION: External email. Do not click links or open attachments unless you verify. Send all suspicious email as an attachment to report.spam@nc.gov

Thanks, Laura. I appreciate you taking the time to review it.

Have a great weekend!

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

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On Tue, Apr 23, 2019 at 1:24 PM Robinson, Laura <Laura.Robinson@ncdcr.gov> wrote:

> Hi Rebekah,
> I've looked over the draft monitoring plan and it looks good to me. I made very few minor edits, in track changes in the attached document. I ran it by Misty once again to make sure the cost estimate was still on track and she said it was fine. Please let me know if you need anything else.
>
> **LAURA ROBINSON**
> Botanist, Natural Heritage Program
> Division of Land and Water Stewardship
>
> 121 W. Jones St, MSC 1651 Raleigh, NC 27699-1651
> 919 707 8647 *office*
>
> *Email correspondence to and from this address is subject to the North Carolina Public Records Law and may be disclosed to third parties.*
> Facebook Twitter Instagram YouTube
>
> NC DEPARTMENT OF NATURAL AND CULTURAL RESOURCES
> NORTH CAROLINA Natural Heritage Program SCIENCE GUIDING CONSERVATION
>
> ---
>
> **From:** Reid, Rebekah <rebekah_reid@fws.gov>
> **Sent:** Tuesday, April 16, 2019 2:31 PM
> **To:** Robinson, Laura <Laura.Robinson@ncdcr.gov>; Bassette, Tim <tpbassette@ncdot.gov>
> **Subject:** [External] Fwd: Hexastylis naniflora Monitoring
>
> **CAUTION:** External email. Do not click links or open attachments unless you verify. Send all suspicious email as an attachment to report.spam@nc.gov
>
> Laura and Tim,
>
> I received a very delayed "delivery has failed" message regarding this email. I'm just re-sending to make sure you received it.
>
> 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

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---------- Forwarded message ---------
From: **Reid, Rebekah** <rebekah_reid@fws.gov>
Date: Tue, Apr 9, 2019 at 9:31 AM
Subject: Hexastylis naniflora Monitoring
To: Robinson, Laura <Laura.Robinson@ncdcr.gov>, Tim Bassette <tpbassette@ncdot.gov>

Hi Laura and Tim,

I am following up on our call last Summer regarding *Hexastylis naniflora*. As a quick refresher, we discussed the potential paths forward for the species: Recovery Plan vs. delisting. No decision has been made to date but I have been asked what a monitoring plan would look like for the species in the event of delisting. Attached is a draft monitoring plan for your review. I would appreciate any comments or feedback since info in the plan was compiled from previous reports by both agencies and input during our call. I don't have a specific due date but if you all have the time in the next couple of weeks to review, that would be great.

Because this is a draft document and no decision has been made regarding listing status, I ask that you keep this plan confidential and do not distribute to others.

Please do not hesitate to contact me if you have any questions. If a call is in order, just let me know and I'll be happy to schedule it.

Thank you.

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

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From: Reid, Rebekah N
To: Bassette, Tim
Subject: Re: [EXTERNAL] Hexastylis draft monitoring
Date: Monday, May 6, 2019 3:36:14 PM
Attachments: image001.png

Hi Tim,

Word is fine. No need to convert to PDF unless you just want to.

Thank you!

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

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On Mon, May 6, 2019 at 1:24 PM Bassette, Tim <tpbassette@ncdot.gov> wrote:

> Rebekah,
>
> I did receive the draft monitoring report. I will get you comments by the end of May 17. Would you prefer comments back in Word or in .pdf format (I would just convert the draft document to a .pdf)?
>
> Tim Bassette
>
> Tim Bassette
>
> Environmental Program Consultant
>
> Biological Surveys Group
>
> Environmental Analysis Unit
>
> North Carolina Department of Transportation

919-707-6104 office

919-819-9010 mobile

tpbassette@ncdot.gov

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THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20 1775
APRIL 12 1776
ESSE QUAM VIDERI

From: Bassette, Tim
To: Reid, Rebekah N
Subject: [EXTERNAL] Dwarf-Flowered Heartleaf PDM
Date: Tuesday, May 21, 2019 7:44:42 PM
Attachments: image001.png[1]
NCDOT Expenditures Memo 051519.pdf[2]
Tate Conservation Easement Monitor NTP Contract.pdf[3]
Broad River Greenway Conservation Easement Contract NTPs.pdf[4]
NCNHP_Rare_Plant_Form_2016_Instructions.pdf[5]
Hexastylis naniflora PDM Draft V1 (04.08.19).pdf[6]
Importance: High

Rebekah,

This email is to start the conversation on funding for PDM of H naniflora. First, I have enclosed a memo that went out last Wednesday regarding NCDOT expenditures. Also enclosed is a consultant Notice to Proceed contract for the 2015 monitoring of the Tate Conservation Easement. Finally, there are two consultant Notice to Proceed contracts (attached into one file) associated with the 2015 monitoring of the Broad River Greenway Conservation Area.

Some notes on the Notices to Proceed and costs associated with them…

For the Tate: The cost listed in the NTP is for one monitoring period paid out to our consultant for their work only. NCDOT staff also assisted our consultant with the fieldwork under that contract, so add in a couple more thousand dollars. Add in an additional couple thousand dollars on top of that for NCDOT staff management and review associated with the contract. If this work was contracted out today, it would probably cost $25-30K in total between NCDOT and our consultants to do one round of monitoring because of the increased salary and overhead costs on the consultant side as well as the recent increase in salary costs with NCDOT staffing.

For the Broad River Greenway Conservation Area: Add those two costs from the two NTPs together, and that is what it cost NCDOT to have our consultant do the 2015 monitoring of the BRGCA: $109,220.32 for one monitoring period. That does not include NCDOT staff costs for management and review. If this was contracted out today, I am going to guess that it would cost $150,000 for one monitoring period that combines the consultant and NCDOT costs. And I will add that the 2012 monitoring probably cost in excess of $250,000 for our consultant plus NCDOT staffing, but there was a giant learning curve during that time.

As you can see, it costs a lot for NCDOT to complete the monitoring tasks, and those costs are only going higher. While the BRGCA is an extreme case, some of the smaller monitoring projects will probably run $15,000 each for consultant and NCDOT costs just for one monitoring period.

And NCDOT is now on notice for expenditure issues, per the enclosed memo.

The primary way in which NCDOT can participate in the PDM and have it funded is to tie the PMD to a project undergoing ESA Section 7 Formal Consultation for dwarf-flowered heartleaf. The USFWS might be able to place the PMD as a Conservation Measure into in its Biological Opinion for that project. So for example, instead of NCDOT obtaining additional ROW or a conservation easement to protect what is left of the plants after project construction occurs, DOT would be required to do the

Summary of Comments on 20190521 194442_[EXTERNAL] Dwarf-Flowered Heartleaf PDM.pdf

Page: 1

Number: 1 Author: Date: Indeterminate

Number: 2 Author: Date: Indeterminate

Number: 3 Author: Date: Indeterminate

Number: 4 Author: Date: Indeterminate

Number: 5 Author: Date: Indeterminate

Number: 6 Author: Date: Indeterminate

PDM instead of, or in addition to, land acquisition. From that point on, funding mechanisms for the monitoring could be set up through the road project itself. While this is the principal way that NCDOT could tie project funding with the PDM, there may be other means by which DOT might be able to fund the PDM that would have to be discussed at a level within in DOT much higher than where I am.

As for tying an NCDOT project undergoing Section 7 Consultation with the PDM, the issue is what projects does NCDOT have in its pipeline requiring Formal Consultation for the species. The only project in the current Biological Assessment pipeline that I know of is STIP No. B-5531, a bridge replacement in Cleveland County that will incur a loss of about 32 plants and 0.037 ac of occupied habitat. That project is going to construction let in February 2020. I currently have a draft of that project's Biological Assessment that will be submitted to the US Army Corps of Engineers as the lead Federal agency within the next few weeks. This is small project from a construction standpoint, and impacts a relatively small amount of dwarf-flowered heartleaf. Given the large costs associated with the PDM efforts, it would be more easily justifiable in having Conservation Measures from a much larger project (or maybe multiple projects) tied to the PDM.

I recommend that we talk with Claire to get a sense on how we might be able to coordinate this under the Section 7 Formal Consultation process. I also want to talk to you by phone about the PDM within the grand scheme of its post-delisting context, because any funding for PDM – and any Conservation Measures under ESA Section 7 - will have to go through various approvals here at NCDOT.

Finally, I have enclosed additional comments on the draft PDM report, as well as the NCNHP Rare Plant Form guidelines that we have been including with our consultants' contracts.

I will be in the office the rest of this week if you are able to talk.

And most importantly, thank you for allowing NCDOT to provide input on all of this!

Tim

Tim Bassette
Environmental Program Consultant
Biological Surveys Group
Environmental Analysis Unit
North Carolina Department of Transportation

919-707-6104 office
919-819-9010 mobile
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STATE
NORTH CAROLINA

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

JAMES H. TROGDON, III
SECRETARY

May 15, 2019

MEMO TO: NCDOT Executive Leadership

FROM: Secretary Jim Trogdon, III, PE

SUBJECT: Expenditures

This past year, NC saw major declared disasters. Your efforts to prepare and respond to these disasters was unprecedented. But now we must wait for reimbursement from our federal partners. Our disaster-related expenditures must come from the Highway Trust Fund (State dollars). The recovery effort for Hurricane Florence, was followed by rare and expensive December/January snow events—again, these activities must be paid for from the Highway Trust Fund.

These events and a few other disasters have required us to spend over $350 million of our new construction dollars on critical repairs and response efforts and we are now waiting for federal reimbursement.

As NC policy makers seek ways to help offset this short-term cashflow issue, we at NCDOT must do our part.

Therefore, effective immediately, the following procedures are put in place:

- Only mission critical travel
    - Travel must be approved in advance by Deputy Secretary level
    - Meetings that can be conducted via webinar or phone should be
- No conference registration
    - Any conference that has been paid for, refunds should be requested
- Only mission-critical purchases
    - Purchases must be approved by Deputy Secretary level
    - Includes purchases through Pcards
- All contracts for goods or services must be approved by COO
    - Only mission-critical goods and services contracts will be executed

It is critical that we continue to design, build and maintain North Carolina's transportation system to the best of our ability. It is also critical that we be good stewards of the resources entrusted to us. That means that we will focus on spending funds ONLY when they are directly related to our core mission. If you have questions regarding these policies, please seek guidance from Bobby Lewis.

Mailing Address:
NC DEPARTMENT OF TRANSPORTATION
OFFICE OF THE SECRETARY
1501 MAIL SERVICE CENTER
RALEIGH, NC 27699-1501

Telephone: (919) 707-2800
Fax: (919) 733-9150
Customer Service: 1-877-368-4968

Website: www.ncdot.gov

Location:
1 SOUTH WILMINGTON STREET
RALEIGH, NC 27601

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

PAT MCCRORY
GOVERNOR

ANTHONY J. TATA
SECRETARY

NOTICE TO PROCEED – March 6, 2015

LIMITED SERVICES CONTRACT NUMBER: [redacted]

Project: **R-9999M – (34634.2.13) – Tate Conservation Easement DFHL Monitoring**

CONTRACT WORK DESCRIPTION:

DFHL Monitoring

[redacted] P. O. Number for Invoicing

The Professional Services Management Unit has reviewed the final negotiated cost proposal and has determined that it is consistent with the above-numbered LSC's salaries and rates reviewed/approved by NCDOT's Office of Inspector General. PSMU has also verified the computation of the grand total of the cost proposal.

For professional services related to the scope of work and cost proposal dated **March 2, 2015** for the **lump sum** amount of **$14,181.40**

Acknowledgment and Acceptance:

_____
Firm Name:

_____
Signatory:

_____
Date:

APPROVED: Cathy S. Houser

Cathy S. Houser, PE, Project Engineer – Preconstruction
Professional Services Management Unit

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
PROFESSIONAL SERVICES MANAGEMENT UNIT
1592 MAIL SERVICE CENTER
RALEIGH NC 27699-1592

TELEPHONE: 919-707-7130
WEBSITE: WWW.NCDOT.GOV

LOCATION:
CENTURY CENTER BUILDING A
1000 BIRCH RIDGE DRIVE, SUITE 184
RALEIGH NC 27610

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

PAT MCCRORY
GOVERNOR

ANTHONY J. TATA
SECRETARY

NOTICE TO PROCEED – February 27, 2015

LIMITED SERVICES CONTRACT NUMBER: [redacted]

Project: **R-9999L – (34497.1.2) – DFHL Monitoring**

CONTRACT WORK DESCRIPTION:

[redacted] P. O. Number for Invoicing

DFHL Monitoring

The Professional Services Management Unit has reviewed the final negotiated cost proposal and has determined that it is consistent with the above-numbered LSC's salaries and rates reviewed/approved by NCDOT's Office of Inspector General. PSMU has also verified the computation of the grand total of the cost proposal.

For professional services related to the scope of work and cost proposal dated **February 11, 2015** for the **lump sum** amount of **$75,556.33**

Acknowledgment and Acceptance:

_____
Firm Name:

_____
Signatory:

_____
Date:

APPROVED: Cathy S. Houser

Cathy S. Houser, PE, Project Engineer – Preconstruction
Professional Services Management Unit

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
PROFESSIONAL SERVICES MANAGEMENT UNIT
1592 MAIL SERVICE CENTER
RALEIGH NC 27699-1592

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CENTURY CENTER BUILDING A
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RALEIGH NC 27610

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

PAT MCCRORY
GOVERNOR

NICHOLAS J. TENNYSON
SECRETARY

GENERAL INFORMATION	
Notice to Proceed	Tuesday, March 08, 2016
Contract Work Type	**COST + OVERHEAD + PROFIT**
Limited Services Contract Number:	[redacted]
Purchase Order Number	[redacted]

CONTRACT WORK DESCRIPTION:

R-2707 Monitoring Report for 2015 Surveys
Total Mandays 36.50

LINE ITEM DETAIL INFORMATION:

ITEM	WBS/ORDER NO.	DESCRIPTION	OLD VALUE	CHANGE VALUE	NEW VALUE	SHORT TEXT	MANDAYS
10	34497.1.2	R-2707 - PE - US 74	$0.00	$33,663.99	$33,663.99	R-2707 NES	0.000
			$0.00	$33,663.99	$33,663.99		0.000

SPECIAL NOTES / CONDITIONS / TERMS:

OTHER DETAILS / INFORMATION:

DATES (MM/DD/YYYY)			
COST PROPOSAL DATE (e-mail, etc.):		PSMU's Revisions / Changes:	
REVISED PROPOSAL DATE (email, etc.):		PEF's Concurrence with PSMU's Revisions / Changes:	

The Professional Services Management Unit has reviewed the final negotiated cost proposal and has determined that it is consistent with the above-numbered LSC's salaries and rates reviewed/approved by NCDOT's Office of Inspector General. PSMU has also verified the computation of the Grand Total of the cost proposal. **THEREFORE**, this **Notice to Proceed is given** for professional services related to the scope of work and cost proposal as outlined above.

A completed and signed Subconsultant Form RS-2 must accompany this form when returning it to the NCDOT Contract Administrator. The Subconsultant Form RS-2 can be found at:

http://www.ncdot.org/doh/forms/files/SubconsultantFormRS2.doc

MAILING ADDRESS:
NC Department of Transportation
Professional Services Management Unit
1592 Mail Service Center
Raleigh, NC 27699-1592

Telephone: (919) 707-7130

Website: WWW.NCDOT.ORG

LOCATION:
Century Center Building A
1000 Birch Ridge Drive, Door A-1, Suite 184
Raleigh, NC 27610

NORTH CAROLINA
Natural Heritage Program
SCIENCE GUIDING CONSERVATION

Please submit this form by email:
natural.heritage@ncdcr.gov
Or mail:
N.C. Natural Heritage Program
Rare Plant Form
1651 Mail Service Center
Raleigh NC 27699-1651

Rare Plant Form

DATE SUBMITTED _NCDOT'S SUBMITTAL DATE_

Contact Information	
Name	Provide the name of the North Carolina Department of Transportation's (NCDOT) Environmental Analysis Unit (EAU) project manager.
Agency/Affiliation	Environmental Analysis Unit, North Carolina Department of Transportation
Street Address	1598 Mail Service Center
City ST Zip Code	Raleigh, NC 27699-1598
Phone	Provide the office number of NCDOT's EAU project manager.
E-Mail Address	Provide the e-mail address of NCDOT's EAU project manager.
Observation Information	
Scientific Name	*Hexastylis naniflora*
Common Name	Dwarf-flowered heartleaf
EO Number (if updating existing)	If the surveyed population is a new occurrence that is not documented by North Carolina Natural Heritage Program (NCNHP), note this. If the surveyed population is an existing Element Occurrence (EO) previously documented by NCNHP, provide the EO Number being updated.
Survey Location	Latitude _____ Longitude _____ (decimal degrees) County _____ Landowner _Match landowner and/or entity name(s) with the name(s) provided in the #21 entry for "Landowner(s), if known."_
Date(s) of Observation	Include all applicable dates of the survey period in which any of the following occur: the population is first observed and/or identified to species, the limits are delineated and/or located with Global Positioning System (GPS), specimens within those limits are enumerated or estimated, and/or data necessary to prepare this form is collected in the field.
Observer(s)	A.) If the form is prepared by an agency/affiliation on behalf of NCDOT, note this and provide the individual's name, agency/affiliation, street address, city, state, zip code, phone number, and e-mail address of the principal field observer. Provide the name(s) of all other field observer(s) with name(s) of corresponding agency/affiliation, but without providing any other additional contact information. B.) If the form is prepared by NCDOT, provide the individual's name, agency, street address, city, state, zip code, phone number, and e-mail address of the principal field observer. Provide the individual name(s) of all other field observer(s) with the name(s) of the corresponding agency/affiliation, but without providing any other additional contact information.

Observation Description:

1. Site Name (if this is within previously identified site):

   Provide both the Transportation Improvement Program (TIP) number associated with the NCDOT project that the site is found on and the NCDOT site identification name or number specifically used to identify the site for project purposes. Site can also be an NCNHP natural area, a managed area, or an NCDOT protected area in owned right-of-way or a conservation easement. Some examples include the following: 1.) B-1234, Site 1; 2.) R-9999L, Murray's Mill Conservation Area; 3.) R-2707, Broad River Greenway Conservation Area, Site AA; 4.) William B. Umstead State Park; 5). Holly Shelter Game Land.

2. Site location and directions (please provide a specific written description and also provide a shapefile, kmz file, or attach copy of map with site marked):

   A.) For site location and directions, describe how to drive to the population and how to get to the population in the field. Include specific information that would help locate the population as accurately as possible, using landmarks identifiable on a map or in the field. You may include specific directions or distance from known landmarks (i.e. along a stream or distance from a known intersection).

   B.) If provided, prepare the Geographic Information Systems (GIS) shape files in accordance with NCDOT procedures and submit to NCDOT.

   C.) For attached map(s), refer the reader to the attachments using the specific reference number of each map. For example, if a vicinity map (Figure 1) and an aerial close-up depicting the surveyed population (Figure 2) are both attached to this form; the response provided for this entry is "See attached Figures 1 and 2."

3. Number of individuals:

   Provide the actual number of individuals directly counted, or an estimate of individuals if the surveyed area was not directly counted. If only a portion of the population was surveyed, provide the number of individuals only within that portion of the population surveyed. If sample plots were used to derive the total number of individuals within the population, depict both the total number of plants and the area within each sample plot and the total number of plants calculated to occur within the entire surveyed population.

   Define individual (stem, clump, etc.):

   Include all dominant forms the individual is observed to occur as. Examples for *H. naniflora* may include single stems, multiple stems, clumps, etc.

4. Size of area in which population occurs:

   If population is delineated/located by GPS, provide the actual size of the population in acres or an estimate in acres if it is not. If only a portion of the population was surveyed, provide that portion as the answer. The acreage of the delineated portion of the population is to be rounded to the nearest one-one hundredth of an acre. When the rounded acreage is less than 0.005 ac, provide the acreage rounded up or down to the first decimal unit that does not contain a zero in it. For example, if the delineated area of the population is 0.000394 ac, the acreage depicted on the form is 0.0004 ac.

5. Estimate whether the entire population was surveyed, or only a portion:

   This field is to determine if the population might extend beyond the areas surveyed. If only a portion was surveyed, provide the limits that were used to determine the extent of what was surveyed (e.g., project area or corridor limits, right-of-way or conservation easement limits, etc.).

6. Estimated Population Viability (circle one):

   Excellent Good Fair Poor Unknown Failed to find

   Give your best estimate of the viability of the population based on the area of occupancy, number of individuals, the condition (evidence of reproduction, health), and landscape context of the population (quality, structure, and extent of the surrounding habitat). In general, populations of excellent viability have an excellent probability of persisting for 20-100 years and those of poor viability have a poor probability of persisting 20-100 years.

7. Population Viability Comments:

   A.) Comment on the biological integrity of the population and its individuals as well as the population's habitat and surrounding landscape.

   B.) Note observed evidence of natural conditions or human activities that affect population viability in either a positive or negative manner. Examples include - but are not limited to – protective conservation measures (e.g., restrictive barriers); land conservation acquisitions; prevalence and/or control of invasive, exotic plant species; increased/decreased competition from other plants species due to changes in the growth or density of vegetative understory layers; fire suppression; stream bank erosion or protection; trail or slope erosion; trampling, harvesting, excavation or removal of individuals; trail construction activities; all-terrain vehicle usage; evidence of herbicide applications; effects from drought or excessive precipitation; land clearing; vegetative clearing or replanting; land or stream disposal of solid wastes; and ditching or other drainage activities.

8. Phenology (include % or # in each stage):

   vegetative bud flower

   Indicate whether the plants, and what %, or number, are in vegetative form, in flower, fruit, bud, or just past flowering. Informally estimate the % or number in each stage; an approximation is fine. If the survey was conducted outside of the species' optimal flowering window, note this.

9. Evidence of reproduction:

   fruit seedlings clonal/vegetative

   Indicate if plants (and if so, what %) have produced fruits, or if seedlings are present. This helps to assess the reproductive viability of the population. Informally estimate the % or number in each stage; an approximation is fine.

10. Reproduction Comments:

Note the presence or absence of any newly emerged single leaves presumed to have originated from underground rhizomes. If these leaves are present, indicate if they are rare, common, or very abundant.

11. Habitat (NC NHP natural community name and description, if known; include quality, soils, geology, etc.):

A.) Classify natural community habitat in accordance with the Guide to the Classification of the Natural Communities of North Carolina, Fourth Approximation (NCNHP 2012) for undisturbed upland communities; best professional judgment for disturbed upland communities based on dominant vegetation or land use (e.g., Pine Plantation, Agricultural Field, Residential Development); and the North Carolina Wetland Assessment Method (NCWAM) classification for wetland habitats. Provide the complete name of any natural communities classified by NCNHP or NCWAM. For example, a complete name is Mesic Mixed Hardwood Forest (Piedmont Subtype) rather than just Mesic Mixed Hardwood Forest. Finally, provide a quality (low, medium, or high) for each of the natural communities or wetland habitats listed.

B.) Using the most current soil reference materials - such as that posted on the United States Department of Agriculture-Natural Resources Conservation Service's (USDA-NRCS) Web Soil Survey - or field-specific observations, indicate any known information about the geology and soils of the population. Examples of geologic information may include the presence of diabase sill. For the soils, provide the full Soil Series Map Unit Name that equates to the first two letters of the map unit symbol for all soil mapping units found within the population, rather than just reporting the map unit symbols within the population. For example, the population in question contains mapped soil units that are symbolized as PcB2, PcC2, and PaC. The reported soil mapping units will be Pacolet sandy clay loam and Pacolet gravelly fine sandy loam, leaving out any associated descriptions of the slope, erosion, or flooding phases. The map unit names (e.g., Pacolet sandy clay loam) will be reported rather than the map unit symbols (e.g., PcB2). Note that the USDA-NRCS Web Soil Survey is the official source of current soil survey information. Published USDA-NRCS soil surveys may not provide the most current information. Finally, if using soil reference material such as the USDA-NRCS Web or published soil surveys instead of field-confirming the actual soil units, note that the soils are mapped.

12. Associated species:

Provide the scientific name of all dominant plant species, including other rare plant species, within the limits of the population that the survey form is prepared for. For instances in which the population is extremely small in area, list the dominant plant species, including rare plant species, both at or inside the population - as well as in the vicinity of the population - in order to help characterize the habitat. Do not include the specific rare plant species that the survey form is being prepared for, nor include any species listed as an invasive, exotic plant in the document entitled Invasive Exotic Plants of North Carolina (NCDOT 2008) because they are listed in the entry below instead.

13. Invasive species noted & degree of threat from invasive species:

Provide the scientific name of all invasive, exotic plants found in Invasive Exotic Plants of North Carolina (NCDOT 2008) that are field-observed to occur either within the limits of the population that the survey form is prepared for or immediately outside of the limits of that population. If an invasive species is not listed in the aforementioned reference document and is found within the delineated limits of the population, list this species under the associated species entry above rather than in this entry. Note if there is one particular species that is very prevalent within or immediately outside of the population. Provide a single degree of threat (low, medium, or high) that combines the effects that all of the listed invasive plant species have or could have on the delineated population.

14. Area of apparently suitable habitat (suitable for, but not necessarily occupied by the species):

Estimate the acreage of suitable occupied + suitable unoccupied habitat of the rare plant species in question. Define the parameters or limits used to assess this area. For example, the area could be assessed within the limits of the project's study area or corridor, between the confluence of two streams or road crossings, within a defined patch of woodlands, etc. At a minimum, the area of apparently suitable habitat will be equal to (and cannot be less than) the acreage of the surveyed population, assuming no additional unoccupied habitat of the species is found within the limits used to assess this area. If additional unoccupied habitat of the species in question occurs within the limits of the assessed area, then the area of apparently suitable habitat will be greater than the area of the surveyed population.

15. If the population is within a Right-of-Way, does suitable habitat exist outside Right-of-Way?

If applicable, estimate if plants or suitable habitat (suitable, but not necessarily occupied by the species) exist beyond the right-of-way. Overall, try to estimate the total area that could be occupied if the plant were fully utilizing the entire available habitat. Recognize that in any given year, all individuals may not be observed; some plants may be dormant, seedlings, or vegetative within the suitable habitat, but not readily apparent when you are doing the survey. For purposes of this question, right-of-way is defined as an existing road or conservation right-of-way, an existing drainage or construction easement, an existing utility easement, or an existing conservation easement. If the population is not within one of these rights-of-way, note this and move on to the next question. If the population is within one of these rights-of-way, note which of the right(s)-of-way the population is found in, and provide a yes or no answer as to whether suitable habitat occurs both adjacent to the population and outside of the applicable right(s)-of-way.

16. Topographic position (examples: crest, mid slope, alluvial, etc):

Evaluate the entire population for topographic position(s). Include stream bank as a position, if applicable.

17. Moisture regime (examples: inundated, dry, seasonally wet, etc):

Provide the moisture regime observed in the field for each natural and disturbed community habitat type found at the population. If the moisture regime observed at the time of the survey greatly differs from that which is typically associated with the community or habitat type, then report both the moisture regime typically found as well as the moisture condition observed in the field that is uncharacteristic of that community. For example, a Mesic Mixed Hardwood Forest (Piedmont Subtype) observed under drought conditions will be reported as typically mesic but observed in the field to be under dry conditions.

18. Light (examples: open, woodland, closed canopy, etc):

If assessed outside of the growing season when leaves are not fully present, assume the presence of full foliage when estimating the light characteristic(s) of the surveyed population.

19. Other information:

A.) Provide the general slope aspect across the entire surveyed population, rather than just a portion or single point within that population. Include all applicable cardinal (north, south, east, and west) and ordinal (northeast, northwest, southeast, and southwest) directions.

B.) Provide the enumeration method used to determine the number of individuals of the rare plant species within the surveyed population. Enumeration methods include - but are not limited to - direct counts, formal estimates, informal estimates, and presence/absence determinations. A direct count is an enumeration of individual plants within visual range along straight-line walking transects across the entire delineated population. A formal estimate involves the use of temporary or permanent sample plot(s) placed within the delineated limits of the population, with direct plant counts performed in the plot(s) such that the total number of plants across the delineated limits of the population can be estimated (back-calculated) from the number of plants within the plot(s). An informal estimate may involve a broad, sweeping visual observation completed across the entire delineated portion of the population in order to approximate the number of single plants within that part of the population. A presence/absence determination may be made to document whether or not the rare plant species occurs within a particular area.

C.) If a proportion of the total number of *Hexastylis* spp. specimens enumerated within the surveyed population was used to derive an estimated number of *H. naniflora* individuals of that population, note this and provide the percentage or ratio used in estimating the number of *H. naniflora* individuals. If applicable, provide contact information of the personnel who confirmed the species identification and the date and manner in which this confirmation occurred.

D.) All individual specimens of the rare plant are assumed to be native to the population. If any of the individuals are transplanted, note this.

20. Protection / management needs and opportunities:

A.) Identify any protection/management needs that may help alleviate observed threats to the population. Report any recent management activities known to have occurred, including the control or removal of invasive, exotic plant species.

B.) Note if the surveyed population is officially protected in a right-of-way or conservation easement.

C.) If the population or portion of which could be further evaluated for formal protection within an existing road right-of-way or through an extension of an existing or proposed road right-of-way, note this. Exclude from consideration those populations that are relatively small or of poor quality. A right-of-way extension may be applicable in situations where a portion of a population is already situated within an existing or proposed road right-of-way associated with the project, with an additional amount of the population extending beyond that right-of-way.

D.) If the population or portion of which could be further evaluated for formal protection under a conservation easement, note this. Exclude from consideration those populations that are relatively small or of poor quality. The consideration to further evaluate the potential viability of a conservation easement may be applicable in situations where the entire population remains outside of any proposed or existing road right-of-way associated with the project.

21. Landowner(s), if known:

    Check county GIS or similar Geospatial Information Services, if available. List all current landowners, including any public municipalities or non-profit organizations, which own any portion of the surveyed population. If any portion of the population occurs within a defined right-of-way, then the owner of that right-of-way is listed as a landowner. For example, depict the State of North Carolina as the landowner if any portion of the population is situated within a road right-of-way owned by the State of North Carolina. Cite the source used to obtain landowner information, and provide a specific date (month, day, and year) in which this information was obtained. Finally, landowner(s) depicted here must match the landowner(s) depicted in the Survey Location entry of the Observation Section.

22. Specimens collected? (permits are required for federal or state listed species) Note yes or no.
    Collection #: Provide the collector number, herbarium specimen number.
    Repository: Provide the herbarium name or personal collection.

General comments that pertain to responses provided on the survey form:

A.) Use the blank survey form template provided by NCNHP when preparing each form.

B.) Provide responses in a typed format.

C.) Be consistent with capitalizing, or not capitalizing, the first word of an incomplete sentence. Always capitalize the first word of a complete sentence.

D.) Be consistent with the font style and font size used.

E.) Be consistent in the use or lack of use in punctuation at the end of the responses provided. Always provide appropriate punctuation at the end of a complete sentence.

F.) Be consistent in the number of blank rows of spacing placed between each response, unless at the end of a page.

G.) Italicize or underline scientific names, but do not italicize or underline "sp.," "spp.," or "var."

H.) Correctly spell all scientific names.

I.) If a provided response is exactly identical for more than one population across multiple survey forms, provide a complete response to each question on each separate form. For example, if the list of associated species for Populations A and B are exactly identical, then each population requires is own distinct survey form to be prepared. The complete list of associated species must be depicted on the survey form for Population A as well as the form for Population B, rather than depicting the complete list of associated species on the form for Population A and then stating "See Population A" or "Same as Population A" under the associated species entry on the form for Population B.

J.) Return final completed survey form to NCDOT for submittal to NCNHP.

**Instructions for preparing this survey form represent NCNHP guidance, as modified by NCDOT for use by its staff and contractors.

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U.S. FISH AND WILDLIFE SERVICE

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

April 2019

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Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)

April 2019

DRAFT

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Acknowledgements

The Draft Post-Delisting Monitoring Plan (Plan) for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) was prepared by the US Fish and Wildlife Service (Service) with participation from Rebekah Reid, Asheville Ecological Services Field Office, and Drew Becker, Southeast Regional Office. The Service acknowledges partners outside our agency who provided input during development of this draft Plan, including the North Carolina Natural Heritage Program and the North Carolina Department of Transportation.

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Table of Contents

II. Summary of Species Status at Delisting 1
A. Demographic Parameters 1
B. Discussion of Populations 2
III. Public Review and Comment 3
IV. Monitoring Methods and Locations 4
IV. Definition of Response Triggers for Potential Monitoring Outcomes 5
A. Category I 5
B. Category II 6
C. Category III 6
V. Data Compilation and Reporting Procedures 6
VI. Estimated Funding Requirements and Sources 7
VII. PDM Implementation Schedule 7
VIII. Literature Cited 8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

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I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2015), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June. They are small,

inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989). The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).

B. Discussion of Populations

When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2010).

Since listing, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to NCNHP Element Occurrence (EO) records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This generated considerable discrepancies among sources with respect to abundance and distribution of the species, to the extent that data are usually not comparable from one source to the next (Service 2010).

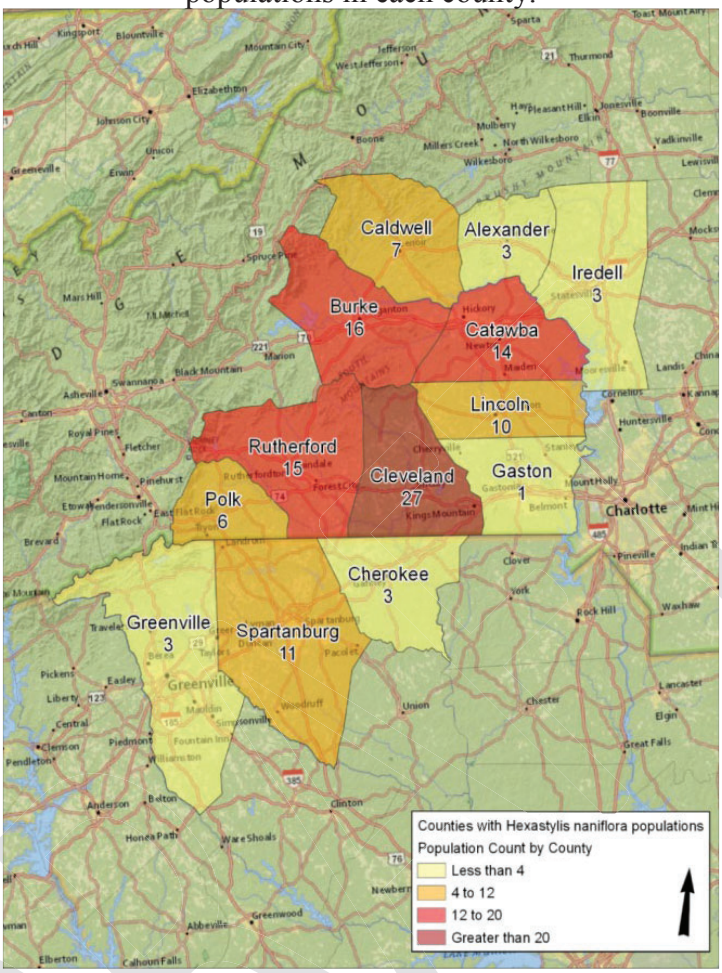
NatureServe and its member Natural Heritage Programs (NHP) have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records into meaningful units of conservation interest that may approximate biological populations (NatureServe 2004). The Service does not maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards the NHP databases as the best repository for this information.

As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).

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Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.



The listing rule placed emphasis on populations containing more than 1,000 rosettes. This threshold has been used in subsequent reports to call attention to particularly large populations. Populations with greater than 1,000 rosettes increased from three in 1989 to 26 in 2016 (Robinson 2016). This is approximately 23% of the total known populations and many contain well over 1,000 rosettes. Twenty-five of the largest known populations have been monitored for at least 5 years by NCNHP (13 populations) and NCDOT (12 populations).

III. Public Review and Comment

The Service will announce the availability of the draft Plan for public review and comment in the publication of the proposed rule to delist dwarf-flowered heartleaf. At conclusion of the comment period, the Service will review each comment and prepare responses to substantive comments.

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IV. Monitoring Methods and Locations

The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). A second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants occuring at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data were used to determine the size of the entire population. The supplemental acreage from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals, when every tract could not be visited. The estimated extrapolated size of each population for each year was determined with the following formula:

$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

The PDM will be a continuation of the monitoring described above and occur within at least 13 previously monitored populations (Appendix A).

A. Procedures to Assure Consistency

The following practices will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked (unless population is small enough for a complete census).
- A field data sheet, developed prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
- Threats will be assessed at each location using NCPCP guidelines (Appendix B).
- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 13 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6-7 sites are monitored each year for six years (three complete monitoring cycles).

IV. Definition of Response Triggers for Potential Monitoring Outcomes

Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios.

After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

A. Category I

PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections.
This would be true if:

1) Population numbers are within the standard deviation of the mean or above, and

Page: 24

Number: 1 Author: tpbassette Subject: Highlight Date: 5/21/2019 1:52:59 PM -06'00'

May need to talk about this term. We must hire contractors, whether they have done the work before or not. If they do not have the experience, the contractors must be trained by NCDOT.

Number: 2 Author: tpbassette Subject: Highlight Date: 5/21/2019 3:31:52 PM -06'00'

Note: Due to safety concerns, NCDOT has a couple sites in the Broad River Greenway Conservation Area that utilize permanently marked plots. Otherwise, NCDOT always enumerates via direct count using walked, straight-line transects across occupied habitat to better ensure the accuracy of the number of specimens.

Number: 3 Author: tpbassette Subject: Highlight Date: 5/21/2019 1:33:08 PM -06'00'

Is this the NCNHP Rare Plant Form? This is what we are currently requiring NCDOT staff and our contractors to complete, I have enclosed guidelines that I developed in conjunction with NCNHP on preparing the forms. These have been included in all NCDOT contracts to ensure that our contractors are completing the work in the same, consistent manner.

Number: 4 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 3:52:54 PM -06'00'

Request that NCDOT continues to generally differentiate between the plant numbers and acreage of occupied habitat that occurs or is officially protected inside NCDOT right-of-way/conservation easement and plant numbers and acreage of occupied habitat that occurs within the Element Occurrence or portion of the EO ("site"). The EO (or "site") and what NCDOT has in its ROW or conservation easement may or may not equate. This concept is derived from various Conservation Measures found in our project's Biological Opinions.

Number: 5 Author: tpbassette Subject: Highlight Date: 5/21/2019 2:24:37 PM -06'00'

What about acreage of occupied habitat? Does it get reported? NCDOT has been incorporating this information into its monitoring efforts. The threat analysis includes information pertaining to habitat.

2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

B. Category II

PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, all actions from Category II will be implemented. Additionally, the Service will initiate a formal status review and determine whether a proposal for relisting is appropriate.

V. Data Compilation and Reporting Procedures

Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be

Page: 25

Number: 1 Author: tpbassette Subject: Highlight Date: 5/21/2019 2:24:57 PM -06'00'
What about acreage of occupied habitat? Does it get reported? NCDOT has been incorporating this information into its monitoring efforts. The threat analysis includes information pertaining to habitat.

Number: 2 Author: tpbassette Subject: Highlight Date: 5/21/2019 2:25:35 PM -06'00'
What about acreage of occupied habitat? Does it get reported? NCDOT has been incorporating this information into its monitoring efforts. The threat analysis includes information pertaining to habitat.

Number: 3 Author: tpbassette Subject: Highlight Date: 5/21/2019 1:51:17 PM -06'00'
Is there a standardized format for this report, like the report format created by Carolyn Wells when she was with USFWS?

negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

If response triggers in Section IV are met or exceeded, the Service will consult with NCNHP, NCDOT, and other partners to determine whether to conclude the PDM process or pursue management actions. The determination will also include, if necessary, an evaluation of the threats to dwarf-flowered heartleaf using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state and tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of dwarf-flowered heartleaf following removal from protections of the Act. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this draft Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

As staff resources and funding allow, the primary entities conducting the PDM and preparing reports will be NCNHP and/or NCDOT. Based on a funding estimate received from NCNHP, monitoring 6-7 sites each year would require approximately $6,100 in funding. A complete monitoring cycle of two years would require approximately $12,200 and the entire six years of monitoring (three monitoring cycles) would require approximately $36,600. The NCNHP funding estimates do not apply to NCDOT and NCDOT is unable to provide an estimate for monitoring additional sites at this time. The Service will provide assistance as needed and as resources permit.

VII. PDM Implementation Schedule

A schedule will be developed in coordination with NCNHP and/or NCDOT in order to ensure that it is feasible to accomplish PDM activities at all sites scheduled for a given year. An example schedule is shown below:

Sites	Year	Monitoring Cycle	Reporting
1-6	1	1	
7-13	2	1	Cycle 1 (end of year)
1-6	3	2	
7-13	4	2	Cycle 2 (end of year)
1-6	5	3	
7-13	6	3	Cycle 1-3 Final Report (end of year)

Page: 26

Number: 1 Author: tpbassette Subject: Highlight Date: 5/21/2019 2:26:40 PM -06'00'
See comments in my email accompanying this.

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VIII. Literature Cited

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Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:
Blalock Reservoir (SC EO 007, 031)
Broad River: Cleghorn Creek, US 221 (EO 176)
Broad River: Floyds Creek, Long Branch (EO 177)
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop (EO 099)
Cliffside Steam Station (EO 276)
Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Love Lady Site (EO 029)
Mills Creek Forest and Seep (EO 023)
New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
Rhyne Preserve (EO 302)
Second Broad River (Forest City Industrial Complex) (EO 154) [1]
South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)

NCDOT Sites:
Broad River Greenway (EO 049-051, 073-074, 149, 233, 238-241)
Buffalo Shoals Creek (EO 275) [2]
Catawba County (EO 158, 1[illegible])
Extension of 15th Avenue (EO 031)
Gunpowder Creek (EO 077)
Little Gunpowder Creek (EO 044) [3]
Longview (EO 032)
Micol Creek (EO 159)
Murray's Mill (EO 184) [4]
Shelby Bypass Site 7 (EO 191)
Tate Boulevard Extension (EO 030)
Tate Conservation Area (EO 106, 286) [5]
[6]

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Page: 29

Number: 1 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 1:44:22 PM -06'00'
EO 158 is listed for both NHP (Camp Creek) and NCDOT (Catawba County, though even we often refer to it as Camp Creek).

Number: 2 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 2:26:48 PM -06'00'
EO 158 is listed for both NHP (Camp Creek) and NCDOT (Catawba County, though even we often refer to it as Camp Creek).

Number: 3 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 3:27:35 PM -06'00'
Note that Little Gunpowder Creek should become a portion of EO 44, rather than the entire EO, since US 321 Widening (STIP No. U-4700) Site 43 is directly opposite Site 44 on the other side of the road.

Number: 4 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 3:29:01 PM -06'00'
Add the following: Shelby Bypass Sites 1 and 2 portion of EO 188; Shelby Bypass Sites 8, 8A, & 8B (EO 192); Shelby Bypass Sites 10, 11, 12 (EO 194); Shelby Sites 15 & 16 portion of EO 199; Shelby Site 22 (EO 209); Shelby Site 24 (EO 202); Shelby Site 25 (EO 213); Shelby Sites 28 & 29 (EO 203); and portion of Shelby Site 32 on portion of EO 208 comprising newly obtained Hoffmier & White Conservation Easements.

Side notes: Could request that all of Site 32 portion of EO 208 be included.

Only what is left with Site 28 is to be on NCDOT ROW, but Site 29 is real close by and is easy to get to.

All Shelby sites will have, or will have this year, a pre-construction baseline survey, followed with 3 rounds of post-construction monitoring.

Number: 5 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 1:17:47 PM -06'00'
Add Lovelady Road EOs 160 & 280.

Number: 6 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 3:27:06 PM -06'00'
I excluded the US 321 Widening (STIP No. U-4700 in Catawba County) Sites 32, 34, 36, & 43, portions of which are required by the USFWS Draft Biological Opinion (April 2019) of to be protected in NCDOT-owned right-of-way. There is currently no funding in place for these land acquisitions to occur, and construction of this portion of the project is currently many years out.

I have also excluded EO 308 and its recently transplanted specimens reintroduced back into the occurrence(STIP B-5391) in Alexander County, since this EO is an approximated mix of *H. naniflora* and *H. heterophylla*.

Appendix B – Threats Assessment Guidance

This methodology was originally developed by the NC Plant Conservation Program (NCPCP) Scientific Committee in 2008 to assess the rarest and most imperiled plant species. This protocol was applied to individual populations of *Hexastylis naniflora*, during baseline monitoring, to develop a standardized assessment of threats and trends.

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species. Each threat is assigned a ranking for its severity, scope, and immediacy, as described below:

Threat Severity

- High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long-term recovery (>100 yr.).
- Moderate: Major reduction of species population or long-term degradation or reduction of habitat in area affected, requiring 50–100 yr. for recovery.
- Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.
- Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yrs.) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations is generally considered Insignificant as defined here.

Scope

- High: >60% of total population, occurrences, or area affected.
- Moderate: 20–60% of total population, occurrences, or area affected.
- Low: 5–20% of total population, occurrences, or area affected.
- Insignificant: <5% of total population or area affected.

Immediacy

- High: Threat is operational (happening now) or imminent (within a year).
- Moderate: Threat is likely to be operational within 2–5 yr.
- Low: Threat is likely to be operational within 5–20 yr.
- Insignificant: Threat not likely to be operational within 20 yr.

DRAFT

Page: 30

Number: 1 Author: tpbassette Subject: Highlight Date: 5/21/2019 3:29:57 PM -06'00'
Do indirect and direct threats roughly correspond to indirect and direct effects as defined under ESA Section 7 Consultation process? If they do, that would make it easier in many instances to assess from NCDOT's perspective.

Number: 2 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 2:13:04 PM -06'00'
Would "cumulative effects" as defined under ESA Section 7 be considered as a threat?

Number: 3 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 3:30:19 PM -06'00'
When assessing for habitat, does this refer to occupied habitat, unoccupied habitat that adjoins the occupied habitat, or both?

From: Reid, Rebekah N
To: Hamilton, Byron
Cc: Peeples, Gary
Subject: Re: Heartleaf rule
Date: Friday, May 31, 2019 3:34:55 PM
Attachments: Draft HENA SSA_05.31.19 Updated Map and Invasive Section.docx

---

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 deficiency in the discussion regarding invasives. 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
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Asheville, NC 28801
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cell: 828-782-0090

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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**

--
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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.

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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

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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.

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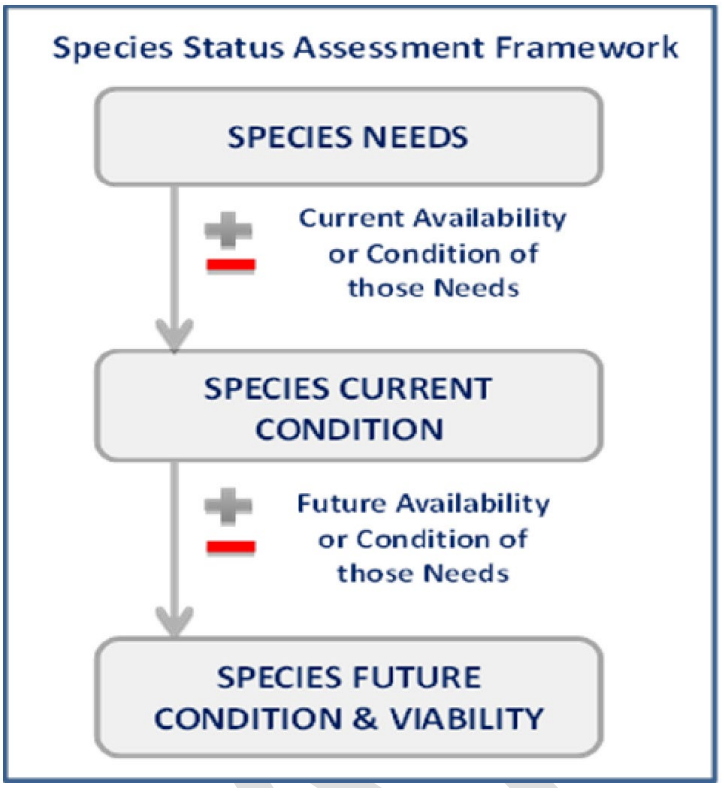


Figure 1.1. Species Status Assessment Framework

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.

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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).

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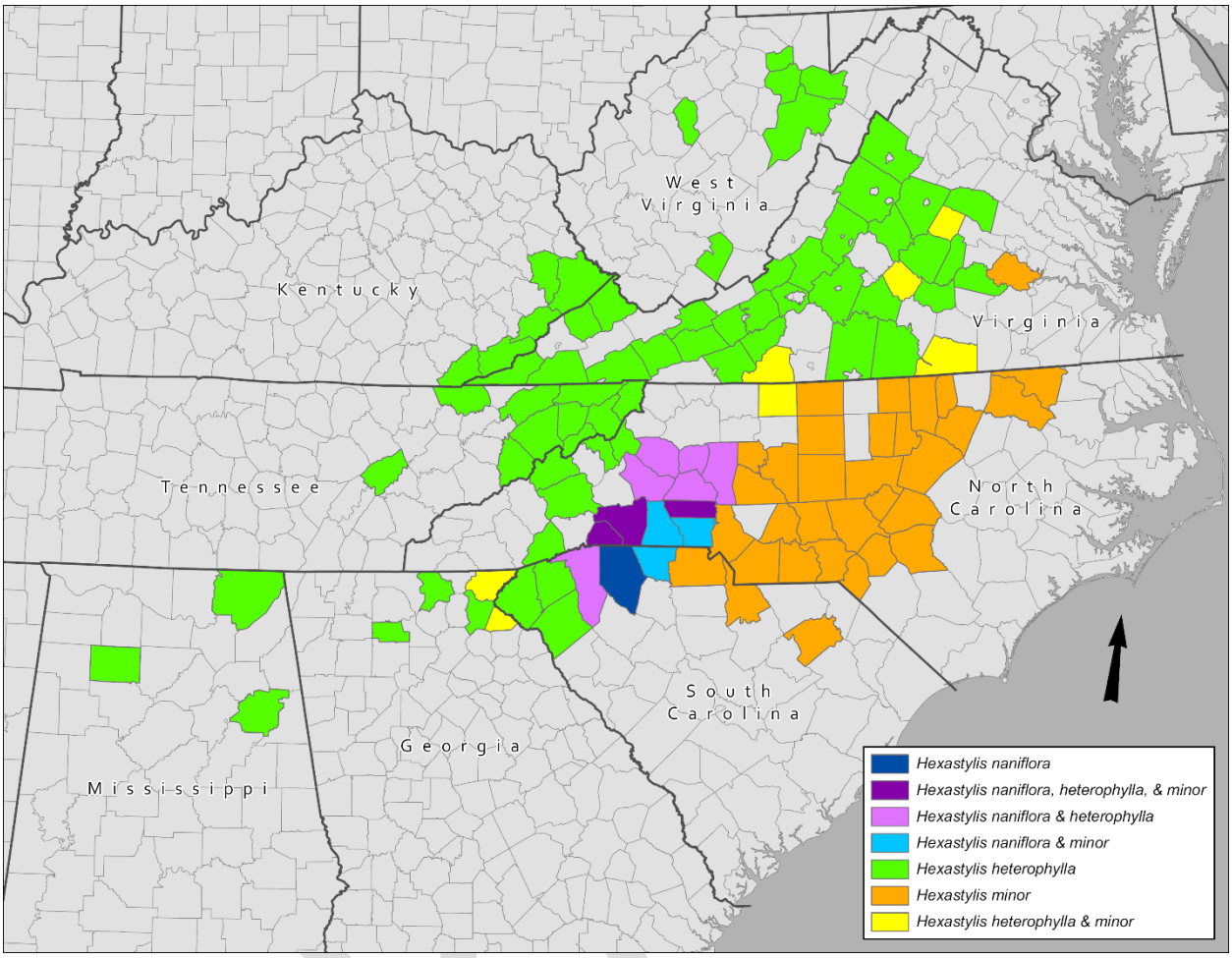


Figure 2.1. Distribution map showing county records for the three species in the Heterophylla complex. Data was gathered from herbarium specimens, element occurrence records and field studies. *Based on Murrell et al. 2007.*

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).

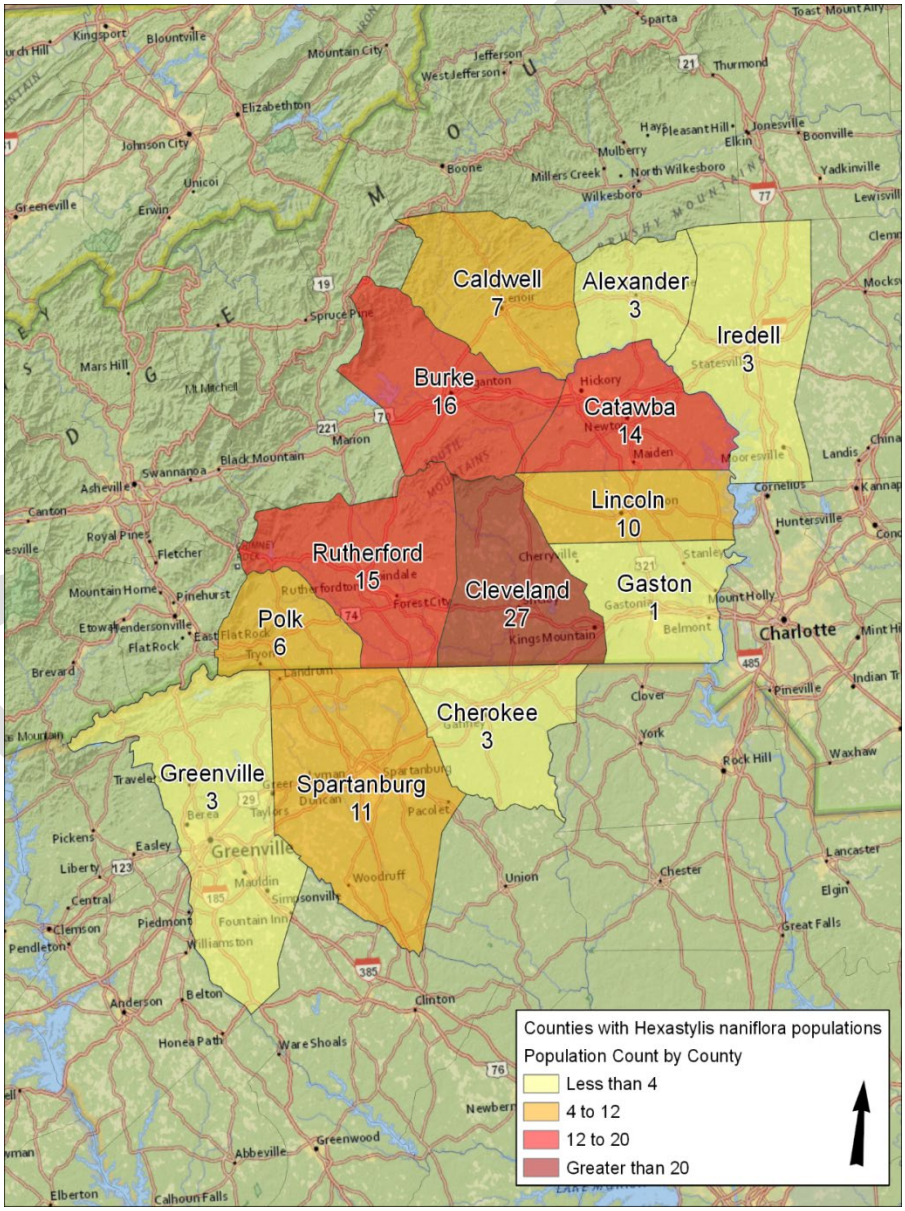


Figure 2.2. Current county distribution for dwarf-flowered heartleaf, with associated number of known populations within each county.

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.

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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*.

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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

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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).

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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.

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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).

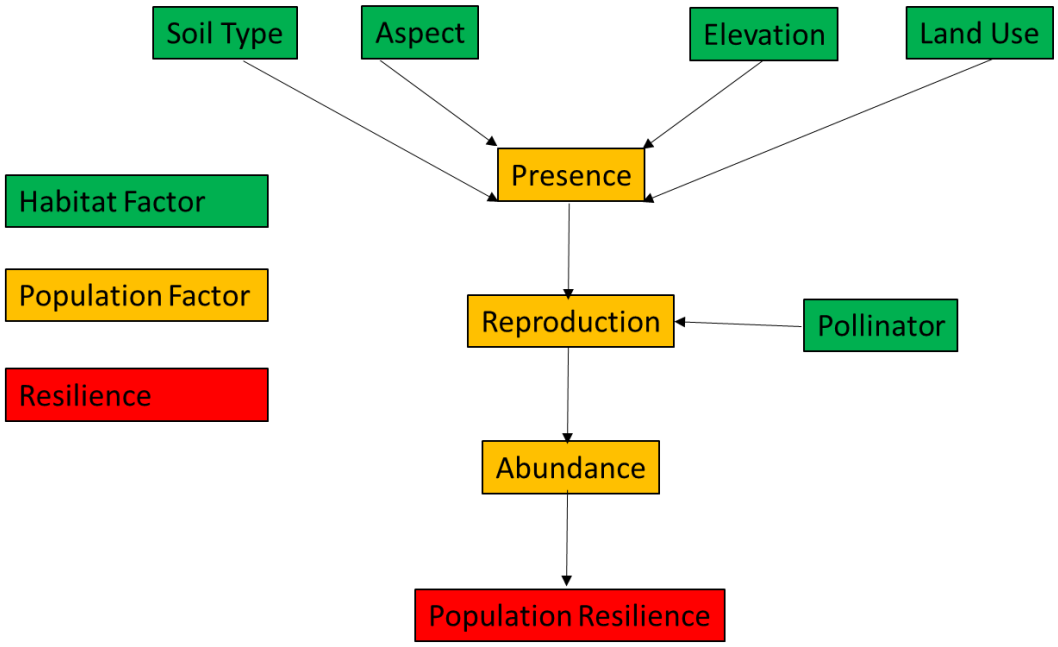


Figure 3.1. Conceptual diagram describing population and habitat factors influencing population resilience for dwarf-flowered heartleaf.

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.

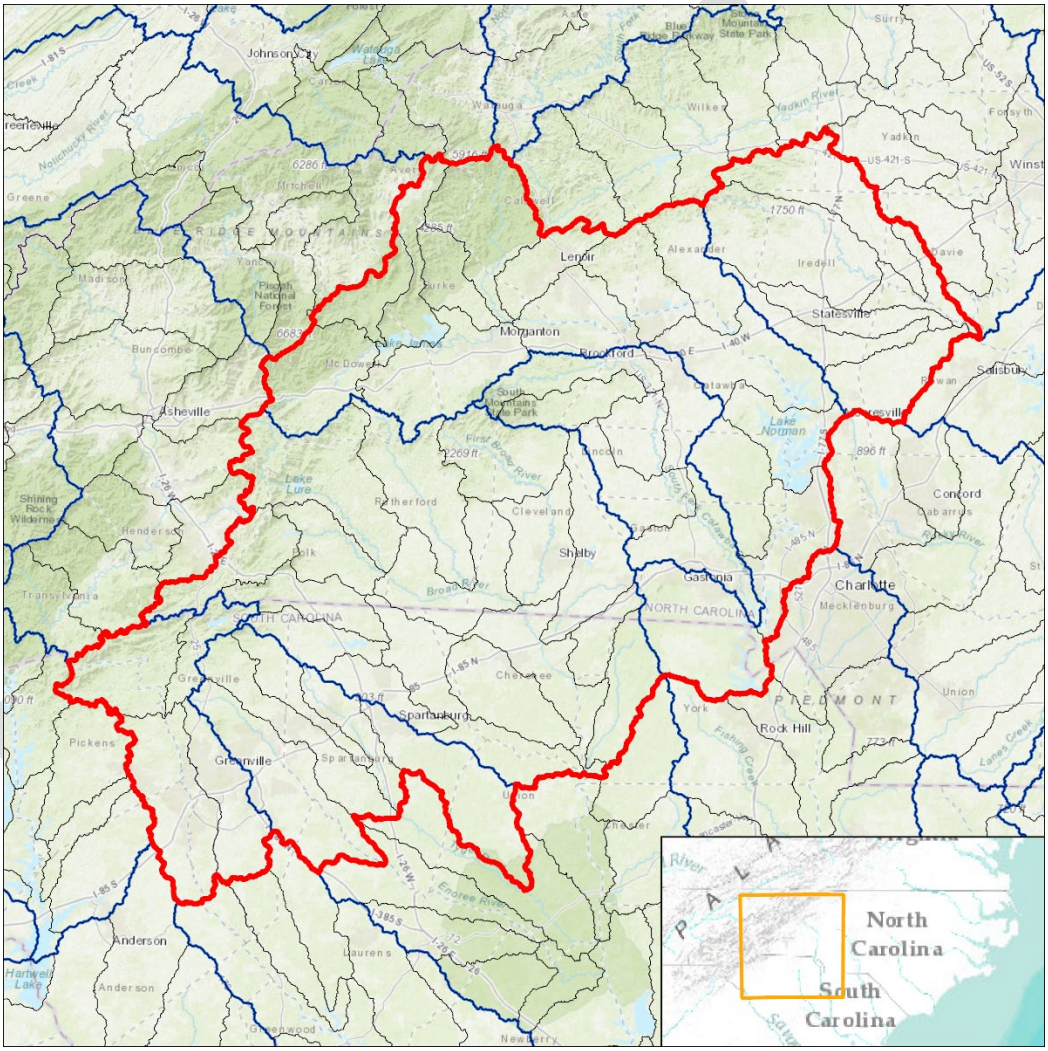


Figure 3.2. Analysis extent of the habitat model for *Hexastylis naniflora.* Red line indicates Maxent analysis extent, blue lines are 8-digit HUC boundaries, black lines are 10-digit HUC boundaries.

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).

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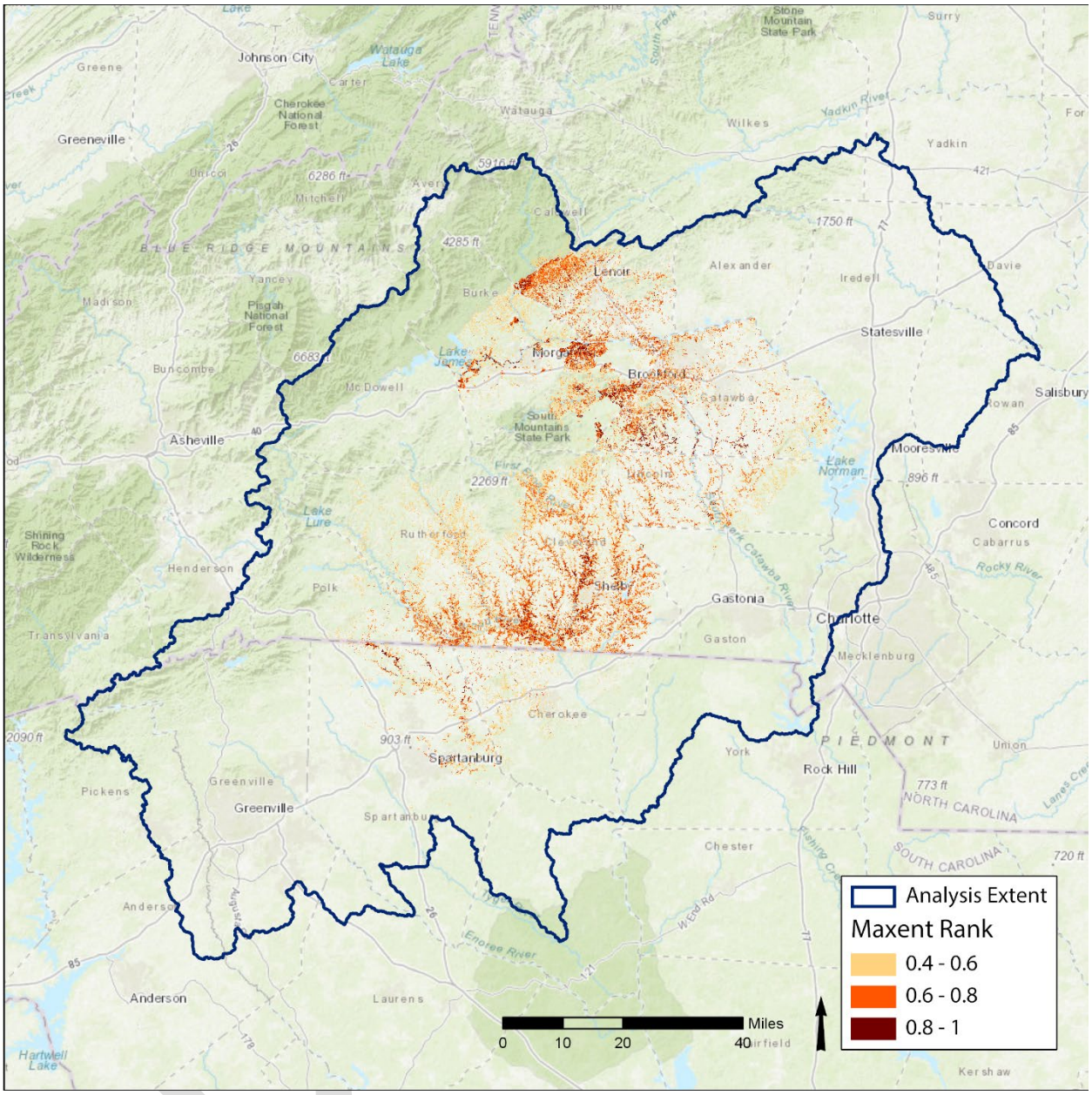


Figure 3.3. Maxent model output map

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 EO 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 (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

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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.

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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.

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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.

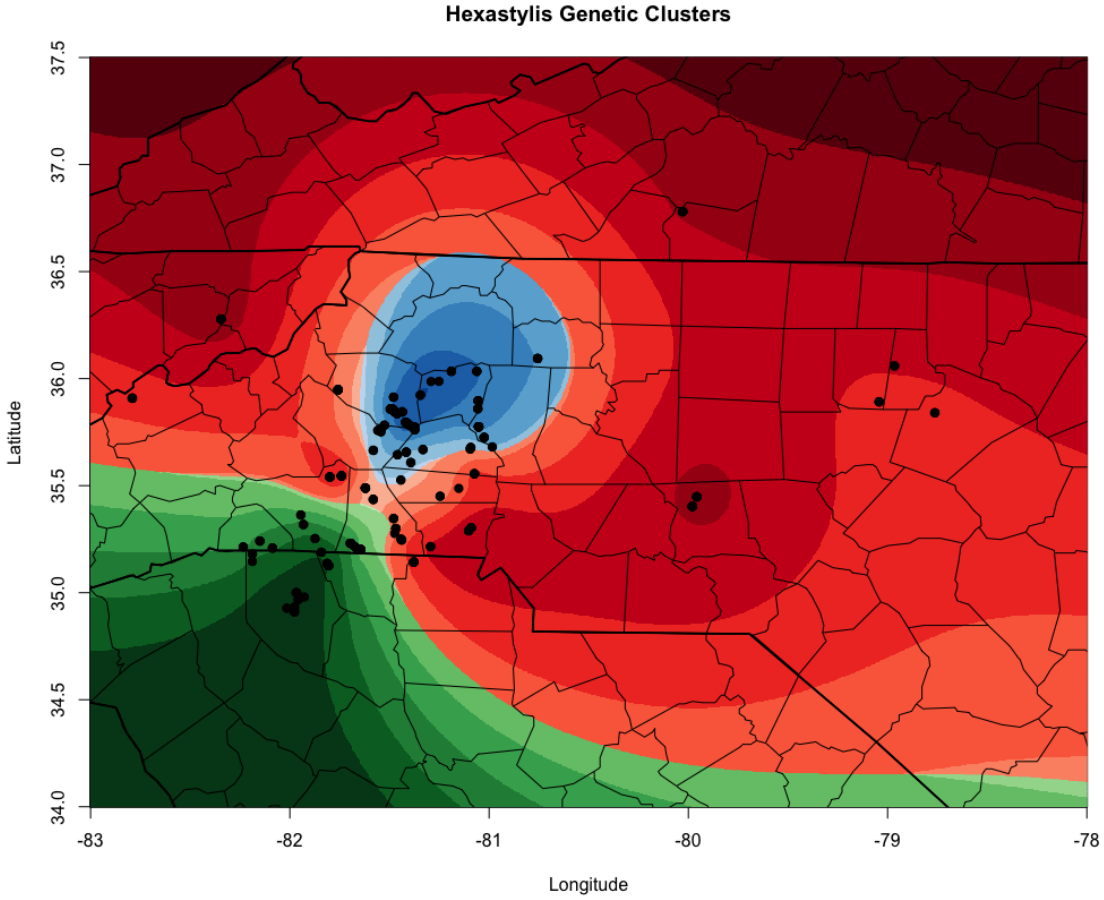


Figure 4.1. Recent genetic analyses detailing clustering of the genus *Hexastylis*. Black dots represent GIS locations of individual plants included in the genetic analysis. Green areas represent "true" *H. naniflora*; Blue represents a possible new species; Red represents other species in the genus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

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- 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

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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

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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

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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*	--

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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.

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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.

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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

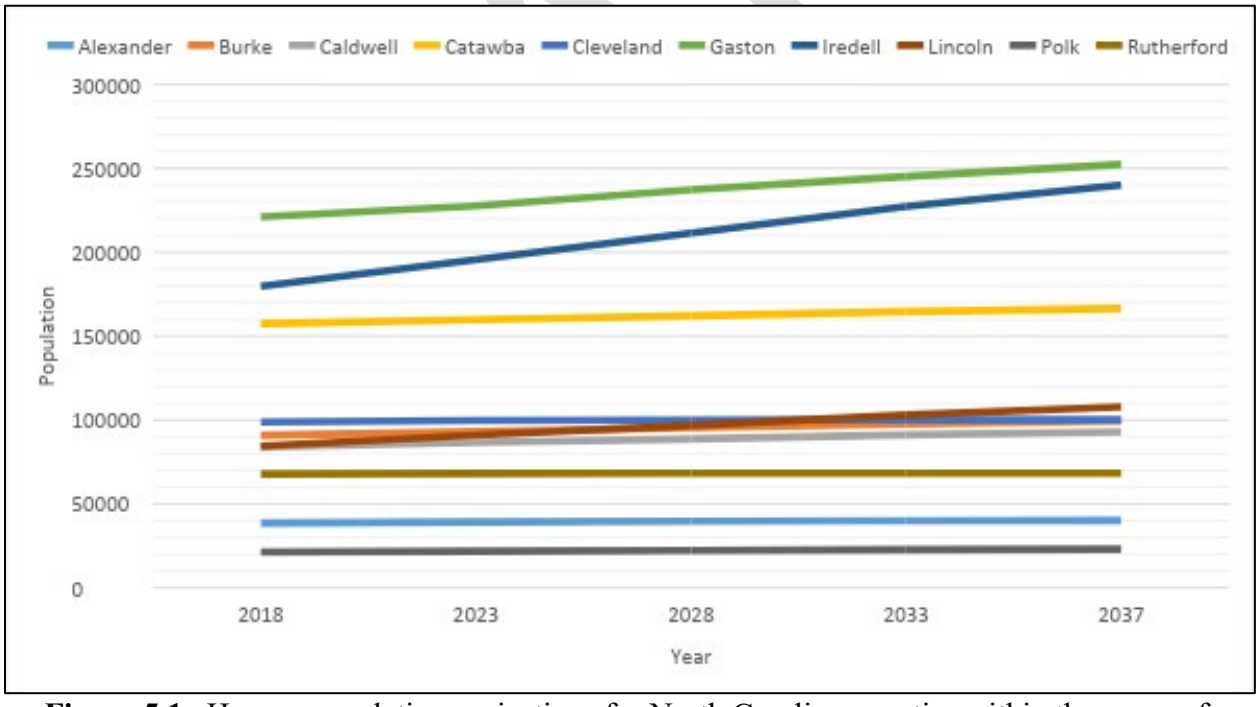


Figure 5.1. Human population projections for North Carolina counties within the range of dwarf-flowered heartleaf. *Source: North Carolina OSBM, Standard Population Estimates.*

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

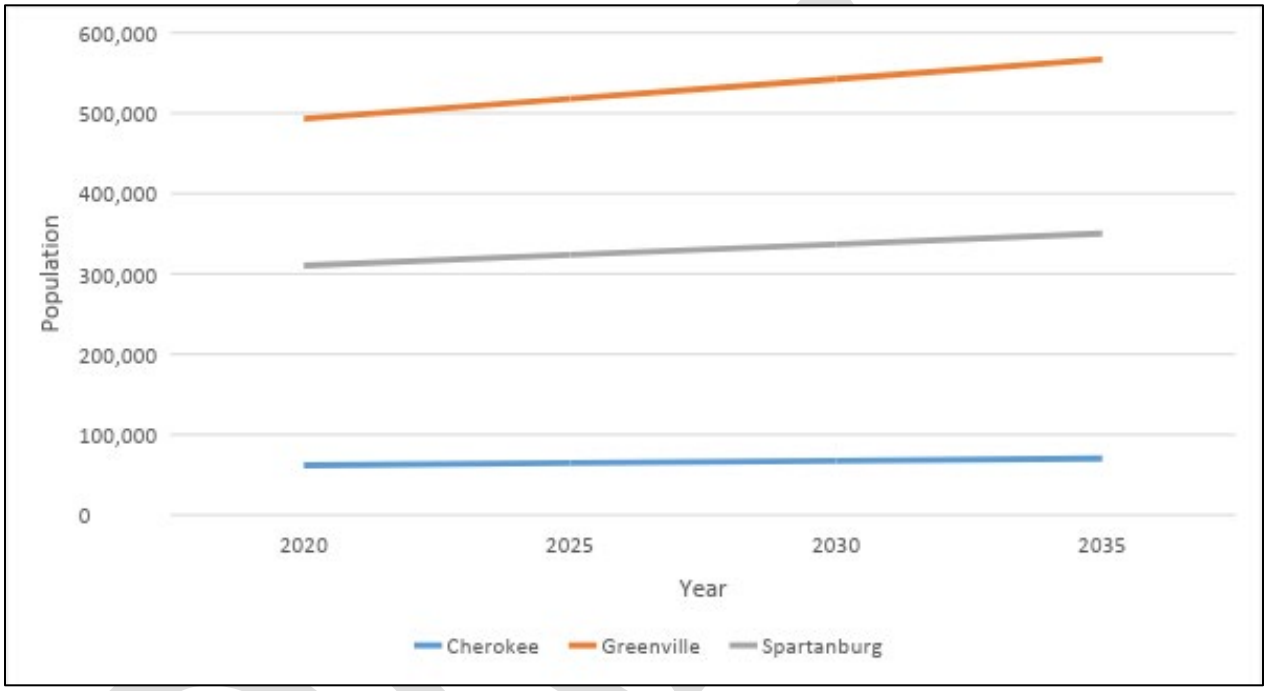


Figure 5.2. Human population projections for South Carolina counties within the range of dwarf-flowered heartleaf. *Source: U.S. Census Bureau, 2000 Census and 2007 Population Estimates. Population projections calculated by South Carolina Budget and Control Board, Office of Research and Statistics.*

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.

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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.

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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.

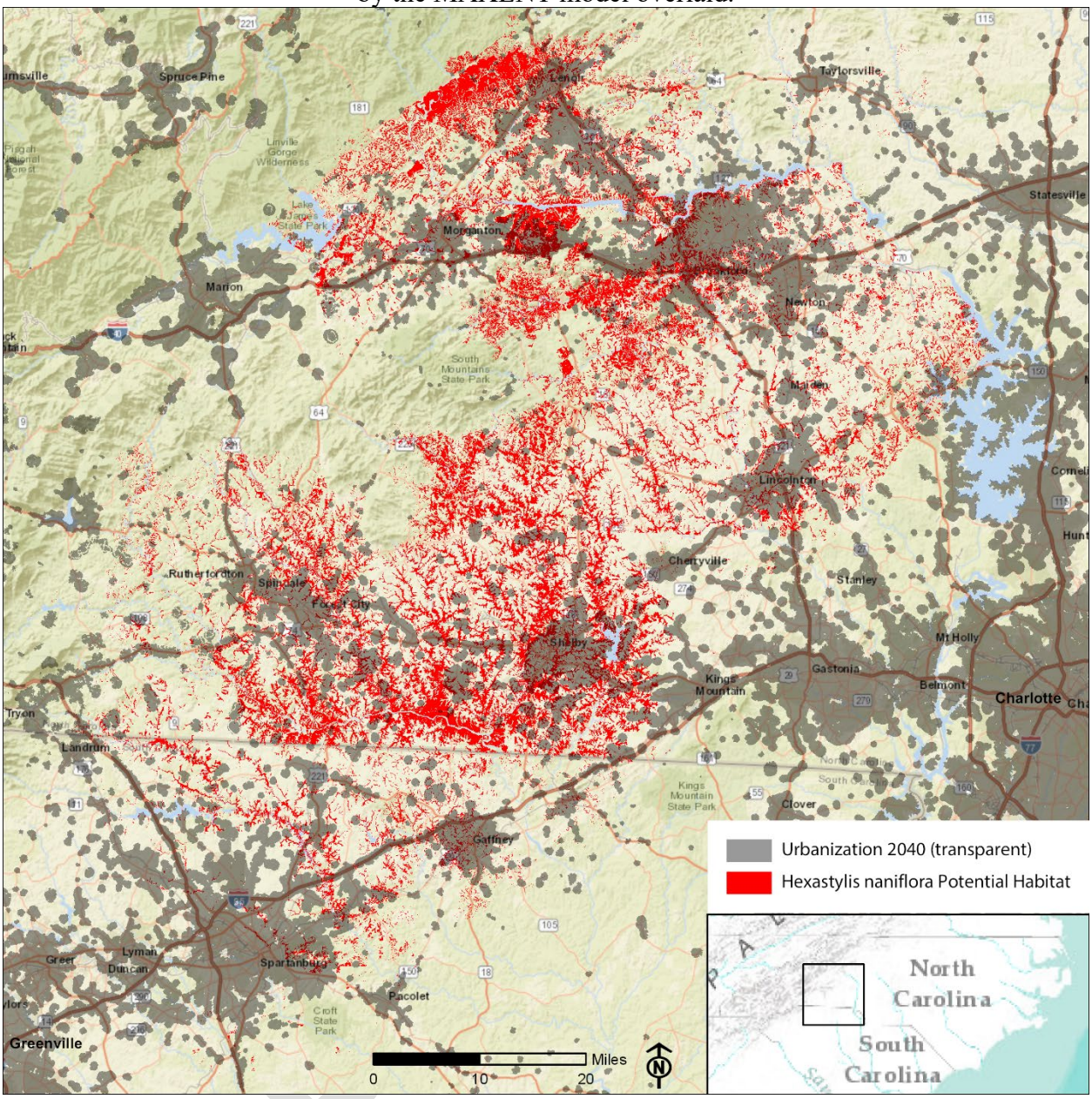
Because the actual impacts of urbanization are unknown, we use three scenarios, projected out to the year 2040, to capture the uncertainty related to the potential impacts to each population's resiliency: Status Quo, Targeted Conservation, and High Development. Results of future projections within each 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).

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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.

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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

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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

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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.

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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

DRAFT

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).

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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.

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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.

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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

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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

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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

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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

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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

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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.

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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.

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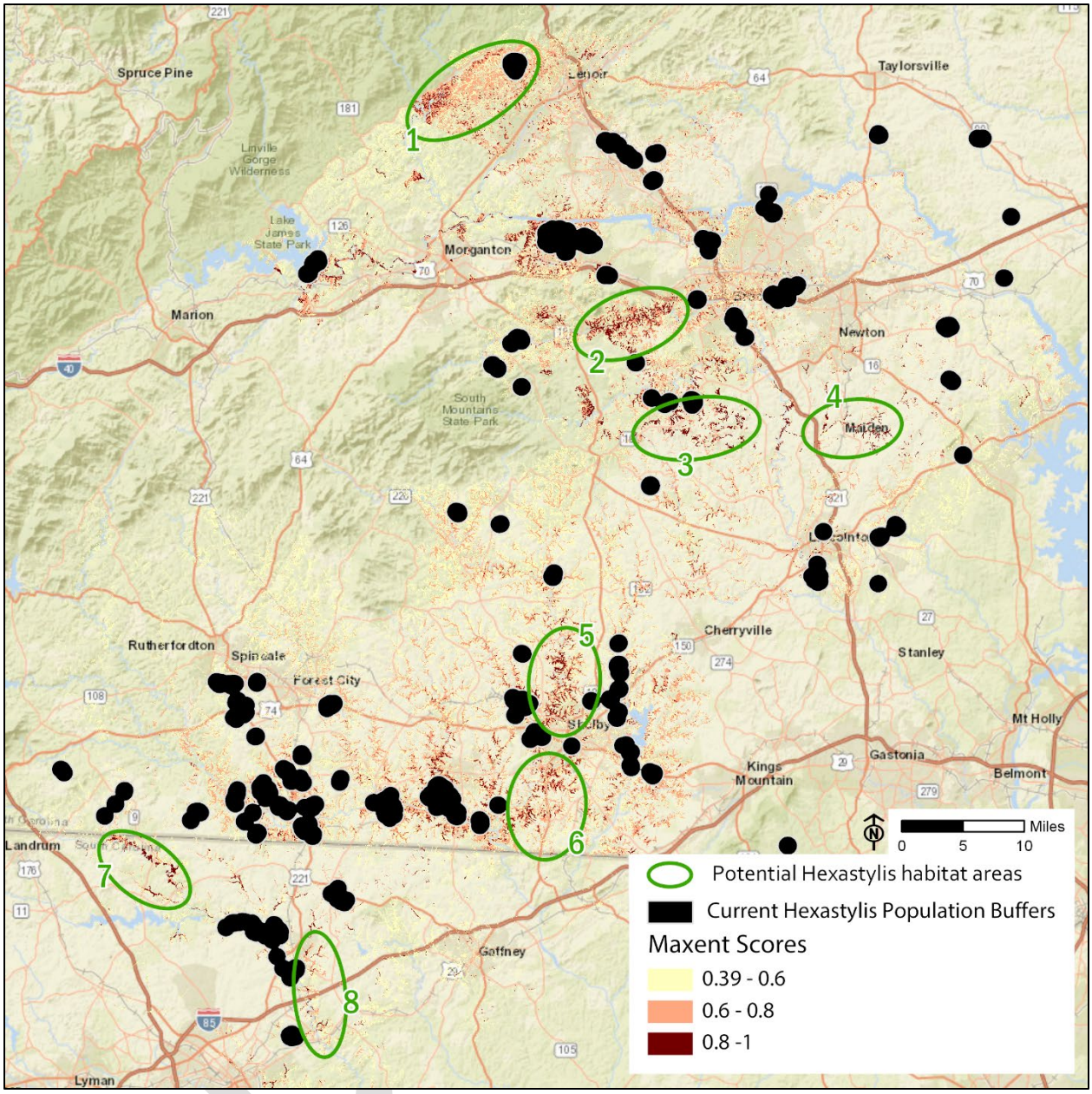


Figure 6.2. Areas identified as high quality potential habitat by Maxent model for *Hexastylis naniflora* that fall outside the immediately known occurrence areas.

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DRAFT

From: Hamilton, Byron
To: Reid, Rebekah N
Cc: Peeples, Gary
Subject: Re: Heartleaf rule
Date: Thursday, July 11, 2019 8:52:11 AM
Importance: High

Got it, thanks!

On Wed, Jul 10, 2019 at 3:10 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> 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 deficiency in the discussion regarding invasives. 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
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>
> 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
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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**
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> **Cell - (803) 707-9518**

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160 Zillicoa St.
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gary_peeples@fws.gov
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> > > **Cell - (803) 707-9518**

> > --
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> > Deputy Field Office Supervisor/Public Affairs Officer
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> > 160 Zillicoa St.
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From: Hamilton, Byron
To: Reid, Rebekah N
Subject: Fwd: Dwarf-flower Heartleaf PDM Draft
Date: Friday, August 9, 2019 6:59:36 AM
Importance: High

Hello Rebekah,

Natchanon wants to know what post delisting coordinations we would have with the state and local partners. Can you supply an answer to his question?

---------- Forwarded message ---------
From: **Merritt, Timothy** <timothy_merritt@fws.gov>
Date: Thu, Aug 8, 2019 at 2:23 PM
Subject: Fwd: Dwarf-flower Heartleaf PDM Draft
To: Byron Hamilton <byron_hamilton@fws.gov>
Cc: Kristi Young <kristi_young@fws.gov>

Can you answer Natchanon's question without sending him the PDM?
Tim

---------- Forwarded message ---------
From: **Ketram, Natchanon** <natchanon_ketram@fws.gov>
Date: Thu, Aug 8, 2019 at 1:34 PM
Subject: Re: Dwarf-flower Heartleaf PDM Draft
To: Merritt, Timothy <timothy_merritt@fws.gov>

Hi Tim,

Yes you are correct that HQ does not need to review the PDM anymore. The reason I wanted to look at the PDM is as a reference material. As I was reviewing the rule, it was not apparent to me what post-delisting coordination (if any) we would do with state or local partners if we delist the species. We had alluded to the contribution made by state partners. I wanted to skim the PDM to see if any of these contributions will continue into the post-delisting period. I do not plan to make any edits on the PDM itself.

On Thu, Aug 8, 2019 at 12:21 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Natchanon,
> Our understanding in the RO is that the PDM stays in the RO and does not go to HQ for review.
> Tim
>
> On Thu, Aug 8, 2019 at 9:38 AM Ketram, Natchanon <natchanon_ketram@fws.gov> wrote:
>
> > Good morning Tim,
> >
> > I am doing the preliminary review of the dwarf-flowered heartleaf for Don. I was wondering if you have the draft PDM for this species that I can look at. 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

--

_____

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

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--

Natchanon Ketram
Biologist
Branch of Delisting and Foreign Species
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Falls Church, VA, USA
(703) 358-2499

--

_____

Timothy Merritt
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From: Hamilton, Byron
To: Reid, Rebekah N
Subject: Re: Dwarf-flowered heartleaf Briefing
Date: Monday, October 7, 2019 12:39:23 PM
Importance: High

Greetings!

I just got comments back from HQ. I will forward you the email.

On Mon, Oct 7, 2019 at 12:31 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Hey Byron,
>
> Happy Fall! Just checking in since it's been about a month since the HQ briefing. Any new news?
>
> 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
>
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On Fri, Aug 30, 2019 at 10:48 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Thanks for helping me get prepared!! Enjoy the Holiday Festivities!
>
> On Fri, Aug 30, 2019 at 10:14 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
>
> > Nice job, Byron! Have a great long weekend!
> >
> > I'll get with Mark in our office about the modeling and see if we can beef-up our justification for FF and the modeling. I'll be in touch.
> >
> > Rebekah Reid
> >
> > US Fish and Wildlife Service
> > Asheville Ecological Services Field Office
> > 160 Zillicoa St.
> > Asheville, NC 28801
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On Thu, Aug 29, 2019 at 2:37 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Not that I can think of.
>
> On Thu, Aug 29, 2019 at 2:23 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
>
> > I've got more detailed notes on that if we need it, I just wasn't thinking they'd want to know about specific sites. Anything else we need to be super prepared for? Any questions that always come up? I saw the ones on the guidance document and reviewed a few from the RD briefing. Anything else?
> >
> > Rebekah Reid
> >
> > US Fish and Wildlife Service
> > Asheville Ecological Services Field Office
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> >
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> >
> > On Thu, Aug 29, 2019 at 2:19 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> >
> > > This is great!. I know the question will come up.
> > >
> > > On Thu, Aug 29, 2019 at 2:17 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
> > >
> > > > Hey Byron,
> > > >
> > > > NC and SC both have laws or regulations that protect plants. They are not the most protective but they do exist. Anything that is in protection with a CE, DR, or fee simple purchase would continue to be protected if delisted. In SC there is a State Heritage Preserve, that will stay a preserve. There are Registered Heritage Agreements with private landowners, those agreements would still be in place. Is that helpful or do you need more info?
> > > >
> > > > Talk with you tomorrow,
> > > >
> > > > Rebekah Reid
> > > >
> > > > US Fish and Wildlife Service
> > > > Asheville Ecological Services Field Office
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> > > > Asheville, NC 28801
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On Thu, Aug 29, 2019 at 10:49 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Hey Rebekah,
>
> Quick question: What conservation efforts/protections for HENA will remain in place after delisting?
>
> On Wed, Aug 28, 2019 at 10:20 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
>
> > Yep, I'll be there.
> >
> > Rebekah Reid
> >
> > US Fish and Wildlife Service
> > Asheville Ecological Services Field Office
> > 160 Zillicoa St.
> > Asheville, NC 28801
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> >
> > ***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, Aug 28, 2019 at 10:19 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> >
> > > Hey Rebekah,
> > >
> > > Bridget rescheduled her 9 am on this Friday for us to use that slot. Will this work for you?
> > >
> > > On Wed, Aug 28, 2019 at 9:27 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
> > >
> > > > Hi Byron,
> > > >
> > > > I can be available most days in Sept. The exceptions are 3rd-4th and 19th-20th - I have previous commitments or leave those days. I can make any other days/times work.
> > > >
> > > > Have a nice long weekend,
> > > >
> > > > Rebekah Reid
> > > >
> > > > US Fish and Wildlife Service
> > > > Asheville Ecological Services Field Office
> > > > 160 Zillicoa St.
> > > > Asheville, NC 28801
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On Wed, Aug 28, 2019 at 9:06 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good morning,
>
> I have to reschedule the Friday briefing for another time. Looking at your schedules there is not much availability over the next two weeks. Can we slide this briefing somewhere in the seams?
>
> --
> **Byron Hamilton, Sr.**
> **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> **U.S. Fish & Wildlife Service**
> **1875 Century Blvd.**
> **Atlanta, GA 30345**
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From: Hamilton, Byron
To: Reid, Rebekah N
Cc: Peeples, Gary
Subject: Re: Heartleaf
Date: Wednesday, January 15, 2020 7:55:54 AM
Importance: High

Thanks Rebekah! This whole process seems to be evolving...

On Wed, Jan 15, 2020 at 7:54 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Hey Byron,
>
> I've been working on it. I had to enlist some help on a few questions and got that info yesterday. Some of the comments are difficult to address and I'm not sure that we can completely address all of them. If other project managers have had similar comments, it would be helpful if you can ask them how they addressed them. I'll try and have something back to you next week.
>
> Thanks.
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
> 160 Zillicoa St.
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>
> On Wed, Jan 15, 2020 at 7:48 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
>
> > Good morning!
> >
> > Have you had an opportunity to review the HQ comments for the Heartleaf rule?
> >
> > --
> > **Byron Hamilton, Sr.**
> > **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> > **U.S. Fish & Wildlife Service**
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From: postmaster@doi.gov
To: Tim Bassette
Subject: Undeliverable: Hexastylis naniflora Monitoring
Date: Wednesday, January 22, 2020 8:51:27 AM
Attachments: Hexastylis naniflora Monitoring.msg
Importance: High

Delivery has failed to these recipients or groups:
Tim Bassette (tpbassette@ncdot.gov) <mailto:tpbassette@ncdot.gov>
The server has tried to deliver this message, without success, and has stopped trying. Please try sending this message again. If the problem continues, contact your helpdesk.

Diagnostic information for administrators:
Generating server: eis.doi.gov
tpbassette@ncdot.gov
#550 4.4.7 QUEUE.Expired; message expired ##
Original message headers:
Received: from mail-oi1-f199.google.com (209.85.167.199) by gsmtp1.doi.gov
(137.227.82.15) with Microsoft SMTP Server (TLS) id 14.3.435.0; Tue, 9 Apr
2019 07:31:53 -0600
Received: by mail-oi1-f199.google.com with SMTP id j202so7423865oih.23
for <tpbassette@ncdot.gov>; Tue, 09 Apr 2019 06:31:52 -0700 (PDT)
DKIM-Signature: v=1; a=rsa-sha256; c=relaxed/relaxed;
d=fws.gov; s=bison;
h=mime-version:from:date:message-id:subject:to;
bh=4/rLrjqIgcIOZqPKdIKE6bZmvlaRR6Bh2LtRLC7d9II=;
b=Quemcx4ZWBzIFPWG+jxuvgh/UX0o5Acy4/WZpf6w8sSqcmGtEP3V66Vit7bow2Gw9L
GLovOUJNTD1AwcdksxOk7/5HRFtGy3EG5zuCgGxvx087Y0sPgAi/1uM6I4BNZKSaZD1x
J585ghUSiHqU2HWBh+UamUa4we2M+IeXR9C6Q=
X-Google-DKIM-Signature: v=1; a=rsa-sha256; c=relaxed/relaxed;
d=1e100.net; s=20161025;
h=x-gm-message-state:mime-version:from:date:message-id:subject:to;
bh=4/rLrjqIgcIOZqPKdIKE6bZmvlaRR6Bh2LtRLC7d9II=;
b=c0SizfdCz/vKkkzXoUWCQWyAUwCOChWmpin83YW30a3h+rp6nUNRVc1HZjCnuE8ESz
W65lVktPlviDH9hgBKiqaQT+Wvms31HwpGL95JM0PPsuecK+NydT9SLEPrxoFG+VUBYF
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Tue, 09 Apr 2019 06:31:51 -0700 (PDT)
X-Google-Smtp-Source:
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X-Received: by 2002:a9d:d66:: with SMTP id 93mr24184057oti.25.1554816710164;
Tue, 09 Apr 2019 06:31:50 -0700 (PDT)
MIME-Version: 1.0
From: "Reid, Rebekah" <rebekah_reid@fws.gov>
Date: Tue, 9 Apr 2019 09:31:38 -0400
Message-ID: <CAEwK02NX8doGWrQtA-Xk=7-naO8aFtR8BwR95N9B+vZ0NTMZiQ@mail.gmail.com>
Subject: Hexastylis naniflora Monitoring
To: "Robinson, Laura" <Laura.Robinson@ncdcr.gov>, Tim Bassette
<tpbassette@ncdot.gov>
Content-Type: multipart/mixed; boundary="000000000000b5ee9f058618f94c"
X-Gm-Spam: 0
X-Gm-Phishy: 0
Return-Path: rebekah_reid@fws.gov

From: Reid, Rebekah N
To: Robinson, Laura; Tim Bassette
Subject: Hexastylis naniflora Monitoring
Date: Tuesday, April 9, 2019 7:31:53 AM
Attachments: Hexastylis naniflora PDM Draft V1 (04.08.19).docx

---

Hi Laura and Tim,

I am following up on our call last Summer regarding *Hexastylis naniflora*. As a quick refresher, we discussed the potential paths forward for the species: Recovery Plan vs. delisting. No decision has been made to date but I have been asked what a monitoring plan would look like for the species in the event of delisting. Attached is a draft monitoring plan for your review. I would appreciate any comments or feedback since info in the plan was compiled from previous reports by both agencies and input during our call. I don't have a specific due date but if you all have the time in the next couple of weeks to review, that would be great.

Because this is a draft document and no decision has been made regarding listing status, I ask that you keep this plan confidential and do not distribute to others.

Please do not hesitate to contact me if you have any questions. If a call is in order, just let me know and I'll be happy to schedule it.

Thank you.

Rebekah Reid

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U.S. FISH AND WILDLIFE SERVICE

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

April 2019

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Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)

April 2019

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Recommended Citation:

US Fish and Wildlife Service. 2019. Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*). Asheville Ecological Services Field Office, Asheville, North Carolina. 12 pp.

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Acknowledgements

The Draft Post-Delisting Monitoring Plan (Plan) for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) was prepared by the US Fish and Wildlife Service (Service) with participation from Rebekah Reid, Asheville Ecological Services Field Office, and Drew Becker, Southeast Regional Office. The Service acknowledges partners outside our agency who provided input during development of this draft Plan, including the North Carolina Natural Heritage Program and the North Carolina Department of Transportation.

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Table of Contents

II. Summary of Species Status at Delisting 1
A. Demographic Parameters 1
B. Discussion of Populations 2
III. Public Review and Comment 3
IV. Monitoring Methods and Locations 4
IV. Definition of Response Triggers for Potential Monitoring Outcomes 5
A. Category I 5
B. Category II 6
C. Category III 6
V. Data Compilation and Reporting Procedures 6
VI. Estimated Funding Requirements and Sources 7
VII. PDM Implementation Schedule 7
VIII. Literature Cited 8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

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I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2015), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June. They are small,

inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989). The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).

B. Discussion of Populations

When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2010).

Since listing, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to NCNHP Element Occurrence (EO) records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This generated considerable discrepancies among sources with respect to abundance and distribution of the species, to the extent that data are usually not comparable from one source to the next (Service 2010).

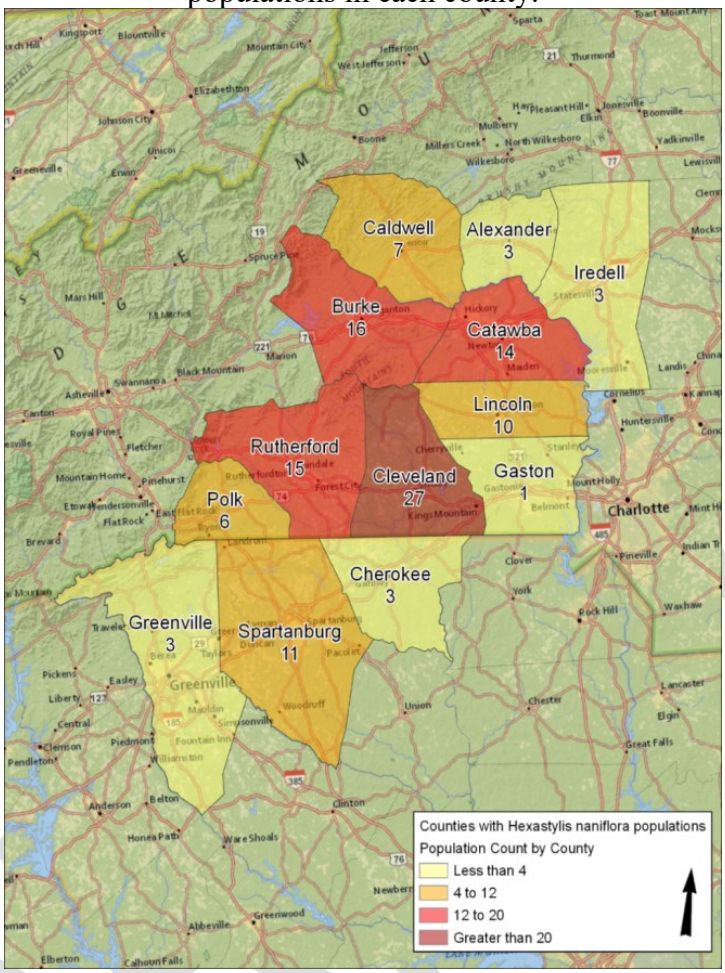
NatureServe and its member Natural Heritage Programs (NHP) have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records into meaningful units of conservation interest that may approximate biological populations (NatureServe 2004). The Service does not maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards the NHP databases as the best repository for this information.

As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).

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Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.



The listing rule placed emphasis on populations containing more than 1,000 rosettes. This threshold has been used in subsequent reports to call attention to particularly large populations. Populations with greater than 1,000 rosettes increased from three in 1989 to 26 in 2016 (Robinson 2016). This is approximately 23% of the total known populations and many contain well over 1,000 rosettes. Twenty-five of the largest known populations have been monitored for at least 5 years by NCNHP (13 populations) and NCDOT (12 populations).

III. Public Review and Comment

The Service will announce the availability of the draft Plan for public review and comment in the publication of the proposed rule to delist dwarf-flowered heartleaf. At conclusion of the comment period, the Service will review each comment and prepare responses to substantive comments.

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IV. Monitoring Methods and Locations

The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). A second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants occuring at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data were used to determine the size of the entire population. The supplemental acreage from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals, when every tract could not be visited. The estimated extrapolated size of each population for each year was determined with the following formula:

$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

The PDM will be a continuation of the monitoring described above and occur within at least 13 previously monitored populations (Appendix A).

A. Procedures to Assure Consistency

The following practices will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked (unless population is small enough for a complete census).
- A field data sheet, developed prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
- Threats will be assessed at each location using NCPCP guidelines (Appendix B).
- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 13 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6-7 sites are monitored each year for six years (three complete monitoring cycles).

IV. Definition of Response Triggers for Potential Monitoring Outcomes

Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios.

After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

A. Category I

<u>PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections</u>.
This would be true if:

1) Population numbers are within the standard deviation of the mean or above, and

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2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

B. Category II

PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, all actions from Category II will be implemented. Additionally, the Service will initiate a formal status review and determine whether a proposal for relisting is appropriate.

V. Data Compilation and Reporting Procedures

Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be

negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

If response triggers in Section IV are met or exceeded, the Service will consult with NCNHP, NCDOT, and other partners to determine whether to conclude the PDM process or pursue management actions. The determination will also include, if necessary, an evaluation of the threats to dwarf-flowered heartleaf using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state and tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of dwarf-flowered heartleaf following removal from protections of the Act. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this draft Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

As staff resources and funding allow, the primary entities conducting the PDM and preparing reports will be NCNHP and/or NCDOT. Based on a funding estimate received from NCNHP, monitoring 6-7 sites each year would require approximately $6,100 in funding. A complete monitoring cycle of two years would require approximately $12,200 and the entire six years of monitoring (three monitoring cycles) would require approximately $36,600. The NCNHP funding estimates do not apply to NCDOT and NCDOT is unable to provide an estimate for monitoring additional sites at this time. The Service will provide assistance as needed and as resources permit.

VII. PDM Implementation Schedule

A schedule will be developed in coordination with NCNHP and/or NCDOT in order to ensure that it is feasible to accomplish PDM activities at all sites scheduled for a given year. An example schedule is shown below:

Sites	Year	Monitoring Cycle	Reporting
1-6	1	1	
7-13	2	1	Cycle 1 (end of year)
1-6	3	2	
7-13	4	2	Cycle 2 (end of year)
1-6	5	3	
7-13	6	3	Cycle 1-3 Final Report (end of year)

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Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:
Blalock Reservoir (SC EO 007, 031)
Broad River: Cleghorn Creek, US 221 (EO 176)
Broad River: Floyds Creek, Long Branch (EO 177)
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop (EO 099)
Cliffside Steam Station (EO 276)
Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Love Lady Site (EO 029)
Mills Creek Forest and Seep (EO 023)
New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
Rhyne Preserve (EO 302)
Second Broad River (Forest City Industrial Complex) (EO 154)
South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)

NCDOT Sites:
Broad River Greenway (EO 049-051, 073-074, 149, 233, 238-241)
Buffalo Shoals Creek (EO 275)
Catawba County (EO 158, 162)
Extension of 15th Avenue (EO 031)
Gunpowder Creek (EO 077)
Little Gunpowder Creek (EO 044)
Longview (EO 032)
Micol Creek (EO 159)
Murray's Mill (EO 184)
Shelby Bypass Site 7 (EO 191)
Tate Boulevard Extension (EO 030)
Tate Conservation Area (EO 106, 286)

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Appendix B – Threats Assessment Guidance

This methodology was originally developed by the NC Plant Conservation Program (NCPCP) Scientific Committee in 2008 to assess the rarest and most imperiled plant species. This protocol was applied to individual populations of *Hexastylis naniflora*, during baseline monitoring, to develop a standardized assessment of threats and trends.

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species. Each threat is assigned a ranking for its severity, scope, and immediacy, as described below:

Threat Severity

- High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long-term recovery (>100 yr.).
- Moderate: Major reduction of species population or long-term degradation or reduction of habitat in area affected, requiring 50–100 yr. for recovery.
- Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.
- Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yrs.) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations is generally considered Insignificant as defined here.

Scope

- High: >60% of total population, occurrences, or area affected.
- Moderate: 20–60% of total population, occurrences, or area affected.
- Low: 5–20% of total population, occurrences, or area affected.
- Insignificant: <5% of total population or area affected.

Immediacy

- High: Threat is operational (happening now) or imminent (within a year).
- Moderate: Threat is likely to be operational within 2–5 yr.
- Low: Threat is likely to be operational within 5–20 yr.
- Insignificant: Threat not likely to be operational within 20 yr.

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From:	Mizzi, Janet
To:	Reid, Rebekah N
Subject:	My edits to the Dwarf-flowered heartleaf rule
Date:	Thursday, January 23, 2020 2:26:34 PM
Attachments:	20190724_Dwarf flowered heartleaf_pDeL_withPRB_nk DCC (1) (Repaired) RNR Comments.docx
Importance:	High

Please see attached. Thanks for the opportunity to weigh in.

Janet Mizzi
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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

Commented [KNN1]: Overall, I have concerns about our post-delisting commitments. We stated in the rule that the number of populations has increase from 24 at the time of listing, to 119 currently. However, it was unclear to me whether these new populations was the result of ongoing conservation efforts by the Service and our partners or solely additional survey efforts. If it is the later, do we have commitment with partners or the states to minimize the effects of future development and climate change? In the rule, we alluded to the high resiliency of many of these populations. However, we also noted that

"…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…"

If we delist this species, the protection provided under Section 7 consultation will no longer apply. What actions will we take then to help ensure the persistence of the species post delisting?

Commented [HB2R1]:

Commented [RRN3R1]: I tried to address comments related to this one as they were asked throughout the document.

Deleted: ; availability of draft post-delisting monitoring plan…

Commented [FB4]: This document is well-written and organized well. I think that we need to do more in the threats section for current condition to convince the reader that development in particular is not a threat. We don't seem to have included any analysis on which populations or what percent of the range of the species is subject to the threat of development. I saw that some of this information comes later in the document, but should appear earlier.

Also, the first paragraph of the press release talks about all the conservation done by Duke Energy along the Broad River. That information is missing from this rule – if it's important enough for the press release, it should be discussed herein (and could help address the comment I provided above).

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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

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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. 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 species status assessment (SSA) to aid in determining the appropriateness of reclassifying the species.

Background

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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 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

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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), 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 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.

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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

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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 proposed for removal from the List of Endangered and Threatened Plants

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(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.

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Summary of Biological Status and Threats

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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

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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 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

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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

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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 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 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 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

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Commented [HB23R22]: We used 78 as a conservative estimate of the number of populations. Because those 41 had not been observed since 2005, we didn't want to use those populations as justification for reclassification and then have someone ask, "well, how do you know they are still there or what their status is if no one has observed them in 15 years?". Assuming those 41 populations are extirpated is not an accurate assumption. The species is long-lived and data shows we can go decades between observations. I think the original thought was, if we can justify reclassification with 78 populations, then we can also do it with 119. As far as conservation value of those 41, because they are spread throughout the range, they bolster the 3Rs (i.e. we have more representation with 119 populations than we do with 78 populations, etc.).

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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 *Kalmia latifolia* (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 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 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

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I commented on this during solicitor review but will restate here. The description about EO distances above is how we defined populations in the SSA and does not describe how we define representation. For this species, how we define populations is not the same as how we define representation.

I've edited to describe how we define representation.

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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 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 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

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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). Thus, even where development is ranked as a high threat, it does not mean that the dwarf-flowered heartleaf is being impacted.

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 (moderate to severe threat for small proportion of population, occurrences, or area) (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).

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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 NC NHP designates "natural areas", which are sites with biological diversity significance due to the presence of rare species or unique natural communities. The NC NHP 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 NC NHP to preserve the natural area and biological diversity of the property. The NC NHP 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 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 31 percent of the 78 current populations are

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Commented [KNN42]: We have identified that NC and SC laws do not provide direct protection to the species. Have the Service undertake any coordination with state environmental agencies to help conserve the species? That will help strengthen our case that threats due to development is being addressed by state partners

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Commented [RRN44R42]: See additions about State partnerships.

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Commented [RRN49R47]: I think BF and NK comments can be address with the same edits. See addition at the end of section.

Commented [KNN50]: If we are so reliant on Section 7 consultation to conserve the species, what will happen once we delist the species? Section 7 consultation will no longe ...

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permanently protected, and another 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 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, 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 necessarily mean that the dwarf-flowered heartleaf is responding negatively.

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Deleted: is greatly reduced at these populations, as protection status is not removed if the ESA is no longer applicable to the species.

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Commented [KNN54]: What are the resilient categories for these populations? Including that information would help give context to the threat ranking that NHP uses below.

Commented [HB55R54]:

Commented [FB56]: Do we have similar info for the threat of development to help us make the case above?

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Commented [RRN58R56]: Yes, I've added it above, see above.

Commented [KNN59]: I like the inclusion of descriptions for each rank.

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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 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

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Commented [FB65]: For this area? Would be good to make sure that citations are for the local area, not broad.

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Commented [FB67]: I'm not sure about this sentence. Weeds do better too when they have more water…doesn't make CC a threat.

Commented [RRN68R67]: See addition about impacts from too much water (ie flooding).

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Deleted: 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,

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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 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 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

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Commented [KNN80]: Since we are discussing foreseeable future in sections before the determination section, we should briefly include our definition of foreseeable future here. I have moved language from a section below.

Also since I have move this language up here, we may not need this additional sentence anymore. Please revise as needed.

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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, 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.

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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-

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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

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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

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). 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

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Commented [FB109]: This is not the strongest rationale, is there a particular reason that we and USGS used this threshold? Note that our foreseeable future reg uses the term "likely" which means "more likely than not" which can be interpreted as 51%.

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- 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.

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

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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 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

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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.

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Commented [FB116]: Is this correct? Seems odd to have a scenario where we presume a number a priori, wouldn't that force the scenario to end up a certain way?

Commented [HB117R116]:

Commented [RRN118R116]: This was poor wording choice. We analyzed each scenario to determine how many of the 78 current populations would persist and based on the analysis, we assume (estimate) that 75 would persist. The "assumption" was made after analyzing each scenario. We didn't do the assumption first. The way the sentences has been edited is much clearer.

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- 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

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Commented [FB119]: Same comment as above

Commented [HB120R119]:

Commented [RRN121R119]: See above.

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:

- 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

Commented [FB122]: Who is doing this targeted conservation? Is it likely to happen, in the absence of an ESA listing?

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Commented [RRN124R122]: 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. Between this scenario and current, we predict 5 extirpations and 6 predicted to persist so we are talking about a gain of 1 population in this scenario. In our briefing meetings, we indicated that the Status Quo was the likely scenario.

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Commented [FB125]: And is this compared with the 113 populations that we know about, or the 78 populations we used for analysis of the current condition? Need to be clear whether we are acknowledging that some loss will occur but the spp will be OK, or if we are predicting the spp will stay relatively stable?

Commented [HB126R125]:

Commented [RRN127R125]: This is saying that 75 of the 78 we analyzed will be extant. So, with our status quo, we are acknowledging loss of three populations but species will be OK based on data presented in the rest of the doc.

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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 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.

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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

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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 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

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Commented [FB128]: Do we consider climate change to be a catastrophic event? When I think about catastrophic events, I usually think about sudden things like oil spills or hurricanes.

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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.

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Table of viability summary for dwarf-flowered heartleaf under three future scenarios (projected to year 2040) and compared to current condition.

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	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 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

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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. ¶

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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 percent are somewhat protected (through voluntary agreements or other management commitments), 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.

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Commented [FB135]: Yes! This needs to be discussed earlier in the development section.

Commented [HB136R135]: Affirmative

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 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

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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 or other causes of habitat loss such as trash disposal, expansion of residential lawns, cattle, and invasive exotics, including cumulative effects.

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Analysis

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 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

Deleted: 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.

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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 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 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

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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). ¶

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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.

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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.

Dated: _____

_____

Aurelia Skipwith
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]~~

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Principal Deputy

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U.S. Fish and Wildlife Service.¶

From: Hamilton, Byron
To: Reid, Rebekah N
Subject: Re: Heartleaf
Date: Monday, March 9, 2020 2:40:28 PM
Attachments: 20200309_Dwarf flowered heartleaf_pDeL.docx

Please see attachment for the rule. Looking forward to speaking to you on Wednesday.

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: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Monday, March 9, 2020 2:20 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Heartleaf

Great! Wednesday will work for me. I will give you a call at 11am. I will send you the rule with only the new comments so they will be easy to find.

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Monday, March 9, 2020 2:15 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Heartleaf

Hey Byron,

I'm free Wednesday and Thursday. You can pick the time. I usually leave around 3:30.

Anything I need to brush up on? It's been a while since I've looked at it.

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.

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Monday, March 9, 2020 1:56 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Heartleaf

Hey Rebekah,

I was wondering if you had some time to get on the phone and talk about the heartleaf rule. What's your schedule?

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

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

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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

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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.

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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

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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.

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,

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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.

Dwarf-flowered heartleaf is historically known to have a restricted range due to its

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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

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"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

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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

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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

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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

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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

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of assessing resiliency, 78 populations observed since 2005 were assessed due to the high confidence in their persistence.

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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:

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- 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

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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, 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 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

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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

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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.

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

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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

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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.

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

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(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.

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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).

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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).

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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 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).

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.

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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***.

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

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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). 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).

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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 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

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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 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

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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 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

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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

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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 dwarf-flowered heartleaf is likely to persist.

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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.

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- 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:

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- 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

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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.

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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.

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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.

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Table of viability summary for dwarf-flowered heartleaf under three future scenarios (projected to year 2040) and compared to current condition.

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	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.

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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. ¶

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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

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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.

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.

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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.

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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.

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 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

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Analysis

Deleted: 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.

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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

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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). ¶

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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.

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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

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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).

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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.

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Director,
U.S. Fish and Wildlife Service.

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Principal Deputy

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U.S. Fish and Wildlife Service.¶

Deleted: ~~[Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants]~~

From: Hamilton, Byron
To: Reid, Rebekah N
Subject: Re: Heartleaf
Date: Friday, May 15, 2020 7:59:43 AM

Thanks Rebekah! You do the same!

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Friday, May 15, 2020 7:55 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Heartleaf

Hey Byron,

See what you think of the revision below. Feel free to change anything based on your notes...

The majority of known dwarf-flowered heartleaf populations were been discovered as a direct result of surveys efforts conducted in the late 1990s and early 2000s (NCNHP 2018). As a result of these efforts, 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.

I can get more specific with dates if we need to, just let me know. Have a great weekend!

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

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From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Thursday, May 14, 2020 6:45 AM

To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Heartleaf

Good morning!

Great! I'm scheduling a Teams call for 2 pm this afternoon.

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Wednesday, May 13, 2020 4:47 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Heartleaf

Hey Byron,

I appreciate his concern. I'm free anytime tomorrow (8am-4pm) for a conference call or Teams chat. Let me know what time works for you both.

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

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From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, May 13, 2020 2:27 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Heartleaf

Hey Rebekah,

Don Morgan is advising against you going into the office. Maybe we can get on a call

tomorrow. What does your schedule look like?

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Wednesday, May 13, 2020 8:37 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Peeples, Gary <gary_peeples@fws.gov>
Subject: Re: Heartleaf

Hey Byron,

Let me see what info the data provides. I'm not sure if there is data on "why" something was protected, just that's it is protected or not and we know some was a result of Section 7 and some was voluntary. However, it doesn't change the fact that those populations are in protection.

Give me a few days, I may have to go by my office to grab some files.

Thanks.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
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phone: 828-258-3939 x42238
cell: 828-782-0090

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From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, May 13, 2020 8:29 AM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Heartleaf

Hey Rebekah,

I have another comment on the Heartleaf that needs to be addressed. The question is how many populations are based on section 7 vs. voluntary conservation actions....

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.

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Thursday, March 12, 2020 12:54 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Heartleaf

Hey Byron,

See my comments.

After thinking more about the population persistence vs. plant longevity question, I understand the issue and we can't necessarily relate the two (persistence and plant longevity) without more intense demography research...although I'm guessing there is a relation. Population persistence could be the result of a few things - long-lived plants, short-lived plants with a lot of recruitment, etc. So, I get where that question is coming from. We could remove the reference to populations?

Thanks. I'm around tomorrow if we need to talk it through some more.

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

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From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Monday, March 9, 2020 2:40 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Heartleaf

Please see attachment for the rule. Looking forward to speaking to you on Wednesday.

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: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Monday, March 9, 2020 2:20 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Heartleaf

Great! Wednesday will work for me. I will give you a call at 11am. I will send you the rule with only the new comments so they will be easy to find.

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Monday, March 9, 2020 2:15 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Heartleaf

Hey Byron,

I'm free Wednesday and Thursday. You can pick the time. I usually leave around 3:30.

Anything I need to brush up on? It's been a while since I've looked at it.

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

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From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Monday, March 9, 2020 1:56 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Heartleaf

Hey Rebekah,

I was wondering if you had some time to get on the phone and talk about the heartleaf rule. What's your schedule?

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: Straight, Carrie A
To: Reid, Rebekah N
Subject: RE: the Post Delisting Monitoring (PDM) plan - dwarf flowered heartleaf
Date: Wednesday, July 22, 2020 10:57:03 AM

Thanks Rebekah,

I likely think this was in response to the same issue that came up so we are just double checking all of the species in the delisting workplan!

Carrie

<°))))< <°))))< <°))))< <°))))< <°))))<

Carrie A. Straight, PhD
Pronouns: she, her, hers

Recovery Coordinator
U.S. Fish and Wildlife Service
1875 Century Boulevard
Atlanta, Georgia 30345
404.679.7226 (office) or via Teams (carrie_straight@fws.gov)

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From: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Wednesday, July 22, 2020 8:13 AM
To: Straight, Carrie A <carrie_straight@fws.gov>
Cc: Davis, Victoria <victoria_davis@fws.gov>
Subject: Re: the Post Delisting Monitoring (PDM) plan - dwarf flowered heartleaf

Hi Carrie,

Yes, there is a draft PDM for dwarf flowered heartleaf. I worked on it with Drew Becker the first half of 2019. See attached. Just FYI, Byron Hamilton asked for this document yesterday 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

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From: Straight, Carrie A <carrie_straight@fws.gov>
Sent: Tuesday, July 21, 2020 7:47 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Cc: Davis, Victoria <victoria_davis@fws.gov>
Subject: the Post Delisting Monitoring (PDM) plan - dwarf flowered heartleaf

Hi Rebekah,

I have a list of species are on the current list of delistings either with HQ or the DCC branch. Although DCC will be working on the delisting rules, the Post Delisting Monitoring (PDM) plan still falls to the Division of Restoration and Recovery. These plans need to be completed prior to the Final Rule and apparently a draft should be posted with the proposed delisting rule. Can you tell me if there is a PDM for dwarf flowered heartleaf and if so, what the status of that document is?

Thanks,

Carrie

<°))))< <°))))< <°))))< <°))))< <°))))<

Carrie A. Straight, PhD
Pronouns: she, her, hers

Recovery Coordinator
U.S. Fish and Wildlife Service
1875 Century Boulevard
Atlanta, Georgia 30345
404.679.7226 (office) or via Teams (carrie_straight@fws.gov)

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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

SOLIS 00020251.FWS.HHS

April 15, 2021

BY E-MAIL

TO: Leopoldo Miranda-Castro, Regional Director

FROM: Shannon Goessling, Regional Solicitor SHANNON GOESSLING Digitally signed by SHANNON GOESSLING Date: 2021.04.15 09:42:09 -04'00'

SUBJECT: Resurname of Proposed Rule to Remove the Dwarf-Flowered Heartleaf from the List of Endangered and Threatened Species under the ESA

We were asked to resurname the proposed rule to remove the dwarf-flowered heartleaf from the List of Endangered and Threatened Plants under the Endangered Species Act as it has been longer than six months since our original surname in August 2020. Changes since our surname are minimal and, based on our review of the revised version dated December 8, 2020, we are surnaming the document as legally sufficient.

If you have any questions, please contact Helen Speights at (404) 331-5604.

cc: Catherine Phillips, Ecological Services
John Tirpak, Ecological Services
Nicole Rankin, Ecological Services
Kristi Young, Ecological Services
Byron Hamilton, Ecological Services

Enclosures

Note: Any Solicitor's Office "surname" attaches <u>only</u> 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: 2021.04.15 09:43:01 -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

From: Peeples, Gary
To: Reid, Rebekah N
Cc: Mizzi, Janet
Subject: Fw: Dwarf-flower heartleaf PDM - peer review
Date: Thursday, June 17, 2021 2:19:07 PM
Attachments: Draft_PDM_dwarf_flowered_heartleaf_Hexastylis naniflora_draft_v2_20190530.docx
2021-08459_proposed_delisting_rule_dwarf flowered heartleaf.pdf

---

Can you help Carrie with names?

Also, how do you feel about carrying the HENA baton through this process?

Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service, South Atlantic/Gulf Region
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
cell 828/216-4970
fax 828/258-5330
he/him/his

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From: Straight, Carrie A <carrie_straight@fws.gov>
Sent: Monday, June 14, 2021 3:28 PM
To: Mizzi, Janet <janet_mizzi@fws.gov>; Peeples, Gary <gary_peeples@fws.gov>
Subject: Dwarf-flower heartleaf PDM - peer review

Hello,

I was notified by Kristi Young that the proposed rule for the dwarf-flowered heartleaf states that we will be initiating a peer review of the PDM concurrent with the proposed listing rule (see the sentence on the top right column of page 22004, under FOR FURTHER INFORMTION CONTACT).

Facilitating that review has fallen to me. Since we've stated it will happen, here goes… I need a list of at least 3 experts that are not responsible in any way for the post delisting monitoring plan implementation. They can be an expert that might be consulted, but wouldn't be responsible for the actual monitoring or reporting. Let me know if you have a biologist that will be responsible for both this and updating the PDM and incorporating any of the comments, etc. I have attached the PDM from the docket and the proposed rule. Unless there have been major changes of the PDM since the proposed rule, I will use that document to solicit the peer review.

Thanks,

Carrie

<°))))< <°))))< <°))))< <°))))< <°))))<

Carrie A. Straight, PhD
She, her, hers

Recovery Coordinator
South Atlantic-Gulf and Mississippi Basin Regions
U.S. Fish and Wildlife Service
Ecological Services
1875 Century Boulevard
Atlanta, Georgia 30345
404.679.7226 (office) or via Teams (carrie_straight@fws.gov)

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U.S. FISH AND WILDLIFE SERVICE

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

June 2019

Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)

June 2019

Recommended Citation:

US Fish and Wildlife Service. 2019. Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*). Asheville Ecological Services Field Office, Asheville, North Carolina. 11 pp.

Acknowledgements

The Draft Post-Delisting Monitoring Plan (Plan) for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) was prepared by the US Fish and Wildlife Service (Service) with participation from Rebekah Reid, Asheville Ecological Services Field Office, and Drew Becker, Southeast Regional Office. The Service acknowledges partners outside our agency who provided input during development of this draft Plan, including the North Carolina Natural Heritage Program and the North Carolina Department of Transportation.

Table of Contents

II. Summary of Species Status at Delisting 1
A. Demographic Parameters 1
B. Discussion of Populations 2
III. Public Review and Comment 3
IV. Monitoring Methods and Locations 4
IV. Definition of Response Triggers for Potential Monitoring Outcomes 5
A. Category I 5
B. Category II 6
C. Category III 6
V. Data Compilation and Reporting Procedures 6
VI. Estimated Funding Requirements and Sources 7
VII. PDM Implementation Schedule 7
VIII. Literature Cited 8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2018), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June. They are small,

inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989). The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).

B. Discussion of Populations

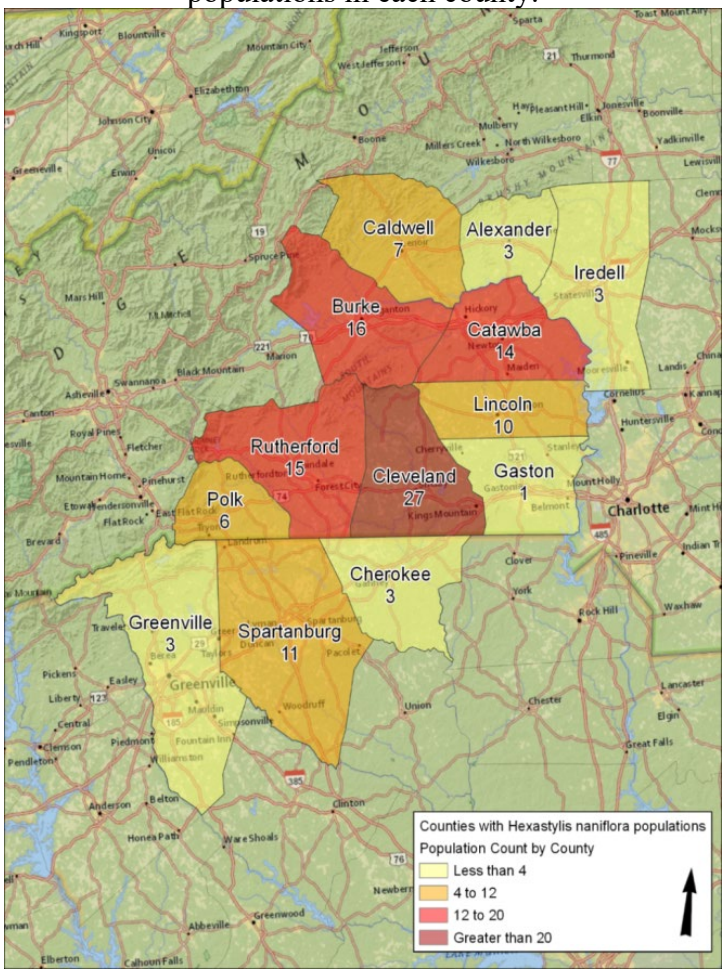
When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2011).

Since listing, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to NCNHP Element Occurrence (EO) records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This generated considerable discrepancies among sources with respect to abundance and distribution of the species, to the extent that data are usually not comparable from one source to the next (Service 2011).

NatureServe and its member Natural Heritage Programs (NHP) 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 into meaningful units of conservation interest that may approximate biological populations (NatureServe 2004). The Service does not maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards the NHP databases as the best repository for this information.

As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.



The listing rule placed emphasis on populations containing more than 1,000 rosettes. This threshold has been used in subsequent reports to call attention to particularly large populations. Populations with greater than 1,000 rosettes increased from three in 1989 to 26 in 2016 (Robinson 2016). This is approximately 23% of the total known populations and many of these populations contain well over 1,000 rosettes. Twenty-five of the largest known populations have been monitored for at least 5 years by NCNHP (13 populations) and NCDOT (12 populations).

III. Public Review and Comment

The Service will announce the availability of the draft Plan for public review and comment in the publication of the proposed rule to delist dwarf-flowered heartleaf. At conclusion of the comment period, the Service will review each comment and prepare responses to substantive comments.

IV. Monitoring Methods and Locations

The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). The second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps provided for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants occurring at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data were used to determine the size of the entire population. When every tract could not be visited, data from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals. The estimated extrapolated size of each population for each year was determined with the following formula:

$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

The PDM will be a continuation of the monitoring described above and occur within at least 12 previously monitored populations (Appendix A).

A. Procedures to Assure Consistency

The practices below will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked or a complete census will be conducted. Area of populations will be delineated to determine acreage of occupied habitat.
- A field data sheet, developed and agreed upon prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
- Threats will be assessed at each location using NCPCP guidelines (Appendix B).
- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 12 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6 sites are monitored each year for six years (each site receives three complete monitoring cycles).

IV. Definition of Response Triggers for Potential Monitoring Outcomes

Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios.

After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

A. Category I

PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections.
This would be true if:

1) Number of plants within a population is within the standard deviation of the mean or above, and

2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

B. Category II

PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Number of plants within a population is below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Number of plants within a population is below the standard deviation of the mean, and

2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, all actions from Category II will be implemented. Additionally, the Service will initiate a formal status review and determine whether a proposal for relisting is appropriate.

V. Data Compilation and Reporting Procedures

Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each

report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

If response triggers in Section IV are met or exceeded, the Service will consult with NCNHP, NCDOT, and other partners to determine whether to conclude the PDM process or pursue management actions. The determination will also include, if necessary, an evaluation of the threats to dwarf-flowered heartleaf using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state and tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of dwarf-flowered heartleaf following removal from protections of the Act. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this draft Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

As staff resources and funding allow, the primary entities conducting the PDM and preparing reports will be NCNHP and/or NCDOT. Based on a funding estimate received from NCNHP, monitoring 6 sites each year would require approximately $6,100 in funding. A complete monitoring cycle of two years would require approximately $12,200 and the entire six years of monitoring (three monitoring cycles) would require approximately $36,600. The NCNHP funding estimates do not apply to NCDOT and NCDOT is unable to provide an estimate for monitoring additional sites at this time. The Service will provide assistance as needed and as resources permit.

VII. PDM Implementation Schedule

A schedule will be developed in coordination with NCNHP and/or NCDOT in order to ensure that it is feasible to accomplish PDM activities at all sites scheduled for a given year. An example schedule is shown below:

Sites	Year	Monitoring Cycle	Reporting
1-6	1	1	
7-12	2	1	Cycle 1 (end of year)
1-6	3	2	
7-12	4	2	Cycle 2 (end of year)
1-6	5	3	
7-12	6	3	Cycle 1-3 Final Report (end of year)

VIII. Literature Cited

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Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:
Blalock Reservoir (SC EO 007, 031)
Broad River: Cleghorn Creek, US 221 (EO 176)
Broad River: Floyds Creek, Long Branch (EO 177)
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop (EO 099)
Cliffside Steam Station (EO 276)
Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Lovelady Site (EO 029)
Mills Creek Forest and Seep (EO 023)
New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
Rhyne Preserve (EO 302)
Second Broad River (Forest City Industrial Complex) (EO 154)

NCDOT Sites:
Broad River Greenway (EO 049-051, 073-074, 149, 233, 238-241)
Buffalo Shoals Creek (EO 275)
Extension of 15th Avenue (EO 031)
Gunpowder Creek (EO 077)
Little Gunpowder Creek (portion of EO 044)
Longview (EO 032)
Lovelady Road (EO 160, 280)
Micol Creek (EO 159)
Murray's Mill (EO 184)
Shelby Bypass Sites (EO 192, 194, 202, 203, 209, 213; portions of EO 188, 199, 208)
South Fork Catawba River: Jacob Fork, Camp Creek (EO 158, 162)
Tate Boulevard Extension (EO 030)
Tate Conservation Area (EO 106, 286)

Appendix B – Threats Assessment Guidance

This methodology was originally developed by the NC Plant Conservation Program (NCPCP) Scientific Committee in 2008 to assess the rarest and most imperiled plant species. This protocol was applied to individual populations of *Hexastylis naniflora*, during baseline monitoring, to develop a standardized assessment of threats and trends.

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species. Each threat is assigned a ranking for its severity, scope, and immediacy, as described below:

Threat Severity

- High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long-term recovery (>100 yr.).
- Moderate: Major reduction of species population or long-term degradation or reduction of habitat in area affected, requiring 50–100 yr. for recovery.
- Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.
- Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yrs.) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations is generally considered Insignificant as defined here.

Scope

- High: >60% of total population, occurrences, or area affected.
- Moderate: 20–60% of total population, occurrences, or area affected.
- Low: 5–20% of total population, occurrences, or area affected.
- Insignificant: <5% of total population or area affected.

Immediacy

- High: Threat is operational (happening now) or imminent (within a year).
- Moderate: Threat is likely to be operational within 2–5 yr.
- Low: Threat is likely to be operational within 5–20 yr.
- Insignificant: Threat not likely to be operational within 20 yr.

must be made for the appropriate amount, as prescribed in § 201.3(c) of this chapter. The fee for small claims expedited registration is intended to accelerate the registration process for a qualifying Copyright Claims Board claimant or counterclaimant that already has a pending registration application; it is in addition to, and does not offset, the fee for copyright registration.

(2) *Method of payment.* (i) The fee for small claims expedited registration must be submitted electronically to the Copyright Claims Board and not through the Copyright Office's electronic registration system (eCO).

(ii) A claimant or counterclaimant shall follow instructions on the Copyright Office website to make electronic payments with credit or debit cards, or directly from their bank accounts by means of automated clearing house (ACH) debit transactions. Applicants may not use a deposit account to make payments for small claims expedited registration.

(3) *No refunds.* The small claims expedited registration fee is not refundable, unless the small claims expedited registration request is denied under paragraph (d) of this section.

(d) *Denied requests.* If the applicant failed to pay the required fee or if the Copyright Office determines that expedited registration under this section would be unduly burdensome, the Office will notify the applicant that the request has been denied and that the copyright registration claim will be examined on a regular basis.

(e) *Granted requests.* If the request for expedited registration under this section is granted, the Office will make every attempt to examine the application or the document within ten business days after notice of the request is delivered by the Copyright Claims Board to the Copyright Office's Office of Registration Policy and Practice, although the Copyright Office cannot guarantee that all applications or all documents will be registered or recorded within that timeframe.

(f) *Identical registration standards.* The Copyright Office will apply the same practices and procedures set out in the part when examining a copyright registration claim, regardless of whether the applicant asks for small claims expedited registration.

Dated: April 20, 2021.

Regan A. Smith,

General Counsel and Associate Register of Copyrights.

[FR Doc. 2021–08570 Filed 4–23–21; 8:45 am]

BILLING CODE 1410–30–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 June 25, 2021. 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 June 10, 2021.

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.

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.

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.

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.

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).

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 E.O. 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).

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.*

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.

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.

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 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.

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 (Gaddy 1986, 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).

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.

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).

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.

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.

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.

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.

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.

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.

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).

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 ''*Hexastylis naniflora*'' under ''FLOWERING PLANTS'' from the List of Endangered and Threatened Plants.

Martha Williams,

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

[FR Doc. 2021–08459 Filed 4–23–21; 8:45 am]

BILLING CODE 4333–15–P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2019–0069, FWS–R4–ES–2019–0070; FXES11130900000–189–FF0932000]

RIN 1018–BE14; 1018–BD01

Reclassifying the Virgin Islands Tree Boa From Endangered to Threatened With a Section 4(d) Rule; Reclassification of *Eugenia woodburyana* as Threatened and Section 4(d) Rule

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Reopening of comment periods; announcement of public hearing.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), are reopening the public comment periods on two proposed rules to allow all interested parties additional time to comment, and to conduct a public hearing. The two relevant proposed rules are our September 30, 2020, proposed rule to reclassify the endangered Virgin Islands tree boa (*Chilabothrus granti*) as a threatened species with a rule issued under section 4(d) of the Endangered Species Act of 1973 (Act), as amended; and our October 21, 2020, proposed rule to reclassify the endangered plant *Eugenia woodburyana* (no common name) as a threatened species with a rule issued under section 4(d) of the Act. Comments previously submitted need not be resubmitted and will be fully considered in preparation of the final rules.

DATES: *Written comments:* The comment periods for the proposed rules published on September 30, 2020, at 85 FR 61700, and October 21, 2020, at 85 FR 66906, are reopened. We will accept comments received or postmarked on or before May 26, 2021.

Public hearing: On May 12, 2021, we will hold a public hearing from 6 to 8 p.m., Atlantic Time, using the Zoom platform (for more information, see Public Hearing, below).

ADDRESSES: *Availability of documents:* You may obtain copies of the proposed rules and their associated documents on the internet at *http://www.regulations.gov* under the following docket numbers:

Proposed rule	Docket number
Reclassifying the Virgin Islands Tree Boa From Endangered to Threatened With a Section 4(d) Rule (published September 30, 2020, at 85 FR 61700).	FWS–R4–ES–2019–0069.
Reclassification of Eugenia woodburyana as Threatened and Section 4(d) Rule (published October 21, 2020, at 85 FR 66906).	FWS–R4–ES–2019–0070.

Comment submission: You may submit written comments by one of the following methods:

(1) *Electronically:* Go to the Federal eRulemaking Portal: *http://www.regulations.gov.* In the Search box, enter the appropriate docket number (see table above). 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 the document. You may submit a comment by clicking on ''Comment Now!'' Please ensure you have located the correct document before submitting your comments.

(2) *By hard copy:* Submit by U.S. mail to: Public Comments Processing, Attn: [Enter appropriate docket number; see table above], U.S. Fish and Wildlife Service, MS: PRB/3W, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

Please note that comments submitted electronically using the Federal eRulemaking Portal must be received by 11:59 p.m. Eastern Time on the closing date, and comments submitted by U.S. mail must be postmarked by that date to ensure consideration. 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).

FOR FURTHER INFORMATION CONTACT: Edwin E. Muñiz, Field Supervisor, U.S. Fish and Wildlife Service, Caribbean Ecological Services Field Office, at either: Road 301 Km 5.1, Corozo Ward, Boquerón, PR 00622; or P.O. Box 491, Boquerón, PR 00622. Telephone 787–405–3641. Persons who use a telecommunications device for the deaf

From: Straight, Carrie A
To: Reid, Rebekah N
Cc: Peeples, Gary
Subject: RE: DFHL Post Delisting Monitoring Plan
Date: Friday, June 25, 2021 3:40:15 PM
Attachments: Sent_to_reviewers.zip

I sent out the document for peer review today. Please find attached the documents that I sent out for your file. I have requested a response by 7/16.

Carrie

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Carrie A. Straight, PhD
She, her, hers

Regional Recovery Coordinator
South Atlantic-Gulf and Mississippi Basin Regions
U.S. Fish and Wildlife Service
Ecological Services
1875 Century Boulevard
Atlanta, Georgia 30345
404.679.7226 (office) or via Teams (carrie_straight@fws.gov)

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Tuesday, June 22, 2021 9:23 AM
To: Straight, Carrie A <carrie_straight@fws.gov>
Cc: Peeples, Gary <gary_peeples@fws.gov>
Subject: Re: DFHL Post Delisting Monitoring Plan

Hey Carrie,

It hasn't changed from when you and Byron asked for it last summer.

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.

From: Straight, Carrie A <carrie_straight@fws.gov>
Sent: Tuesday, June 22, 2021 9:18 AM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Cc: Peeples, Gary <gary_peeples@fws.gov>
Subject: RE: DFHL Post Delisting Monitoring Plan

Thanks for the update. Do you have the most recent version of the PDM or was that put up with the original docket?

Carrie

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Carrie A. Straight, PhD
She, her, hers

Regional Recovery Coordinator
South Atlantic-Gulf and Mississippi Basin Regions
U.S. Fish and Wildlife Service
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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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Tuesday, June 22, 2021 8:37 AM
To: Straight, Carrie A <carrie_straight@fws.gov>
Cc: Peeples, Gary <gary_peeples@fws.gov>
Subject: Re: DFHL Post Delisting Monitoring Plan

No, as planned none of those folks will be conducting the monitoring.

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.

From: Straight, Carrie A <carrie_straight@fws.gov>
Sent: Tuesday, June 22, 2021 8:34 AM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Cc: Peeples, Gary <gary_peeples@fws.gov>
Subject: RE: DFHL Post Delisting Monitoring Plan

Thanks Rebekah,

A quick question, will Keith (or any of them) be involved in any of the monitoring? If so we'll need someone different.

Thanks,

Carrie

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Carrie A. Straight, PhD
She, her, hers

Regional Recovery Coordinator
South Atlantic-Gulf and Mississippi Basin Regions
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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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Tuesday, June 22, 2021 7:44 AM
To: Straight, Carrie A <carrie_straight@fws.gov>
Cc: Peeples, Gary <gary_peeples@fws.gov>
Subject: DFHL Post Delisting Monitoring Plan

Hi Carrie,

Below is a list of possible reviewers. These folks were not involved in the SSA or development of the PDM plan.

Dr. Doug Rayner

Wofford College

raynerda@wofford.edu

Dr. LL “Chick” Gaddy

Terra Incognita

llgaddy2@gmail.com

Keith Bradley

SC Heritage Trust Program

bradleyk@dnr.sc.gov

I'll update the plan if we get any comments.

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.

U.S. Fish and Wildlife Service
Participation in Peer Review of the Draft Post Delisting Monitoring Plan for Dwarf-flowered Heartleaf

CONFLICT OF INTEREST DISCLOSURE

NAME: _____ TELEPHONE: _____

ADDRESS: _____

_____

EMAIL ADDRESS: _____

CURRENT EMPLOYER: _____

Please complete, **sign** and **date** the form on the last page, and **return the form to** Carrie Straight at carrie_straight@fws.gov. **Please retain a copy for your records**.

CONFLICT OF INTEREST DISCLOSURE

INSTRUCTIONS

It is essential that a peer reviewer used by the U.S. Fish and Wildlife Service as part of its peer review of proposed listing and proposed critical habitat rules under the ESA report any conflict of interest. For this purpose, **the term "conflict of interest" means any financial or other interest which conflicts with the service of the individual because it (1) could significantly impair the individual's objectivity or (2) could create an unfair competitive advantage for any person or organization.**[1] In those situations in which the Service determines that a conflict of interest is unavoidable we will publicly disclose the conflict of interest.

The term "conflict of interest" means something more than individual bias. There must be an *interest* that could be directly affected by your participation as a peer reviewer.

[1] This definition and the other information in these instructions are drawn from the National Academy of Sciences Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports (May 12, 2003).

Conflict of interest requirements are *objective* and *prophylactic.* They are not an assessment of one's actual behavior or character, one's ability to act objectively despite the conflicting interest, or one's relative insensitivity to particular dollar amounts of specific assets because of one's personal wealth. Conflict of interest requirements are objective standards designed to eliminate certain specific, potentially compromising situations from arising, and thereby to protect the individual, the Service, and the public interest. The individual and the Service should not be placed in a situation where others could reasonably question, and perhaps discount or dismiss, the information produced through the peer review simply because of the existence of conflicting interests.

The term "conflict of interest" applies only to *current interests*. It does not apply to past interests that have expired, no longer exist, and cannot reasonably affect current behavior. Nor does it apply to possible interests that may arise in the future but do not currently exist, because such future interests are inherently speculative and uncertain. For example, a pending formal or informal application for a particular job is a current interest, but the mere possibility that one might apply for such a job in the future is <u>not</u> a current interest.

The term "conflict of interest" applies not only to the personal interests of the individual but also to the *interests of others* with whom the individual has substantial common financial or other interests if these interests are relevant to the functions to be performed. Thus, in assessing an individual's potential conflicts of interest, consideration must be given not only to the interests of the individual but also to the interests of the individual's spouse and minor children, the individual's employer, the individual's business partners, and others with whom the individual has substantial common financial or other interests. Consideration must also be given to the interests of those for whom one is acting in a fiduciary or similar capacity (e.g., being an officer or director of a corporation, whether profit or nonprofit, or serving as a trustee).

Such interests could include an individual's stock holdings in excess of $10,000 in a potentially affected company or being an officer, director, or employee of the company. Serving as a consultant to the company could constitute such an interest if the consulting relationship with the company could be directly affected or is directly related to the subject matter of the regulatory process.

An individual's other possible interests might include, for example, relevant patents and other forms of intellectual property, serving as an expert witness in litigation directly related to the subject matter of the regulatory process, or receiving research funding from a party that would be directly affected by the regulatory process if the research funding could be directly affected or is directly related to the subject matter of the regulatory process and the right to independently conduct and publish the results of this research is limited by the sponsor. Consideration would also need to be given to the interests of others with whom the individual has substantial common financial interests -- particularly spouses, employers, clients, and business or research partners.

The following questions are designed to elicit information from you concerning possible conflicts of interest that are relevant to the functions to be performed by your peer review.

1. EMPLOYMENT. (a) If the information received by the Service through the peer review process were to provide the basis for government regulatory action or inaction with respect to the species--

(i) If you are employed or self-employed, could your current employment or self-employment (or your spouse's current employment or self-employment) be directly affected?

(ii) To the best of your knowledge, could any financial interests of your (or your spouse's) employer or, if self-employed, your (or your spouse's) clients and/or business partners be directly affected?

(iii) If you are an officer, director or trustee of any corporation or other legal entity, could the financial interests of that corporation or legal entity be directly affected?

(iv) If you are a consultant (whether full-time or part-time), could there be a direct effect on any of your current consulting relationships?

(v) Regardless of the potential effect on the consulting relationship, do you have any current or continuing consulting relationships (including, for example, commercial and professional consulting and service arrangements, scientific and technical advisory board memberships, serving as an expert witness in litigation, or providing services in exchange for honorariums and travel expense reimbursements) that are directly related to the subject matter of the possible government regulatory action or inaction?

(b) If you are or have ever been a U.S. Government employee (either civilian or military), to the best of your knowledge, are there any federal conflict of interest restrictions that may be applicable to your service in connection with this peer review?

(c) If you are a U.S. Government employee, are you currently employed by the Service?

If the answer to all of the above questions under EMPLOYMENT is either "no" or "not applicable," check here _____ (NO).

If the answer to any of the above questions under EMPLOYMENT is "yes," check here ____ (YES), and briefly describe the circumstances on the last page of this form.

2. INVESTMENT INTERESTS. Taking into account stocks, bonds, and other financial instruments and investments including partnerships (but excluding broadly diversified mutual funds and any investment or financial interest valued at less than $10,000), if the

information received by the Service through the peer review process were to provide the basis for government regulatory action or inaction with respect to the species --

(a) Do you or your spouse or minor children own directly or indirectly (e.g., through a trust or an individual account in a pension or profit-sharing plan) any stocks, bonds or other financial instruments or investments that could be affected, either directly or by a direct effect on the business enterprise or activities underlying the investments?

(b) Do you have any other significant financial investments or interests such as commercial business interests (e.g., sole proprietorships), investment interests (e.g., stock options), or personal investment relationships (e.g., involving parents or grandchildren) that could be affected, either directly or by a direct effect on the business enterprise or activities underlying the investments?

If the answer to all of the above questions under INVESTMENT INTERESTS is either "no" or "not applicable," check here _____ (NO).

If the answer to any of the above questions under INVESTMENT INTERESTS is "yes," check here ____ (YES), and briefly describe the circumstances on the last page of this form.

3. PROPERTY INTERESTS. Taking into account real estate and other tangible property interests, as well as intellectual property (patents, copyrights, etc.) interests, if the information received by the Service through the peer review process were to provide the basis for government regulatory action or inaction with respect to the species --

(a) Do you or your spouse or minor children own directly or indirectly any such property interests that could be directly affected?

(b) To the best of your knowledge, do any others with whom you have substantial common financial interests (e.g., employer, business partners, etc.) own directly or indirectly any such property interests that could be directly affected?

If the answer to all of the above questions under PROPERTY INTERESTS is either "no" or "not applicable," check here _____ (NO).

If the answer to any of the above questions under PROPERTY INTERESTS is "yes," check here ____ (YES), and briefly describe the circumstances on the last page of this form.

4. RESEARCH FUNDING AND OTHER INTERESTS. (a) Taking into account your research funding and other research support (e.g., equipment, facilities, industry partnerships, research assistants and other research personnel, etc.), if the information

received by the Service through the peer review process were to provide the basis for government regulatory action or inaction with respect to the species --

(i) Could the research funding and support for you or your close research colleagues and collaborators be directly affected, or

(ii) If you have any research agreements for current or continuing research funding or support from any party whose financial interests could be directly affected, and such funding or support is directly related to the subject matter of the regulatory process, do such agreements significantly limit your ability to independently conduct and publish the results of your research?

(b) Is the central purpose of the proposed rule for which this disclosure form is being prepared a critical review and evaluation of your own work or that of your employer?

(c) Do you have any existing professional obligations (e.g., as an officer of a scientific or engineering society) that effectively require you to publicly defend a previously established position on an issue that is relevant to the proposed rule?

(d) To the best of your knowledge, will your participation in this peer review process enable you to obtain access to a competitor's or potential competitor's confidential proprietary information?

(e) Could your service as a peer reviewer create a specific financial or commercial competitive advantage for you or others with whom you have substantial common financial interests?

If the answer to all of the above questions under RESEARCH FUNDING OR OTHER INTERESTS is either "no" or "not applicable," check here _____ (NO).

If the answer to any of the above questions under RESEARCH FUNDING OR OTHER INTERESTS is "yes," check here ____ (YES), and briefly describe the circumstances below.

EXPLANATION OF "YES" RESPONSES:

During your period of service in connection with the activity for which this form is being completed, any changes in the information reported, or any new information, which needs to be reported, should be reported promptly by written or electronic communication to the responsible staff officer.

_____ _____

YOUR SIGNATURE DATE

Reviewed by: _____ _____

Regional Liaison Date

U.S. Fish and Wildlife Service

Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

Peer Review sent on 6/25/2021

The Fish and Wildlife Service is requesting your help by asking you to serve as a peer reviewer of our draft post delisting monitoring (PDM) plan for the dwarf-flowered heartleaf.

Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted due to recovery remains secure from risk of extinction after the protections of the Endangered Species Act (ESA) no longer apply. The primary goal of PDM is to monitor the species to ensure the status does not deteriorate, and if a substantial decline in the species (numbers of individuals or populations) or an increase in threats is detected, to take measures to halt the decline so that re-proposing it as a threatened or endangered species is not needed.

Section 4(g), added to the ESA in the 1988 reauthorization, requires the U.S. Fish and Wildlife Service to implement a system in cooperation with the states to monitor for not less than five years the status of all species that have recovered and been removed from the list of threatened and endangered plants and animals (50 CFR 17.11, 17.12, 224.101, and 227.4). This plan is being developed in accordance with the requirements of Section 4(g) of the ESA.

We ask for your comments on the draft PDM plan 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 and provide references when needed. Please note that we are not seeking your opinion of the legal status of this species, but rather that the best available data and analyses were considered in reassessing its status.

Additionally, as part of the peer review process, we must evaluate the potential for conflicts of interest with the subject species or the action. Please complete the attached Conflict of Interest form and return it with any notes, comments, or questions that you are willing to provide along with your peer review.

By agreeing to participate in the peer review process for this species, you are considered an unpaid, volunteer consultant to assist the Service by providing the best scientific information and clarity in this document. As part of our reporting process under the Information Quality Act, we will also be listing your name and affiliation along with the comments in a document available to the public.

We hope that you view this peer review process as a worthwhile undertaking. Once you complete your review of the attached document, please submit comments and signed Conflict of Interest Form to the Atlanta Regional Office, to our Regional Recovery Coordinator, Carrie Straight. Your comments can be provided to Carrie by email carrie_straight@fws.gov or by letter (1875 Century Boulevard, 4th Floor, Atlanta, Georgia 30345) and should be received by **July 16, 2021**, to help us complete the document. Thank you in advance for your assistance. We appreciate your time in helping complete this review. If

you feel you cannot complete the review in the allotted time or would like to decline review, please let me know.

Thank you for your time,

Carrie

Straight, Carrie A

From: Straight, Carrie A
Sent: Friday, June 25, 2021 3:37 PM
To: 'bradleyk@dnr.sc.gov'
Subject: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Attachments: Draft_PDM_dwarf_flowered_heartleaf_2021_for_peer_review.docx; 20210625 _dwarf_flowered_heartleaf_PDM_conflictofinterestform.docx

Mr. Bradley,

The Fish and Wildlife Service is requesting your help by asking you to serve as a peer reviewer of our draft post delisting monitoring (PDM) plan for the dwarf-flowered heartleaf.

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Carrie

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Carrie A. Straight, PhD
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Regional Recovery Coordinator
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Atlanta, Georgia 30345
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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.

Straight, Carrie A

From: Straight, Carrie A
Sent: Friday, June 25, 2021 3:36 PM
To: llgaddy2@gmail.com
Subject: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Attachments: 20210625_dwarf_flowered_heartleaf_PDM_conflictofinterestform.docx; Draft_PDM_dwarf_flowered_heartleaf_2021_for_peer_review.docx

Dr. Gaddy,

The Fish and Wildlife Service is requesting your help by asking you to serve as a peer reviewer of our draft post delisting monitoring (PDM) plan for the dwarf-flowered heartleaf.

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Carrie

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Carrie A. Straight, PhD
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Regional Recovery Coordinator
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Atlanta, Georgia 30345
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Straight, Carrie A

From: Straight, Carrie A
Sent: Friday, June 25, 2021 3:36 PM
To: raynerda@wofford.edu
Subject: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Attachments: 20210625_dwarf_flowered_heartleaf_PDM_conflictofinterestform.docx; Draft_PDM_dwarf_flowered_heartleaf_2021_for_peer_review.docx

Dr. Rayner,

The Fish and Wildlife Service is requesting your help by asking you to serve as a peer reviewer of our draft post delisting monitoring (PDM) plan for the dwarf-flowered heartleaf.

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Carrie A. Straight, PhD
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Draft document for peer review.

U.S. FISH AND WILDLIFE SERVICE

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

June 2019

Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)

June 2019

Recommended Citation:

US Fish and Wildlife Service. 2019. Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*). Asheville Ecological Services Field Office, Asheville, North Carolina. 11 pp.

Acknowledgements

The Draft Post-Delisting Monitoring Plan (Plan) for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) was prepared by the US Fish and Wildlife Service (Service) with participation from Rebekah Reid, Asheville Ecological Services Field Office, and Drew Becker, Southeast Regional Office. The Service acknowledges partners outside our agency who provided input during development of this draft Plan, including the North Carolina Natural Heritage Program and the North Carolina Department of Transportation.

Table of Contents

II. Summary of Species Status at Delisting 1
A. Demographic Parameters 1
B. Discussion of Populations 2
III. Public Review and Comment 3
IV. Monitoring Methods and Locations 4
IV. Definition of Response Triggers for Potential Monitoring Outcomes 5
A. Category I 5
B. Category II 6
C. Category III 6
V. Data Compilation and Reporting Procedures 6
VI. Estimated Funding Requirements and Sources 7
VII. PDM Implementation Schedule 7
VIII. Literature Cited 8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2018), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June. They are small,

inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989). The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).

B. Discussion of Populations

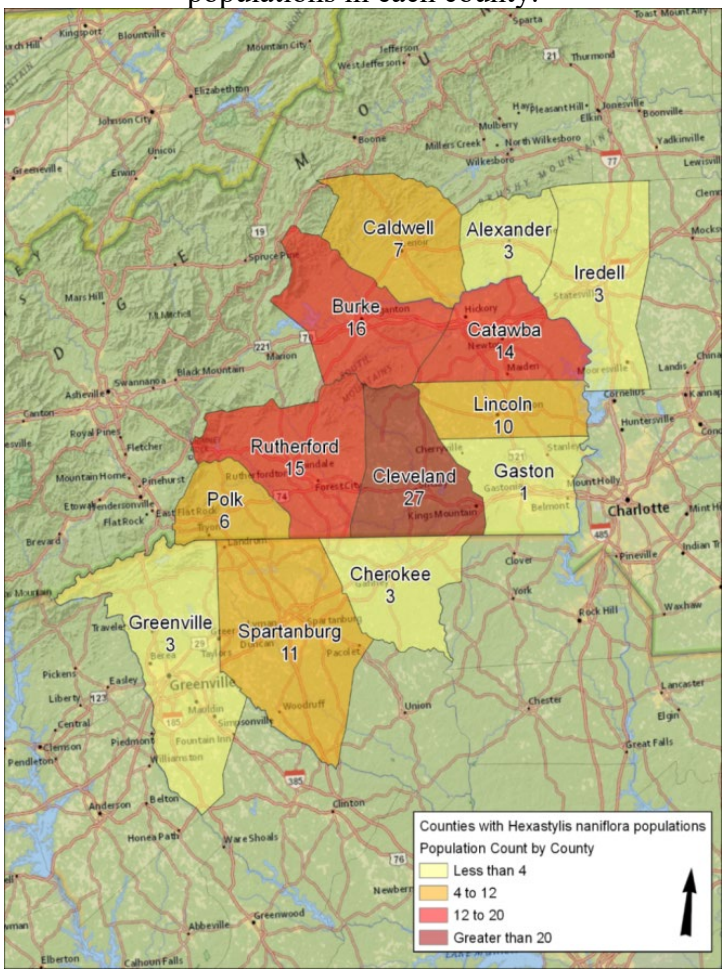
When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2011).

Since listing, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to NCNHP Element Occurrence (EO) records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This generated considerable discrepancies among sources with respect to abundance and distribution of the species, to the extent that data are usually not comparable from one source to the next (Service 2011).

NatureServe and its member Natural Heritage Programs (NHP) 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 into meaningful units of conservation interest that may approximate biological populations (NatureServe 2004). The Service does not maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards the NHP databases as the best repository for this information.

As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.



The listing rule placed emphasis on populations containing more than 1,000 rosettes. This threshold has been used in subsequent reports to call attention to particularly large populations. Populations with greater than 1,000 rosettes increased from three in 1989 to 26 in 2016 (Robinson 2016). This is approximately 23% of the total known populations and many of these populations contain well over 1,000 rosettes. Twenty-five of the largest known populations have been monitored for at least 5 years by NCNHP (13 populations) and NCDOT (12 populations).

III. Public Review and Comment

The Service will announce the availability of the draft Plan for public review and comment in the publication of the proposed rule to delist dwarf-flowered heartleaf. At conclusion of the comment period, the Service will review each comment and prepare responses to substantive comments.

IV. Monitoring Methods and Locations

The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). The second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps provided for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants occurring at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data were used to determine the size of the entire population. When every tract could not be visited, data from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals. The estimated extrapolated size of each population for each year was determined with the following formula:

$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

The PDM will be a continuation of the monitoring described above and occur within at least 12 previously monitored populations (Appendix A).

A. Procedures to Assure Consistency

The practices below will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked or a complete census will be conducted. Area of populations will be delineated to determine acreage of occupied habitat.
- A field data sheet, developed and agreed upon prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
- Threats will be assessed at each location using NCPCP guidelines (Appendix B).
- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 12 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6 sites are monitored each year for six years (each site receives three complete monitoring cycles).

IV. Definition of Response Triggers for Potential Monitoring Outcomes

Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios.

After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

A. Category I

PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections.
This would be true if:

1) Number of plants within a population is within the standard deviation of the mean or above, and

2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

B. Category II

PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Number of plants within a population is below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Number of plants within a population is below the standard deviation of the mean, and

2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, all actions from Category II will be implemented. Additionally, the Service will initiate a formal status review and determine whether a proposal for relisting is appropriate.

V. Data Compilation and Reporting Procedures

Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each

report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

If response triggers in Section IV are met or exceeded, the Service will consult with NCNHP, NCDOT, and other partners to determine whether to conclude the PDM process or pursue management actions. The determination will also include, if necessary, an evaluation of the threats to dwarf-flowered heartleaf using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state and tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of dwarf-flowered heartleaf following removal from protections of the Act. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this draft Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

As staff resources and funding allow, the primary entities conducting the PDM and preparing reports will be NCNHP and/or NCDOT. Based on a funding estimate received from NCNHP, monitoring 6 sites each year would require approximately $6,100 in funding. A complete monitoring cycle of two years would require approximately $12,200 and the entire six years of monitoring (three monitoring cycles) would require approximately $36,600. The NCNHP funding estimates do not apply to NCDOT and NCDOT is unable to provide an estimate for monitoring additional sites at this time. The Service will provide assistance as needed and as resources permit.

VII. PDM Implementation Schedule

A schedule will be developed in coordination with NCNHP and/or NCDOT in order to ensure that it is feasible to accomplish PDM activities at all sites scheduled for a given year. An example schedule is shown below:

Sites	Year	Monitoring Cycle	Reporting
1-6	1	1	
7-12	2	1	Cycle 1 (end of year)
1-6	3	2	
7-12	4	2	Cycle 2 (end of year)
1-6	5	3	
7-12	6	3	Cycle 1-3 Final Report (end of year)

VIII. Literature Cited

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

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.

-----. 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.

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

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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.

Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:

Blalock Reservoir (SC EO 007, 031)
Broad River: Cleghorn Creek, US 221 (EO 176)
Broad River: Floyds Creek, Long Branch (EO 177)
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop (EO 099)
Cliffside Steam Station (EO 276)
Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Lovelady Site (EO 029)
Mills Creek Forest and Seep (EO 023)
New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
Rhyne Preserve (EO 302)
Second Broad River (Forest City Industrial Complex) (EO 154)

NCDOT Sites:

Broad River Greenway (EO 049-051, 073-074, 149, 233, 238-241)
Buffalo Shoals Creek (EO 275)
Extension of 15th Avenue (EO 031)
Gunpowder Creek (EO 077)
Little Gunpowder Creek (portion of EO 044)
Longview (EO 032)
Lovelady Road (EO 160, 280)
Micol Creek (EO 159)
Murray's Mill (EO 184)
Shelby Bypass Sites (EO 192, 194, 202, 203, 209, 213; portions of EO 188, 199, 208)
South Fork Catawba River: Jacob Fork, Camp Creek (EO 158, 162)
Tate Boulevard Extension (EO 030)
Tate Conservation Area (EO 106, 286)

Appendix B – Threats Assessment Guidance

This methodology was originally developed by the NC Plant Conservation Program (NCPCP) Scientific Committee in 2008 to assess the rarest and most imperiled plant species. This protocol was applied to individual populations of *Hexastylis naniflora*, during baseline monitoring, to develop a standardized assessment of threats and trends.

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species. Each threat is assigned a ranking for its severity, scope, and immediacy, as described below:

Threat Severity

- High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long-term recovery (>100 yr.).
- Moderate: Major reduction of species population or long-term degradation or reduction of habitat in area affected, requiring 50–100 yr. for recovery.
- Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.
- Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yrs.) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations is generally considered Insignificant as defined here.

Scope

- High: >60% of total population, occurrences, or area affected.
- Moderate: 20–60% of total population, occurrences, or area affected.
- Low: 5–20% of total population, occurrences, or area affected.
- Insignificant: <5% of total population or area affected.

Immediacy

- High: Threat is operational (happening now) or imminent (within a year).
- Moderate: Threat is likely to be operational within 2–5 yr.
- Low: Threat is likely to be operational within 5–20 yr.
- Insignificant: Threat not likely to be operational within 20 yr.

From:	Straight, Carrie A
To:	Reid, Rebekah N
Subject:	FW: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date:	Sunday, August 8, 2021 9:50:42 PM
Attachments:	hexletter.08.02.21.docx hexletter.06.24.21.docx Gaddy_COI_dwarf_flowered_heartleaf_20210803_signed.pdf

Rebekah,

Please find attached the peer review documents for dwarf flowered heartleaf.

Thanks,

Carrie

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Carrie A. Straight, PhD
She, her, hers

Regional Recovery Coordinator
South Atlantic-Gulf and Mississippi Basin Regions
U.S. Fish and Wildlife Service
Ecological Services
1875 Century Boulevard
Atlanta, Georgia 30345
404.679.7226 (office) or via Teams (carrie_straight@fws.gov)

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: L L Gaddy <llgaddy2@gmail.com>
Sent: Monday, August 2, 2021 3:08 PM
To: Straight, Carrie A <carrie_straight@fws.gov>
Subject: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Sorry I am so late. See two attached letters. Call me to discuss.

Chick 803 629-6128

On Fri, Jun 25, 2021 at 12:36 PM Straight, Carrie A <carrie_straight@fws.gov> wrote:

Dr. Gaddy,

The Fish and Wildlife Service is requesting your help by asking you to serve as a peer reviewer of our draft post delisting monitoring (PDM) plan for the dwarf-flowered heartleaf.

Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted due to recovery remains secure from risk of extinction after the protections of the Endangered Species Act (ESA) no longer apply. The primary goal of PDM is to monitor the species to ensure the status does not deteriorate, and if a substantial decline in the species (numbers of individuals or populations) or an increase in threats is detected, to take measures to halt the decline so that re-proposing it as a threatened or endangered species is not needed.

Section 4(g), added to the ESA in the 1988 reauthorization, requires the U.S. Fish and Wildlife Service to implement a system in cooperation with the states to monitor for not less than five years the status of all species that have recovered and been removed from the list of threatened and endangered plants and animals (50 CFR 17.11, 17.12, 224.101, and 227.4). This plan is being developed in accordance with the requirements of Section 4(g) of the ESA.

We ask for your comments on the draft PDM plan 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 and provide references when needed.
Please note that we are not seeking your opinion of the legal status of this species, but rather that the best available data and analyses were considered in reassessing its status.

Additionally, as part of the peer review process, we must evaluate the potential for conflicts of interest with the subject species or the action. Please complete the attached Conflict of Interest form and return it with any notes, comments, or questions that you are willing to provide along with your peer review.

By agreeing to participate in the peer review process for this species, you are considered an unpaid, volunteer consultant to assist the Service by providing the best scientific information and clarity in this document. As part of our reporting process under the Information Quality Act, we will also be listing your name and affiliation along with the comments in a document available to the public.

We hope that you view this peer review process as a worthwhile undertaking. Once you complete your review of the attached document, please submit comments and signed Conflict of Interest Form to the Atlanta Regional Office, to our Regional Recovery Coordinator, Carrie Straight. Your comments can be provided to Carrie by email carrie_straight@fws.gov or by letter (1875 Century

Boulevard, 4th Floor, Atlanta, Georgia 30345) and should be received by **July 16, 2021**, to help us complete the document. Thank you in advance for your assistance. We appreciate your time in helping complete this review. If you feel you cannot complete the review in the allotted time or would like to decline review, please let me know.

Thank you for your time,

Carrie

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Carrie A. Straight, PhD
She, her, hers

Regional Recovery Coordinator
South Atlantic-Gulf and Mississippi Basin Regions
U.S. Fish and Wildlife Service
Ecological Services
1875 Century Boulevard
Atlanta, Georgia 30345
404.679.7226 (office) or via Teams (carrie_straight@fws.gov)

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.

--

L. L. Gaddy, Ph. D., President
terra incognita

125 South Edisto Avenue
Columbia, South Carolina 29205

803 629-6128

www.tibooks.org

Yet all experience is an arch wherethro'
Gleams that untravell'd world...

"Ulysses," Tennyson

terra incognita
125 S. Edisto Avenue, Columbia, SC 29205
llgaddy2@gmail.com 803 629-6128

August 02, 2021

re: review of delisting plan for *Hexastylis naniflora*

Dr.. Carrie A. Straight, Ph. D.
Regional Recovery Coordinator
Fish and Wildlife Service
Atlanta
carrie_straight@fws,gov

Dr. Straight:

I have quickly and cursorily reviewed the *Hexastylis naniflora* delisting plan. I have no major comments on the science and methods of the plan, I think they seem very reasonable. My comments are general and on the nature of the species and how it differs from other listed species. In addition to the following comments, I have attached a letter I wrote to the Fish and Wildlife Service in June of this year.

Hexastylis naniflora is known only from 13 counties in two states. It is what biogeographers call a narrow endemic. It seems to only occur on special types of sandy loam soils in the upper Piedmont of SC and NC, but these soil types occur in other counties where the plant does not occur. We, therefore, do not know why it only occurs in these counties (the reason is probably related to historic distribution and original speciation). Also, the plant does not seem to occur in every ravine or on every bluff or in every spring that has its preferred habitat. I remember many field days when I found ideal habitat for the species, but there were no plants there.

The above problems, including the problem of endemism, brings up other issues. Because of its range and the number of populations already found, a saturation level of its maximum species richness has probably been reached. A good question to ask, therefore, is how many of the populations are protected by law. One must assume that all the unprotected populations could legally be destroyed if it were not state- or federally-listed. What would its protected range look like—that would be a good map. Smooth coneflower, for example, occurs from PA to GA, only a few populations are known, but every year or so a good population is found in SC or VA (one was found on Fort Jackson in SC last year). A similar situation exists with small-whorled pogonia, known from ME to GA. The sets of where the two above plants may occur are much larger than set of potential *Hexastylis nanflora* (and there is no delisting plan for those two).

This big thing that separates endemics from plants with more expansive ranges is that, with endemics, the historic range is the only place where you will probably every find the plant. It is therefore severely limited in possibilities. This must be understood and taken into consideration. I don't think it has heretofore (I also think the same thing about *Shortia galacifolia* and *Dionaea muscipula*, but that can be discussed later).

L. L. Gaddy, President
botanist, naturalist, and biogeographer
Ph. D., University of Georgia

terra incognita
125 S. Edisto Avenue, Columbia, SC 29205
llgaddy2@gmail.com 803 629-6128

June 24, 2021

re: Endangered and threatened species: removal of the dwarf-flowered heartleaf from the federal list of endangered and threatened plants

Sirs/Mme:

It can be asserted that as much as 50% of the known global population of *Shortia galacifolia* (Oconee bells) may have been inundated by the creation of Lake Jocassee along the Blue Ridge front in North and South Carolina. Oconee bells, like Venus flytrap (*Dionaea muscipula*) and *Hexastylis naniflora* (dwarf-flowered heartleaf) are all North Carolina-South Carolina endemics—species found only in these two states and nowhere else. If the Fish and Wildlife Service has their way, none of these three vascular plant species will be protected by Federal law.

As was the case with *Shortia*, acres of *Hexastylis naniflora* were probably destroyed by the creation of Lake Bowen in Spartanburg, South Carolina and Lake James in North Carolina. *Hexastylis naniflora* is a narrow endemic species found only on a few soil types, soils that occur along streams, in bogs, and on low bluffs. Like many endemics, *Hexastylis naniflora* is often locally common, even abundant, but its range is limited to the Piedmont of North and South Carolina. The rarity of endemics is misunderstood. Unlike many other plant species, population range and size are severely limited. The precise habitat of the endemic is determined by micro-features (such as soil types), and their mega-population size is controlled by geography. Because of genetic similarity from plant to plant, narrow endemics are very susceptible to extinction by disease or large ecological disasters (creation of lakes that inundate large populations of the plant). Our famous two-state endemics are part of our Carolina natural heritage and should all be protected and not delisted. If the Federal government will not protect these plants, who will? Let's keep *Hexastylis naniflora* on the list and add *Shortia galacifolia* and *Dionaea muscipula.*

L. L. Gaddy, botanist, naturalist, and biogeographer
Ph. D., University of Georgia, 1985; President of terra incognita

Gaddy, L. L. 1987. A review of the taxonomy and biogeography of *Hexastylis.* Castanea 52:186-196.
Whittemore, A. T. and L. L. Gaddy. 1997. *Hexastylis,* pp. 54-58 In *Flora of North America*, Volume 3, Oxford University Press, New York, London. 590 p.

U.S. Fish and Wildlife Service
Participation in Peer Review of the
Post Delisting Monitoring Plan Dwarf Flowered Heartleaf

CONFLICT OF INTEREST DISCLOSURE

NAME: L. L. GADDY TELEPHONE: 803 629-6128

ADDRESS: 125 S. EDISTO AVE

COLUMBIA SC 29205

EMAIL ADDRESS: llgaddy2@gmail.com

CURRENT EMPLOYER: terra incognita, ENV. Cons., President

Please complete, **sign** and **date** the form on the last page, and **return the form to** Carrie Straight at carrie_straight@fws.gov. **Please retain a copy for your records**.

CONFLICT OF INTEREST DISCLOSURE

INSTRUCTIONS

It is essential that a peer reviewer used by the U.S. Fish and Wildlife Service as part of its peer review of proposed listing and proposed critical habitat rules under the ESA report any conflict of interest. For this purpose, **the term "conflict of interest" means any financial or other interest which conflicts with the service of the individual because it (1) could significantly impair the individual's objectivity or (2) could create an unfair competitive advantage for any person or organization.**[1] In those situations in which the Service determines that a conflict of interest is unavoidable we will publicly disclose the conflict of interest.

The term "conflict of interest" means something more than individual bias. There must be an *interest* that could be directly affected by your participation as a peer reviewer.

[1] This definition and the other information in these instructions are drawn from the National Academy of Sciences Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports (May 12, 2003).

The following questions are designed to elicit information from you concerning possible conflicts of interest that are relevant to the functions to be performed by your peer review.

1. EMPLOYMENT. (a) If the information received by the Service through the peer review process were to provide the basis for government regulatory action or inaction with respect to the species--

(i) If you are employed or self-employed, could your current employment or self-employment (or your spouse's current employment or self-employment) be directly affected?

(ii) To the best of your knowledge, could any financial interests of your (or your spouse's) employer or, if self-employed, your (or your spouse's) clients and/or business partners be directly affected?

(iii) If you are an officer, director or trustee of any corporation or other legal entity, could the financial interests of that corporation or legal entity be directly affected?

(iv) If you are a consultant (whether full-time or part-time), could there be a direct effect on any of your current consulting relationships?

(v) Regardless of the potential effect on the consulting relationship, do you have any current or continuing consulting relationships (including, for example, commercial and professional consulting and service arrangements, scientific and technical advisory board memberships, serving as an expert witness in litigation, or providing services in exchange for honorariums and travel expense reimbursements) that are directly related to the subject matter of the possible government regulatory action or inaction?

(b) If you are or have ever been a U.S. Government employee (either civilian or military), to the best of your knowledge, are there any federal conflict of interest restrictions that may be applicable to your service in connection with this peer review?

(c) If you are a U.S. Government employee, are you currently employed by the Service?

If the answer to all of the above questions under EMPLOYMENT is either "no" or "not applicable," check here [X] (NO).

If the answer to any of the above questions under EMPLOYMENT is "yes," check here [ ] (YES), and briefly describe the circumstances on the last page of this form.

2. INVESTMENT INTERESTS. Taking into account stocks, bonds, and other financial instruments and investments including partnerships (but excluding broadly diversified mutual funds and any investment or financial interest valued at less than $10,000), if the

information received by the Service through the peer review process were to provide the basis for government regulatory action or inaction with respect to the species --

(a) Do you or your spouse or minor children own directly or indirectly (e.g., through a trust or an individual account in a pension or profit-sharing plan) any stocks, bonds or other financial instruments or investments that could be affected, either directly or by a direct effect on the business enterprise or activities underlying the investments?

(b) Do you have any other significant financial investments or interests such as commercial business interests (e.g., sole proprietorships), investment interests (e.g., stock options), or personal investment relationships (e.g., involving parents or grandchildren) that could be affected, either directly or by a direct effect on the business enterprise or activities underlying the investments?

If the answer to all of the above questions under INVESTMENT INTERESTS is either "no" or "not applicable," check here [X] (NO).

If the answer to any of the above questions under INVESTMENT INTERESTS is "yes," check here [ ] (YES), and briefly describe the circumstances on the last page of this form.

3. PROPERTY INTERESTS. Taking into account real estate and other tangible property interests, as well as intellectual property (patents, copyrights, etc.) interests, if the information received by the Service through the peer review process were to provide the basis for government regulatory action or inaction with respect to the species --

(a) Do you or your spouse or minor children own directly or indirectly any such property interests that could be directly affected?

(b) To the best of your knowledge, do any others with whom you have substantial common financial interests (e.g., employer, business partners, etc.) own directly or indirectly any such property interests that could be directly affected?

If the answer to all of the above questions under PROPERTY INTERESTS is either "no" or "not applicable," check here [X] (NO).

If the answer to any of the above questions under PROPERTY INTERESTS is "yes," check here [ ] (YES), and briefly describe the circumstances on the last page of this form.

4. RESEARCH FUNDING AND OTHER INTERESTS. (a) Taking into account your research funding and other research support (e.g., equipment, facilities, industry partnerships, research assistants and other research personnel, etc.), if the information

received by the Service through the peer review process were to provide the basis for government regulatory action or inaction with respect to the species --

(i) Could the research funding and support for you or your close research colleagues and collaborators be directly affected, or

(ii) If you have any research agreements for current or continuing research funding or support from any party whose financial interests could be directly affected, and such funding or support is directly related to the subject matter of the regulatory process, do such agreements significantly limit your ability to independently conduct and publish the results of your research?

(b) Is the central purpose of the proposed rule for which this disclosure form is being prepared a critical review and evaluation of your own work or that of your employer?

(c) Do you have any existing professional obligations (e.g., as an officer of a scientific or engineering society) that effectively require you to publicly defend a previously established position on an issue that is relevant to the proposed rule?

(d) To the best of your knowledge, will your participation in this peer review process enable you to obtain access to a competitor's or potential competitor's confidential proprietary information?

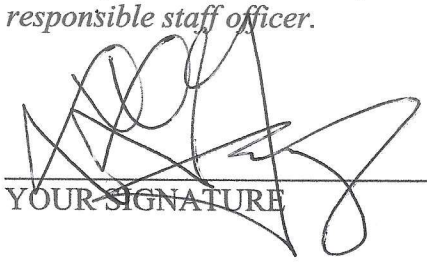
(e) Could your service as a peer reviewer create a specific financial or commercial competitive advantage for you or others with whom you have substantial common financial interests?

If the answer to all of the above questions under RESEARCH FUNDING OR OTHER INTERESTS is either "no" or "not applicable," check here [X] (NO).

If the answer to any of the above questions under RESEARCH FUNDING OR OTHER INTERESTS is "yes," check here [ ] (YES), and briefly describe the circumstances below.

EXPLANATION OF "YES" RESPONSES:

During your period of service in connection with the activity for which this form is being completed, any changes in the information reported, or any new information, which needs to be reported, should be reported promptly by written or electronic communication to the responsible staff officer.



YOUR SIGNATURE

08/07/21
DATE

Reviewed by: CARRIE STRAIGHT Digitally signed by CARRIE STRAIGHT Date: 2021.08.08 21:41:03 -04'00'

Regional Liaison
U.S. Fish and Wildlife Service

Date

BASIC COMMUNICATIONS STRATEGY

FOR ROUTINE NON-CONTROVERSIAL ANNOUNCEMENTS

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?**

   TBD. 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.

- This is the first North Carolina species ever recovered to the point of removal from the endangered species list since the Peregrine falcon in 1999.

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	7/1/2018
Digital photo album	ASFO	7/1/2018
Facebook post	ASFO	7/1/2018
Twitter post	ASFO	7/1/2018

FAQs	ASFO	7/1/2018

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. It would be the first North Carolina species recovered since the Peregrine falcon was removed from the list in 1999.
- 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

12. Congressional member email list

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?)

Agreement NO: F11AC00697
Cost Center: FF04EN1000
WBS: FG.ES11130400000.D2 ($18,000 FY12)

DUNS NO: 809785280

MODIFICATION NO. 1

TO THE

COOPERATIVE AGREEMENT

BETWEEN

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

and

OFFICE OF CONSERVATION, PLANNING & COMMUNITY AFFAIRS
NORTH CAOLINA DEPT. OF ENVIRONMENT & NATURAL RESOURCES

This modification provides for additional funding during fiscal year 2012, and revises the Scope of Work.

1. Article V, SCOPE OF EFFORT

Specifically, the Service will:

Provide an additional $18,000 to the Recipient for a third year of objectively monitoring *Hexastylis naniflora* population trends, assessing threats, collecting updated estimates of population size and geo-referencing the delineation of occupied habitat in 15 sites within North and South Carolina.

2. Article VII, AWARD AMOUNT, is revised by:

B. TOTAL AMOUNT FUNDED TO DATE: $64,500

3. Article VIII, APPROPRIATION DATA:

APPROPRIATION: FF04EN1000-FG.ES11130400000.D2 ($18,000)

All other terms and conditions remain the same.

U.S. DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

BY: _____

TITLE:_____

DATE:_____

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

<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
Rebekah Reid, rebekah_reid@fws.gov; 828/258-3939, ext. 238

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 <insert waterway>. 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 known populations of dwarf-flowered heartleaf, scattered across 10 North Carolina and three South Carolina counties. Of those 119 populations, 28 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 that it has become a conservation success story," said Service botanist Rebekah Reid.

Key to that conservation efforts 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 biggest protectors, having acquired sites to address impacts from road construction over the years, including land that became part of Cleveland County's Broad River Greenway.

This would be the first time a North Carolina plant or animal has been recovered to the point of delisting since the Peregrine falcon was delisted in 1999.

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 proposed delisting appears in the <insert Federal Register notice info>. The proposal is open for public comment for X days.

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.

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.

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Briefing Paper for Departmental Clearance of *Federal Register* Documents

I. Subject: Proposed Rule to Remove the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Wildlife

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 due to recovery. Threats to this species have been eliminated or reduced to the point that the species no longer meets the definition of an endangered species or a threatened species under the Endangered Species Act. The dwarf-flowered heartleaf is a plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina.

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, email

b. Does this document require a press release?

☒ Yes. ☐ No.

Press release title: Conservation Success Story: Threatened Plant Proposed for Removal from the 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: Click here, or as priorities allow.

No-later-than date to clear DOI (if applicable): Click here.

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 (use this space to provide additional helpful information): 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:

Name: Gary Frazer. Assistant Director – Ecological Services

Phone: 202-208-4646

Email: gary_frazer@fws.gov

DWARF-FLOWERED HEARTLEAF ELICITATION QUESTIONS

Below is an overview of the questions we are asking for your expert feedback on. Each question is elaborated on in a new page below with information I've gleaned from the literature and reports. Please record your answers and insights on the following pages and return to me via email by Friday, January 26. Thank you! - Mike

1. How would you suggest delineating populations for this species?

2. What factors are important for characterizing resilience for this species? These include population factors (e.g. population size/density) and habitat factors (e.g. soil type, canopy cover).

3. How would you suggest delineating representative units for this species?

4. In thinking about future scenarios and viability of this species, what are the most pertinent risk factors to consider (e.g. development, invasive species, climate change)?

5. Based on the primary risk factors identified in question #4, what do you think an appropriate future time frame to project future conditions might be?

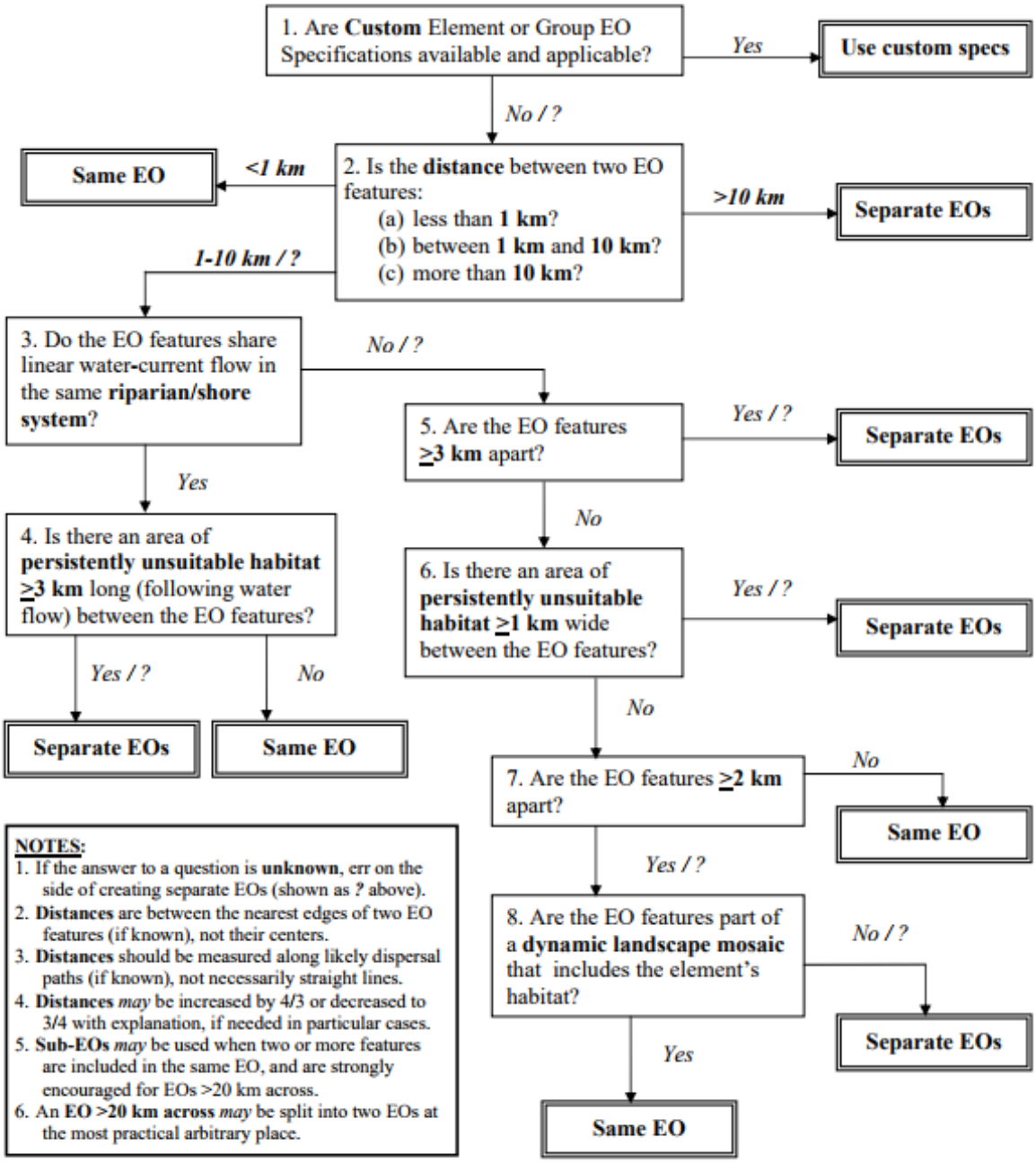
1. How would you suggest delineating populations for this species?

Under the 3 R's framework (resilience, redundancy, and representation), resilience is measured at the scale of a population, and resilient populations are then scaled up to assess redundancy and representation for the whole species. Because the population is the basic unit, it is important to define what constitutes a population. Recently, a "population" was defined based on NatureServe's separation distance criteria for a plant species of 1 km between separate populations/element occurrences. Pasted on the following page is their decision tree (full document here: http://www.natureserve.org/library/deliminting_plant_eos_Oct_2004.pdf). This seems to be the standard for this species and is used in NCNHP reports and the 5-year review. 1 km is the default separation distance, which they recommend altering if additional information or species characteristics warrant it. As of 2016, the combined databases of the NCNHP and SCNDNR contain 239 Element Occurrence Records (EORs) for *H. naniflora* (NCNHP2016, SCDNR 2016). These EORs depict roughly 113 locations which are sufficiently geographically distinct to be regarded as proxies for populations of the species

Based on the Natureserve guidelines or other information currently known, would you suggest using a criterion other than 1 km of separation between distinct populations? If so, what information is that based on (e.g. dispersal vectors or distances, pollinator behavior, genetic results)?

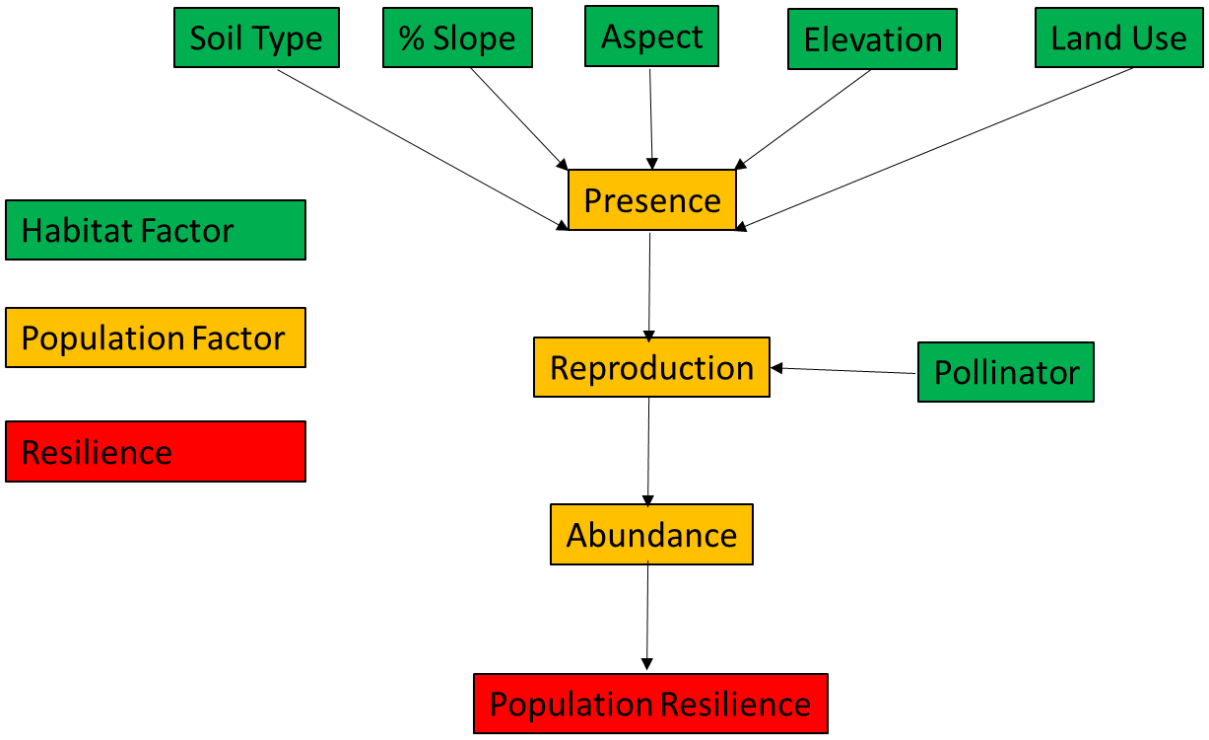
Answer:

Figure 1. Habitat-based Plant Element Occurrence Delimitation Guidance, 1 October 2004



2. What factors are important for characterizing resilience for this species? These include population factors (e.g. population size/density) and habitat factors (e.g. soil type, canopy cover).

These are the factors that we will use for each population to determine its resilience (whether it is a resilient vs. not resilient classification, or low-medium-high resilience, or some other kind of ranking). Based on the literature, there seem to be a few logical factors to include in the SSA (see influence diagram below). To the extent possible, some of these factors would be used in a model to quantify, to the extent possible, current and future condition of the species, and ultimately viability.



Potential habitat seems to be based on a few factors: soil type (occur in 4 soil types, mainly Pacolet sandy loam), % slope (8-10%), aspect (prefer north facing), elevation (199-415 m), and land use (i.e. deciduous forest).

The main population factor driving resilience of a given population seems to be population size. Given habitat is available and the species is present, reproduction must occur for a population to grow, and that is at least partly influenced by presence of pollinators, which seem to be mainly ants.

Other considerations: connectivity for cross-pollination/seed dispersal (distance from nearest neighbor population); Protected- either protected conservation land or some kind of landowner agreement.

Based on your knowledge of the species biology and needs. Feel free to select the most important ones from my preliminary list, please add any important things I missed, and by all means argue against anything on my list or otherwise that isn't an important contributor. While there are many factors that interact to influence populations, our goal is narrow it down to the most important factors for our assessment.

Answer:

3. How would you suggest delineating representative units for this species?

Representation refers to the species ability to adapt to changing environmental conditions, and can also be thought of as diversity. This can be genetic diversity and/or diversity in habitat types, life history traits, or other characteristics that could be indicative of underlying genetic diversity.

For dwarf-flowered heartleaf, one could argue that here are no representative units, that there is only one "type". Support for this idea is the limited range of the species. Other ideas might stem from some of the genetic analyses for the species, indicating some type of latitudinal variation. The STRUCTURE analysis provides strong evidence that populations in the southern part of the range of *H. naniflora* are not subject to significant hybridization pressures, whereas populations in the southeast portion of the range appear to by hybridizing with *H. minor* and populations in the northern portion of the range appear to form a hybrid swarm with *H. heterophylla* and *H. minor*. Would this suggest representative units for the species based on a north-south-southeast split? Where might that split be mapped for purposes of the SSA? Watersheds? Basins?

Given your expertise and experience, would you suggest delineating different representative units for the species? If so, how? Alternately, would you suggest there is only one "type" across the species range? If so, why?

Answer:

4. In thinking about future scenarios and viability of this species, what are the most pertinent risk factors to consider (e.g. development, invasive species, climate change (temp, precip, etc))?

> For the SSA, we will define a set of possible future scenarios, and assess what future resilience, redundancy, and representation might look like under those scenarios. What are the most important factors to consider that could influence species viability now and into the future that we need to consider when defining future scenarios?

Answer:

5. Based on the primary risk factors identified in question #4, what do you think an appropriate future time frame to project future conditions might be?

When we project populations into the future under different scenarios, we will need to be explicit about how far into the future we are projecting. Based on the risk factors identified above, *HENA* life history/generation times, uncertainty associated with the risk factors and *HENA* responses to them, over what time frame do you think we can reasonably predict future population conditions?

DWARF-FLOWERED HEARTLEAF ELICITATION QUESTIONS

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1. How would you suggest delineating populations for this species?

I am not sure there is a good approximation for defining a population. We are still unsure of its pollinator's or seed dispersers. We do know that ants enjoy the elaiosomes attached to the seed, but I believe more work is needed.

2. What factors are important for characterizing resilience for this species? These include population factors (e.g. population size/density) and habitat factors (e.g. soil type, canopy cover).

I think we understand that H nanaflora has some preference for soil type (see Wagner Thesis from ASU).

3. How would you suggest delineating representative units for this species?

I do not have a reasonable answer here.

4. In thinking about future scenarios and viability of this species, what are the most pertinent risk factors to consider (e.g. development, invasive species, climate change)?

Development

5. Based on the primary risk factors identified in question #4, what do you think an appropriate future time frame to project future conditions might be?

1. How would you suggest delineating populations for this species?

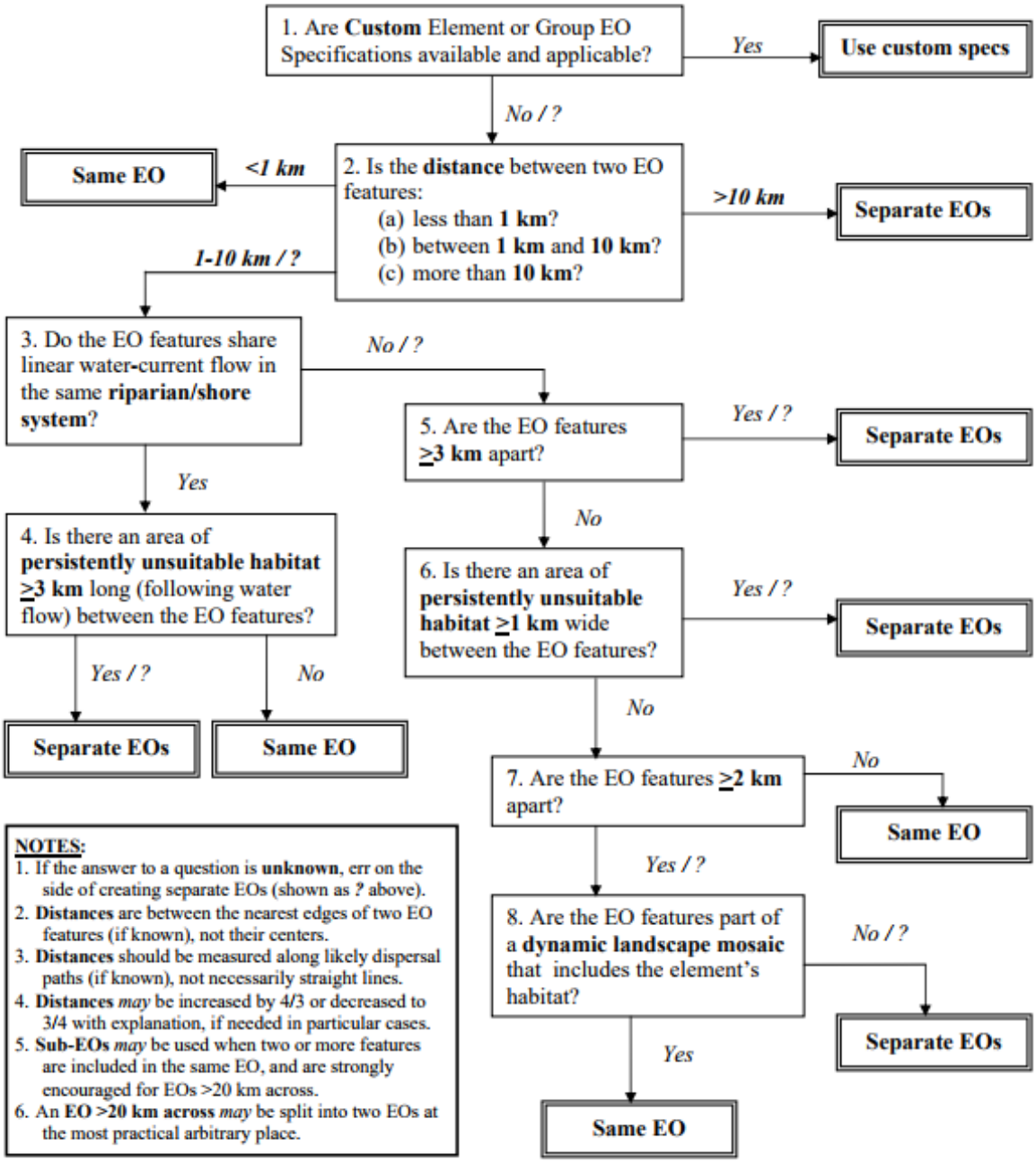
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Based on the Natureserve guidelines or other information currently known, would you suggest using a criterion other than 1 km of separation between distinct populations? If so, what information is that based on (e.g. dispersal vectors or distances, pollinator behavior, genetic results)?

Answer:

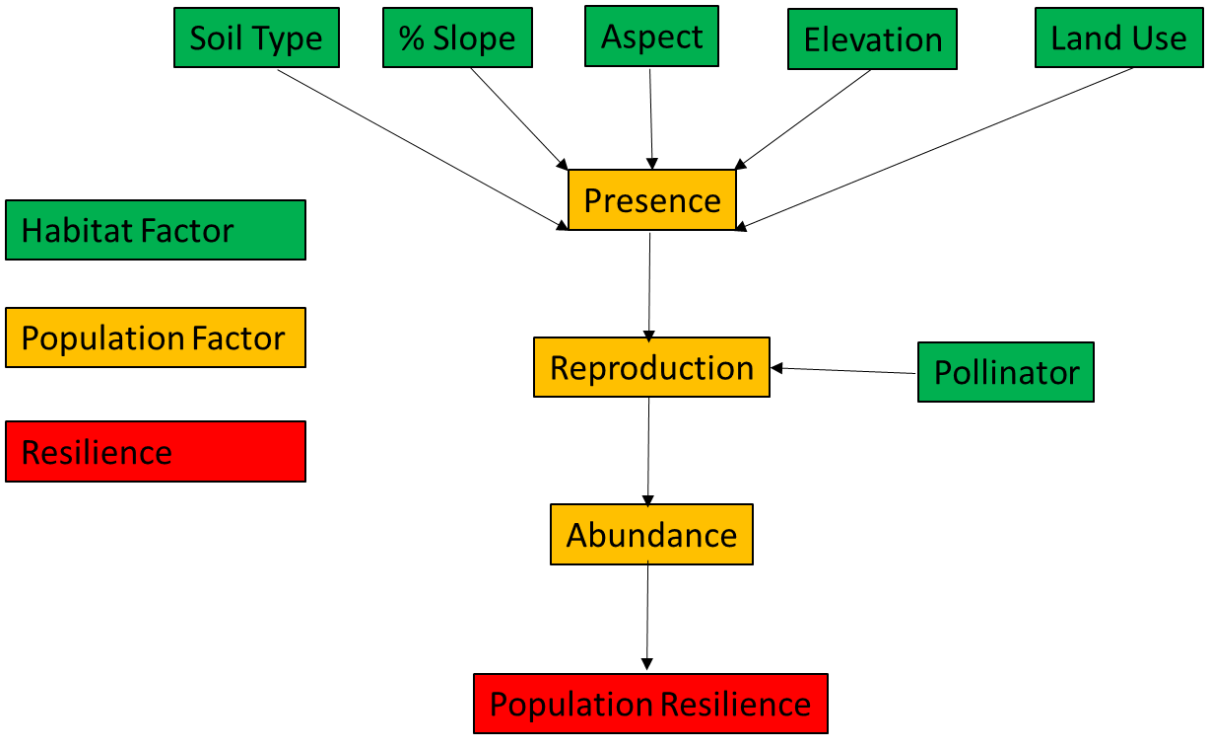
We do have some genetic data in hand that suggests the 239 EO's is an inflated number. The species description and field identification has been expanding ever since it was listed. There have been several conversations about revisiting the morphological characteristics of the species to more narrowly define the species. Our research suggests that H. nanaflora as originally described is found in the southern part of the EO's, but that the northern portion is something else. The genetic analysis to support this is complete, but a review of the morphology is ongoing (Murrell lab @ Appstate) and a new species has not yet been described.

Figure 1. Habitat-based Plant Element Occurrence Delimitation Guidance, 1 October 2004



2. What factors are important for characterizing resilience for this species? These include population factors (e.g. population size/density) and habitat factors (e.g. soil type, canopy cover).

These are the factors that we will use for each population to determine its resilience (whether it is a resilient vs. not resilient classification, or low-medium-high resilience, or some other kind of ranking). Based on the literature, there seem to be a few logical factors to include in the SSA (see influence diagram below). To the extent possible, some of these factors would be used in a model to quantify, to the extent possible, current and future condition of the species, and ultimately viability.



Potential habitat seems to be based on a few factors: soil type (occur in 4 soil types, mainly Pacolet sandy loam), % slope (8-10%), aspect (prefer north facing), elevation (199-415 m), and land use (i.e. deciduous forest).

The main population factor driving resilience of a given population seems to be population size. Given habitat is available and the species is present, reproduction must occur for a population to grow, and that is at least partly influenced by presence of pollinators, which seem to be mainly ants.

Other considerations: connectivity for cross-pollination/seed dispersal (distance from nearest neighbor population); Protected- either protected conservation land or some kind of landowner agreement.

Based on your knowledge of the species biology and needs. Feel free to select the most important ones from my preliminary list, please add any important things I missed, and by all means argue against anything on my list or otherwise that isn't an important contributor. While there are many factors that interact to influence populations, our goal is narrow it down to the most important factors for our assessment.

Answer:

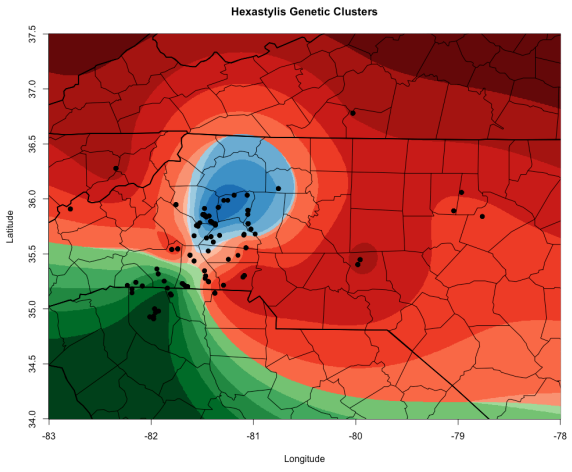
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Given your expertise and experience, would you suggest delineating different representative units for the species? If so, how? Alternately, would you suggest there is only one "type" across the species range? If so, why?

Answer:
I disagree with the analyses that lead to a conclusion of hybridization. I am aware that folks thought that was happening, but our most recent exploration of the data suggest a southern H. nanaflora and a northern H. xxx (still to be described). I no longer argue that hybridization is occurring. This confusion is partly caused by field identification with an ever expanding species definition. Please see the attached graphic. The green area represents "true" H. nanaflora, the Blue represents a possible new species, and the red represents other species in the genus (H. minor, H. heterophylla, ect.) I can provide GPS coordinates for all of the individuals.



4. In thinking about future scenarios and viability of this species, what are the most

pertinent risk factors to consider (e.g. development, invasive species, climate change (temp, precip, etc))?

> For the SSA, we will define a set of possible future scenarios, and assess what future resilience, redundancy, and representation might look like under those scenarios. What are the most important factors to consider that could influence species viability now and into the future that we need to consider when defining future scenarios?

Answer:
Unsure how to respond – lack expertise.

5. Based on the primary risk factors identified in question #4, what do you think an appropriate future time frame to project future conditions might be?

> When we project populations into the future under different scenarios, we will need to be explicit about how far into the future we are projecting. Based on the risk factors identified above, *HENA* life history/generation times, uncertainty associated with the risk factors and *HENA* responses to them, over what time frame do you think we can reasonably predict future population conditions?
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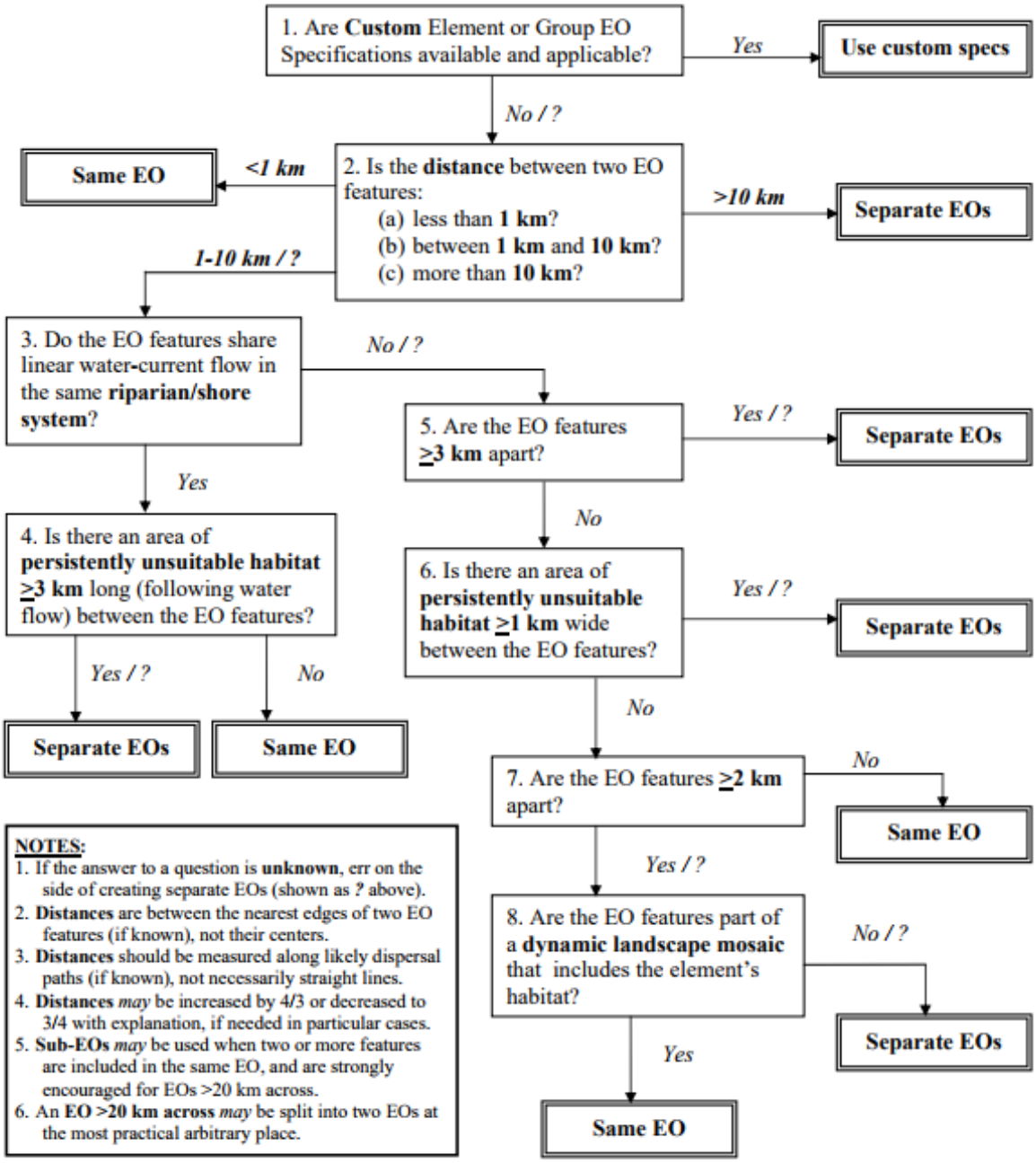
Based on the Natureserve guidelines or other information currently known, would you suggest using a criterion other than 1 km of separation between distinct populations? If so, what information is that based on (e.g. dispersal vectors or distances, pollinator behavior, genetic results)?

Answer:

As part of the NatureServe Network, NCNHP uses the NatureServe Guidelines. The term "population" refers to parent Element Occurrence records (Eos) and all associated subEOs within them, as delineated by the N.C. Natural Heritage Program. In general occurrences are considered separate when 2 km or more suitable habitat distance separates them, and when 1 km unsuitable habitat separates locations. In some circumstances, less than 1 km separates populations as when a major highway like I-74 occurs between locations or when occurrences are in separate watersheds. Comments on separation distances are recorded for each record as data are added or updated.

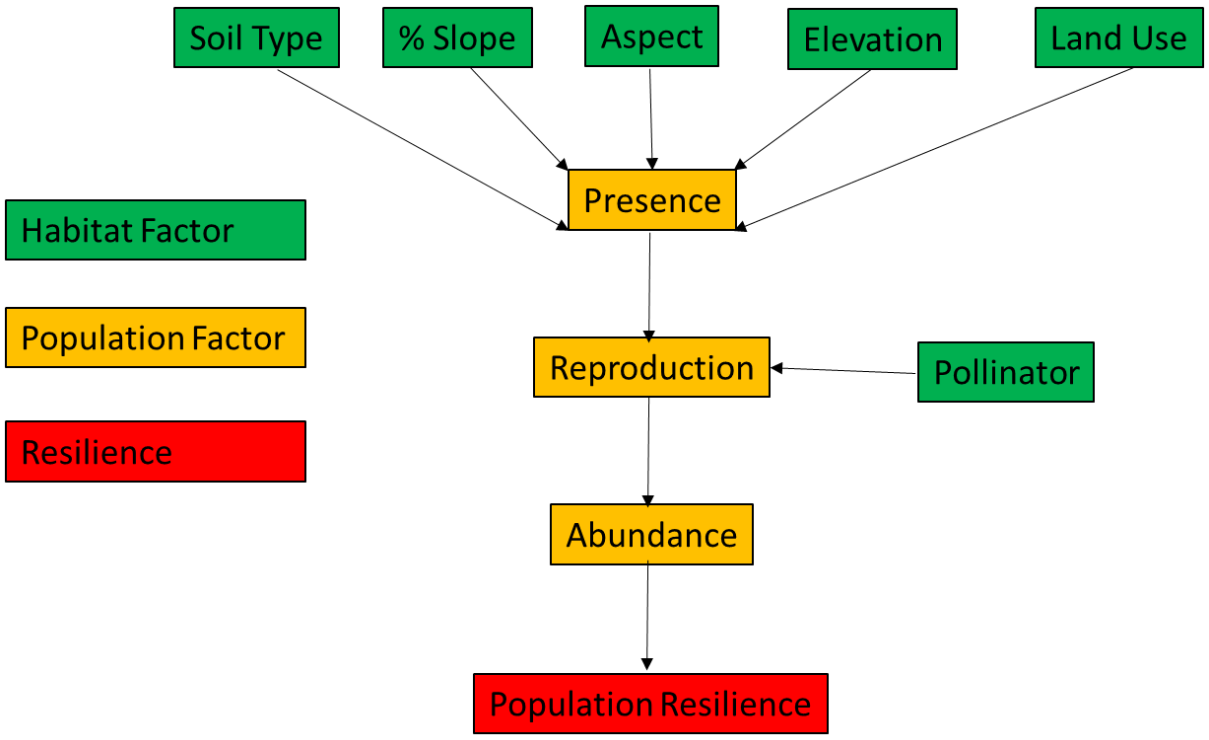
NCNHP procedures are outlined in more detail in the 2016 Dwarf-flowered Heartleaf (*Hexastylis naniflora*) Range-wide Status Report, Appendix B1 B1 (enclosed with email response).

Figure 1. Habitat-based Plant Element Occurrence Delimitation Guidance, 1 October 2004



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Based on your knowledge of the species biology and needs. Feel free to select the most important ones from my preliminary list, please add any important things I missed, and by all means argue against anything on my list or otherwise that isn't an important contributor. While there are many factors that interact to influence populations, our goal is narrow it down to the most important factors for our assessment.

Answer:

The factors used for NCNHP rank specifications are similar to the ones mentioned for Resilience. I have included the rank specifications here:

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).

NCNHP procedures are outlined in more detail in the 2016 Dwarf-flowered Heartleaf (*Hexastylis naniflora*) Range-wide Status Report, Appendix B1 (enclosed with email response).

3. How would you suggest delineating representative units for this species?

> Representation refers to the species ability to adapt to changing environmental conditions, and can also be thought of as diversity. This can be genetic diversity and/or diversity in habitat types, life history traits, or other characteristics that could be indicative of underlying genetic diversity.
>
> For dwarf-flowered heartleaf, one could argue that here are no representative units, that there is only one "type". Support for this idea is the limited range of the species. Other ideas might stem from some of the genetic analyses for the species, indicating some type of latitudinal variation. The STRUCTURE analysis provides strong evidence that populations in the southern part of the range of *H. naniflora* are not subject to significant hybridization pressures, whereas populations in the southeast portion of the range appear to by hybridizing with *H. minor* and populations in the northern portion of the range appear to form a hybrid swarm with *H. heterophylla* and *H. minor*. Would this suggest representative units for the species based on a north-south-southeast split? Where might that split be mapped for purposes of the SSA? Watersheds? Basins?
>
> Given your expertise and experience, would you suggest delineating different representative units for the species? If so, how? Alternately, would you suggest there is only one "type" across the species range? If so, why?

Answer:

NCNHP has used hydrologic units to separate occurrences that are less than 2 km apart, but are not within the same stream drainage, however unsuitable habitat also exists in those cases. In informal review of mapped records, the close association of occurrences to hydrology leads to speculation about HENA's biological relationship to watersheds and river basins (see figure below of a section of the Upper Broad River hydrology layer over-lain with HENA features).

NCNHP does document results of genetic work on the species within EO records when the work indicates uncertainty about the identity of the plants at the location. The genetic work referred to in the question is preliminary and may not be appropriate to base a decision on until it is peer-reviewed.

There is uncertainty if there is one type, and there may be only one as Master's thesis research from Padgett (2004) and Niedenberger (2010) indicate that the pollen morphology of HENA is unique. Without comparison of pollen in conjunction with genetic analysis of those individuals, a north-south-southeast split may not be appropriate based on preliminary genetic work alone. For the purposes of the SSA, splitting at the watershed or basin level would be appropriate.

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.

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

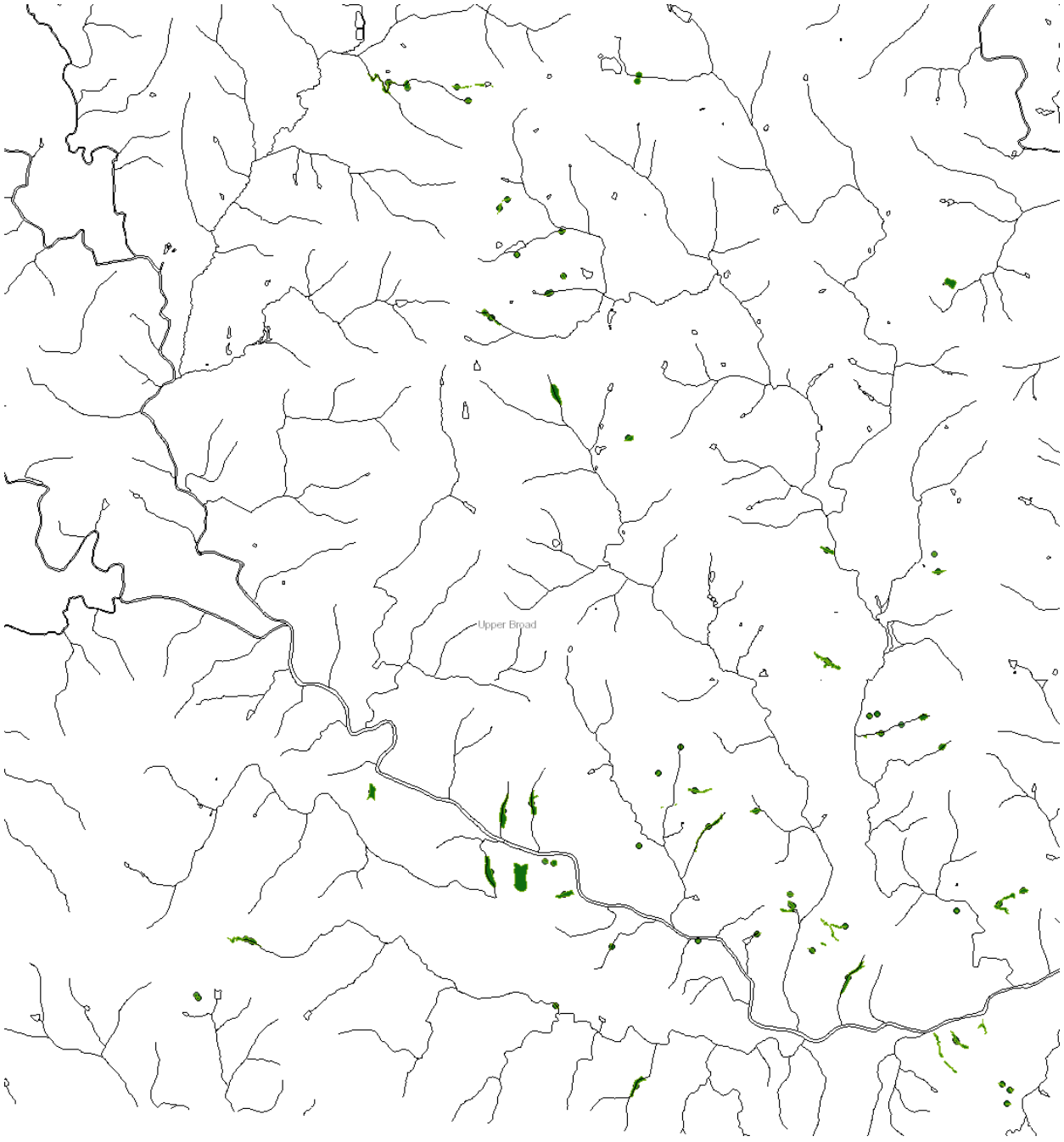


Figure of Hexastylis naniflora records along the Upper Broad River hydrological layer (NCNHP 2018-01)

4. In thinking about future scenarios and viability of this species, what are the most pertinent risk factors to consider (e.g. development, invasive species, climate change (temp, precip, etc))?

> For the SSA, we will define a set of possible future scenarios, and assess what future resilience, redundancy, and representation might look like under those scenarios. What are the most important factors to consider that could influence species viability now and into the future that we need to consider when defining future scenarios?

Answer:
Threats to this species occur at low to moderate levels and include agricultural threats such as incompatible forestry practices and disturbance from cattle, impacts from transportation improvements to roads and highways, damage from recreational activities including foot traffic and ORV use, invasive plant species, residential and commercial development, and siltation and erosion resulting from severe weather.

NCNHP procedures are outlined in more detail in the 2016 Dwarf-flowered Heartleaf (*Hexastylis naniflora*) Range-wide Status Report, Appendix B4 (enclosed with email response).

5. Based on the primary risk factors identified in question #4, what do you think an appropriate future time frame to project future conditions might be?

When we project populations into the future under different scenarios, we will need to be explicit about how far into the future we are projecting. Based on the risk factors identified above, *HENA* life history/generation times, uncertainty associated with the risk factors and *HENA* responses to them, over what time frame do you think we can reasonably predict future population conditions?

The Billing Code 4333-15-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2018-0081; FXES11130900000-189-FF0932000]

RIN 1018-BE00

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

Application for Flexible Funds

Station or Ecosystem Submitting Proposal: **Asheville Field Office**

(1) Project Title: **Collection of data to support delisting of *Hexastylis naniflora***
(2) Region: **4** (3) State: **NC**
(4) Ecoteam Rank:_____ (5) Overall Team Rank (Optional):__
(6) Primary Fund Source: **1113** (7) Alternate Fund Source: **1112**
(8) Cross-Team Project: **No** (9) Cross Regional Project: **No**
(10) Dollar Amount Being Requested: **$18,000 (year 3 of 3)**
Region **4** Amount Requested from this Region: **$18,000 (year 3 of 3)**
(11)Organizational Code: **42910** (12) Station Name: **ASNC Field Office**
(13) Location: **Asheville, NC** (14) Fiscal Year Funded: _____
(15) Date Accomplished: _____ (16) Project Type: _____
(17) Duration: **5 Years**
(18) Station/Stations Receiving Funds: **Asheville Field Office**
(19) Description:

Background

When *Hexastylis naniflora* (dwarf-flowered heartleaf) was federally listed in 1989, there were 24 extant populations across the species' range. The estimated number of individuals (typically counted as "clumps", or rosettes) exceeded 5,000 plants, with > 60% of these occurring in three large populations each estimated to contain over 1,000 rosettes. As of 2010, there are an estimated 108 populations of the species (USFWS 2010; NC NHP, 2010; SCDNR, 2010). Thus, the total number of populations has increased roughly four-fold (from 24 to 108) since the species was listed. The total number of populations last estimated to exceed 1,000 rosettes (27 populations, or 24%) is also now greater than the total number of populations known when the species was listed.

Given the nearly four-fold increase in the number of known populations, *H. naniflora* is not likely to be as threatened with extinction as previously thought. However, in addition to considerations relating to overall abundance, any decision to remove *H. naniflora* from the federal list must include an assessment of whether identified threats to the species have been appreciably reduced, or else a demonstration that *H. naniflora* is more resilient to identified threats than previously thought.

H. naniflora is regularly subject to adverse impacts from activities requiring formal consultation with USFWS, with all or portions of 22 populations of *H. naniflora* having been adversely impacted from activities requiring formal Section 7 consultation (USFWS 2010). A review of best available information reveals that another 20 populations are imminently threatened by one or more factors known to adversely affect the species (e.g., encroaching residential development, invasive exotic vegetation, sedimentation/erosion, trash disposal, or all-terrain vehicles) (USFWS 2010; NC NHP 2010; SCDNR 2010). Therefore, demonstrable threats either have already affected or are imminent at nearly 40% of all known populations. Given this reality, any proposal to remove *H. naniflora* from the federal list must first demonstrate that the species is either adequately protected from, or resilient to, these threats.

Section 7 consultations addressing adverse effects to *H. naniflora* have resulted in protections for significant portions of 30 populations, either through conservation measures or conservation recommendations. The majority of these protected areas have been acquired or otherwise set aside by the North Carolina Department of Transportation (NCDOT), either in the form of off-site (located outside of the footprint of road projects) or on-site (within road rights-of-way) conservation areas. Significant portions of other populations are protected by entities including the National Park Service (Cowpens National Battlefield), Duke Power (Cliffside Stream Station and Paddy Creek), the Spartanburg Water

System in South Carolina (Blalock Reservoir), and the South Carolina Department of Natural Resources (Peters Creek). However, in most cases these populations are only protected from overt habitat loss through land use conversion, because most land owners lack the resources to actively manage *H. naniflora* against other threats such as invasive exotic species, sedimentation and/or erosion, illegal timber harvest, or all-terrain vehicles.

While preparing the most recent five year review for *H. naniflora*, the USFWS noted significant concerns with the best available estimates of population size across the range of the species, for both protected and unprotected populations (USFWS 2010). Most available estimates represent partial population surveys conducted by different observers in different years, usually using widely different protocols and levels of survey effort (NC NHP, 2010; SCDNR, 2010; see also discussion in USFWS 2010). This makes it difficult to assess the true size of existing populations, and because most sites have been visited only once, it is also makes it nearly impossible to determine whether existing populations are stable in the face of known threats. In the event of a decision to remove the species from the federal list of threatened and endangered species, the lack of adequate information on population size and trends also provides no baseline against which to compare the results of post-delisting monitoring (required by statute).

In recognition of the incomplete information regarding range-wide status and trends, the lack of landowner commitment to control known threats at sites in protective ownership, and suggestions of apparent declines at some sizable populations (some under protective ownership), the USFWS was unable to recommend de-listing in the most recent five year review for *Hexastylis naniflora* (USFWS 2010). Instead, the USFWS recommended that robust estimates of population size and trends be acquired for those sites expected to factor heavily into this species' recovery, with the intent of objectively evaluating whether this species remains appreciably threatened with extinction. The current proposal seeks funds to implement actions recommended by the USFWS in the most recent five year review for this species (USFWS 2010).

As a result of commitments pledged over many years of formal Section 7 consultations with the USFWS, NCDOT now protects more populations (or significant portions of them) than any other entity throughout the range of *H. naniflora*. However, there is a critical need to verify the number of plants remaining post-construction, the survival of transplanted individuals, the number of rosettes protected within ROWs, and/or the number of rosettes protected via off-site land purchases across these numerous sites. In 2009, the NCDOT pledged to provide this information for all or portions of 12 populations, as a conservation measure for yet another project involving adverse effects to *H. naniflora* that required formal Section 7 consultation (USFWS 2009). NCDOT has estimated the person-days and costs associated with the collection of this information (see Cooperator Table, item 24 below). This proposal seeks to leverage the matching contributions from NCDOT by obtaining contemporaneous updates at additional populations across the range of *H. naniflora*, in the hopes that this collective body of information will provide the information necessary for an objective assessment of whether or not de-listing is appropriate, and an adequate baseline against which the statutorily required post-delisting monitoring data can be compared.

Project description

This proposal seeks funds to obtain updated information on status and trends at those populations expected to play a substantive role in the recovery of *H. naniflora*, including several populations at which protective measures were either pledged or recommended in conjunction with previous Section 7 consultations. Field work would target those populations last estimated to contain over 1,000 rosettes of *H. naniflora* and/or those populations expected to afford long-term protection to the species, for which the USFWS currently lacks updated information on species' status, trends and threats. The populations targeted by this proposal are in addition to the 12 populations for which NCDOT has previously pledged to provide substantive status updates. A preliminary list of populations expected to be targeted by this

proposal, along with preliminary estimates of the requisite number of field days associated with adequately surveying each site, is provided in Table 3.

At each population, the following information will be provided during the first field season:

- An updated estimate of population size
- A geo-referenced delineation of occupied habitat
- A protocol for objectively monitoring population trends (obtained either through a census or sampling, depending upon the overall size of the population and other factors)
- An objective, standardized assessment of threats (employing the use of categorical rankings)

During the following two field seasons, each population will again be monitored for significant changes in overall abundance, spatial extent, and the magnitude, severity and scope of known or suspected threats. These trend data will provide the baseline for comparison to post-delisting monitoring data.

Table 1.Budget justification for REQUESTED funds

Activity	**Cost Year 1**	**Cost Year 2**	**Cost Year 3**	**Total cost**
Field work	(50 days * $500/day =) $25,000	(30 days * $500/day =) $15,000	(30 days * $500/day =) $15,000	(110 days * $500/day =) $55,000
Report preparation	(5 days * $300/day =) $1,500	(5 days * $300/day =) $1,500	(5 days * $300/day =) $1,500	(15 days * $300/day =) $4,500
Travel	$2,000	$1,500	$1,500	$5,000
TOTALS	$28,500	$18,000	$18,000	$64,500*

***The first two years of this project were funded with FY2011 funds. We are now seeking year 3 funding ($18,000).**

Tangible benefits resulting from this proposal

The activities to be funded by this proposal represent those which the USFWS has previously identified as necessary to support a proposal to remove *H. naniflora* from the federal list of threatened and endangered species (USFWS 2010). Although the Asheville Field Office (AFO) and many of its conservation partners have long sensed that *H. naniflora* may warrant de-listing, a review of currently available information does not support assertions that existing populations are stable, or that threats have been effectively eliminated or reduced (USFWS 2010). Acquisition of data capable of supporting these assertions would enable a de-listing to proceed, ultimately enabling limited resources (within and external to the AFO) to focus on other higher priority species more critically threatened with extinction.

(20) Total Project Cost: **$246,300 ($64,500 requested for ALL years)**
(21) Flex Fund Cost On-Service Lands: N/A
(22) Flex Fund Share Off-Service Lands: N/A
(23)Total Cooperator Contributions:

As noted above, in 2009 the NCDOT pledged to provide status updates for all or portions of 12 populations of *H. naniflora*. The current proposal seeks to leverage the matching contributions from NCDOT by obtaining contemporaneous updates at additional populations across the range of the species, in the hopes that this collective body of information will provide the information necessary for an objective assessment of whether or not de-listing is appropriate, and an adequate baseline against which

the statutorily required post-delisting monitoring data can be compared. The costs presented in the Cooperator Table (item #24 below) represent the minimum amount of matching funds pledged by NCDOT to support field and office work through the 2017 calendar year. The costs identified in Table 2 represent underestimates of actual costs to be incurred by NCDOT, because they do not include costs associated with two additional road projects (the Shelby and Rutherfordton by-passes) for which NCDOT has previously pledged either on- or off-site protections for *H. naniflora* but for which construction has not yet been initiated (Bassette, pers. comm.).

(24) Cooperator Table:

Table 2.Matching funds pledged by NCDOT for years 2010-2017.

Activity	**Person days**	**Cost @ $200/day**
Pre-field preparation	31	$6,200
Field work	614	$122,800
Microstation, GPS, GIS	72	$14,400
Report preparation	146	$29,200
Administrative/scheduling	46	$9,200
TOTALS	909	$181,800

(25) Land Classification: **wetland and adjacent uplands**
(26) Project Action: **monitoring & evaluation in support of anticipated de-listing**
(27) Wetland acres restored: N/A (28) Upland acres restored: N/A
(29) Riparian: N/A (30) Instream: N/A
(31) Listed Species: ***Hexastylis naniflora***
(32) Coordination with Recovery Lead Field Office: **Asheville FO (Mara Alexander)**
(33) Recovery Priority: **none assigned**
(34) Recovery Plan Task and Priority: **no recovery plan has been developed for *H. naniflora***
(35) Key Contacts:
Mara Alexander, Asheville Field Office, 828.258.3939 ext. 238, Mara_Alexander@fws.gov

Sources cited

Bassette, T. 2010. Tim Bassette, North Carolina Department of Transportation. Personal communication with Carolyn Wells (USFWS).

North Carolina Natural Heritage Program (NC NHP). 2010. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: April 7, 2010.

South Carolina Department of Natural Resources (SCDNR) Heritage Trust. 2010. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: August 19, 2010.

U.S. Fish and Wildlife Service. 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, 2009. Biological Opinion for the Proposed Upgrade of Lovelady Road, TIP No. R-2824, in Burke County, North Carolina. USFWS log number 4-2-09-367. November 13, 2009.

Table 3. *Hexastylis naniflora* populations expected to be targeted (for surveys and threat assessments) by this proposal.

State	County	Population name	Last population estimate (year)	Field days (year 1)	Field days (year 2)	Field days (year 3)	Total field days (all years)
NC	Burke	Island Creek Heath Bluff (Lovelady Sites 3-8)	98,789 (2004)	5	2	2	9
NC	Catawba	South Fork Catawba River: Jacob Fork, Camp Creek	1,392 (2005)	2	1	1	4
NC	Catawba	Catawba Wildlife Club	1,279 (1995-2007)	2	1	1	4
NC	Cleveland/ Rutherford	Cliffside Stream Station	5,550 (2005-2008)	2	1	1	4
NC	Lincoln	Lincoln County Airport and Leepers Creek	7,032 (2005-2006)	4	2	2	8
NC	Polk	Mills Creek Forest and Seep	$\geq$ 1,000 (2005)	2	1	1	4
NC	Polk	Broad River: New Hope Springhead Swamp	1,500 (2005)	2	1	1	4
NC	Rutherford	Second Broad River (a.k.a. "Forest City Industrial Complex")	~ 2,478 (2008)	2	2	2	6
NC	Rutherford	Broad River: Hensons Creek Ravine, Brice Rare Plant Site, and Sandy Mush Outcrop	~ 7,765 (2001-2010)	4	2	2	8
NC	Rutherford	Broad River: Cleghorn Creek tributary/US 221	4,964 (2005)	4	2	2	8
NC	Rutherford	Broad River: Floyds Creek, Long Branch	2,156 (2005-2008)	3	3	3	9
SC	Cherokee	Cowpens Battlefield	10,180 (2005)	5	4	4	13
SC	Greenville/ Spartanburg	South Pacolet River and tributaries	5,205 (1991-1998)	4	2	2	8
SC	Spartanburg	Peters Creek Heritage Preserve/Mineral Springs Creek	2,481 (2006)	4	2	2	8
SC	Spartanburg	Blalock Reservoir	1,400 (2006)	5	3	3	11
			TOTALS	**50**	**29**	**29**	**108**

Dwarf flowered heartleaf

Merritt, Timothy <timothy_merritt@fws.gov>

Mon 4/30/2018 5:13 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>

Byron,
Has the SSA for this one gone out for peer review yet? I see the RTM is on June 20th. Just want to be sure I have not overlooked something that I need to do.
Tim

--

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

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Re: HENA SSA peer review ready

Marshall, Michael E <michael_marshall@fws.gov>

Fri 5/11/2018 1:30 PM

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
>
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--

Byron Hamilton, Sr.
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--

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Re: HENA SSA peer review ready

Marshall, Michael E <michael_marshall@fws.gov>

Fri 5/11/2018 1:52 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>

That would be Rebekah Reid from the Asheville, NC office.

Mike

> On Fri, May 11, 2018 at 1:45 PM, Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> Who is the Species lead/Office?
>
> > On Fri, May 11, 2018 at 1:30 PM, Marshall, Michael <michael_marshall@fws.gov> wrote:
> > Here ya go Byron!
> >
> > Thanks,
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Mike

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Mike Marshall
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Monday-Thursday --> In Office 7:30-4:30 CST

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Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment

London, Paula K <paula_london@fws.gov>

Mon 5/14/2018 7:27 AM

To: wesley.knapp@ncdcr.gov <wesley.knapp@ncdcr.gov>; tpbassette@ncdot.gov <tpbassette@ncdot.gov>; gnewberry@uscupstate.edu <gnewberry@uscupstate.edu>; raynerda@wofford.edu <raynerda@wofford.edu>; L L Gaddy <llgaddy2@gmail.com>; Zack Murrell <murrellze@appstate.edu>; brownh@dnr.sc.gov <brownh@dnr.sc.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>; Merritt, Timothy <timothy_merritt@fws.gov>; Reid, Rebekah N <rebekah_reid@fws.gov>; Marshall, Michael E <michael_marshall@fws.gov>; gnewberry@charter.net <gnewberry@charter.net>

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

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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
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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).

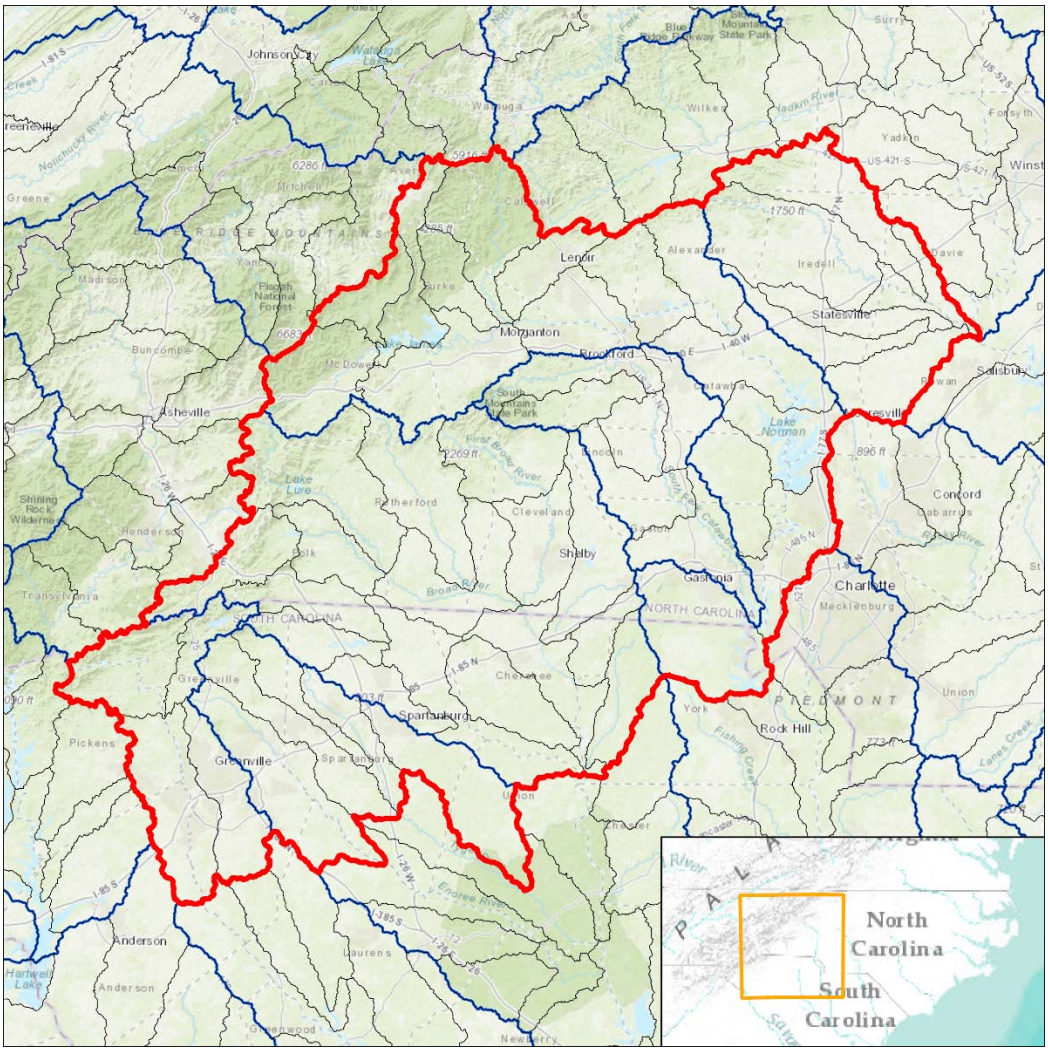
Appendix 3

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

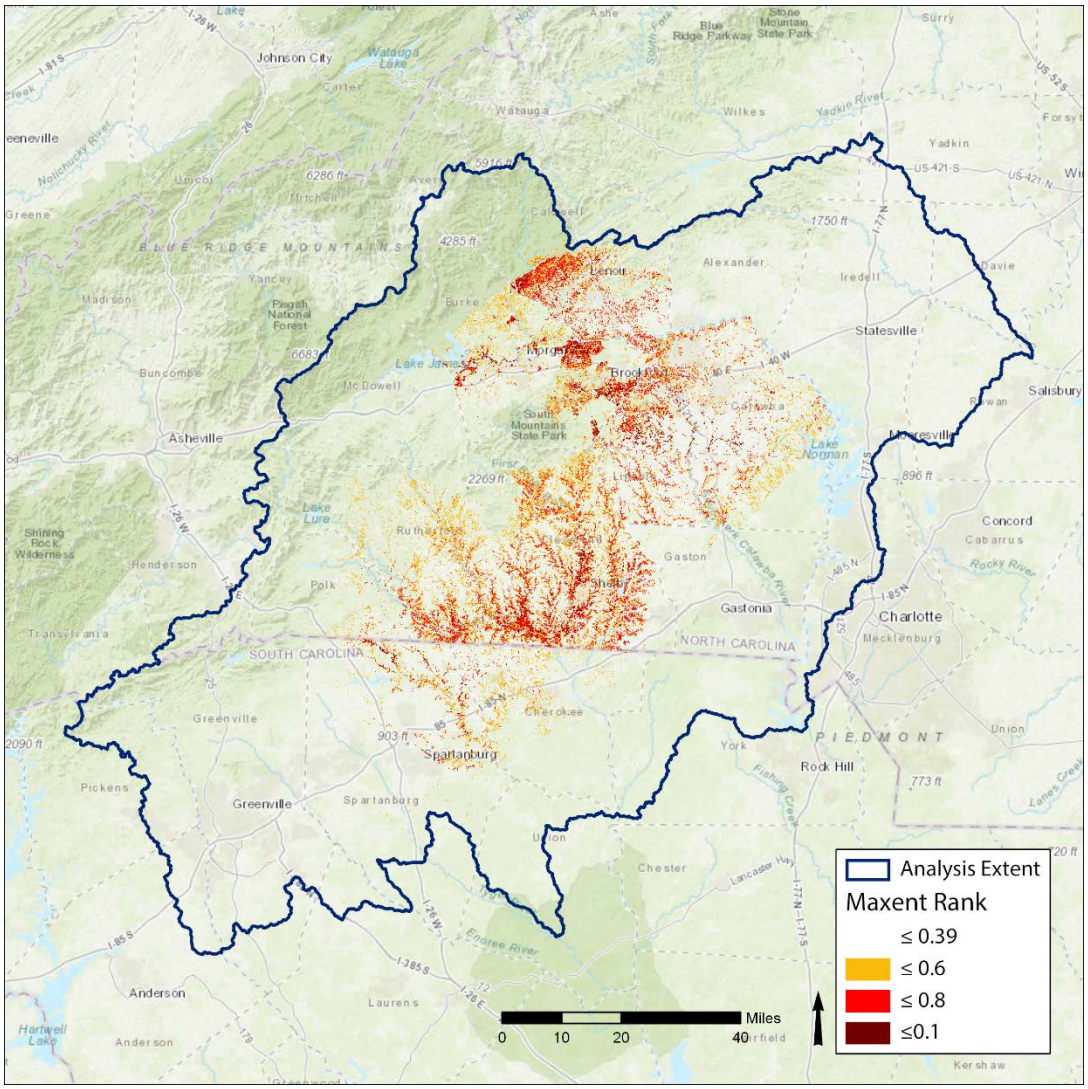
Maxent software for species habitat modeling (version 3.4.1) was used (Philips et al., 2018).

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.

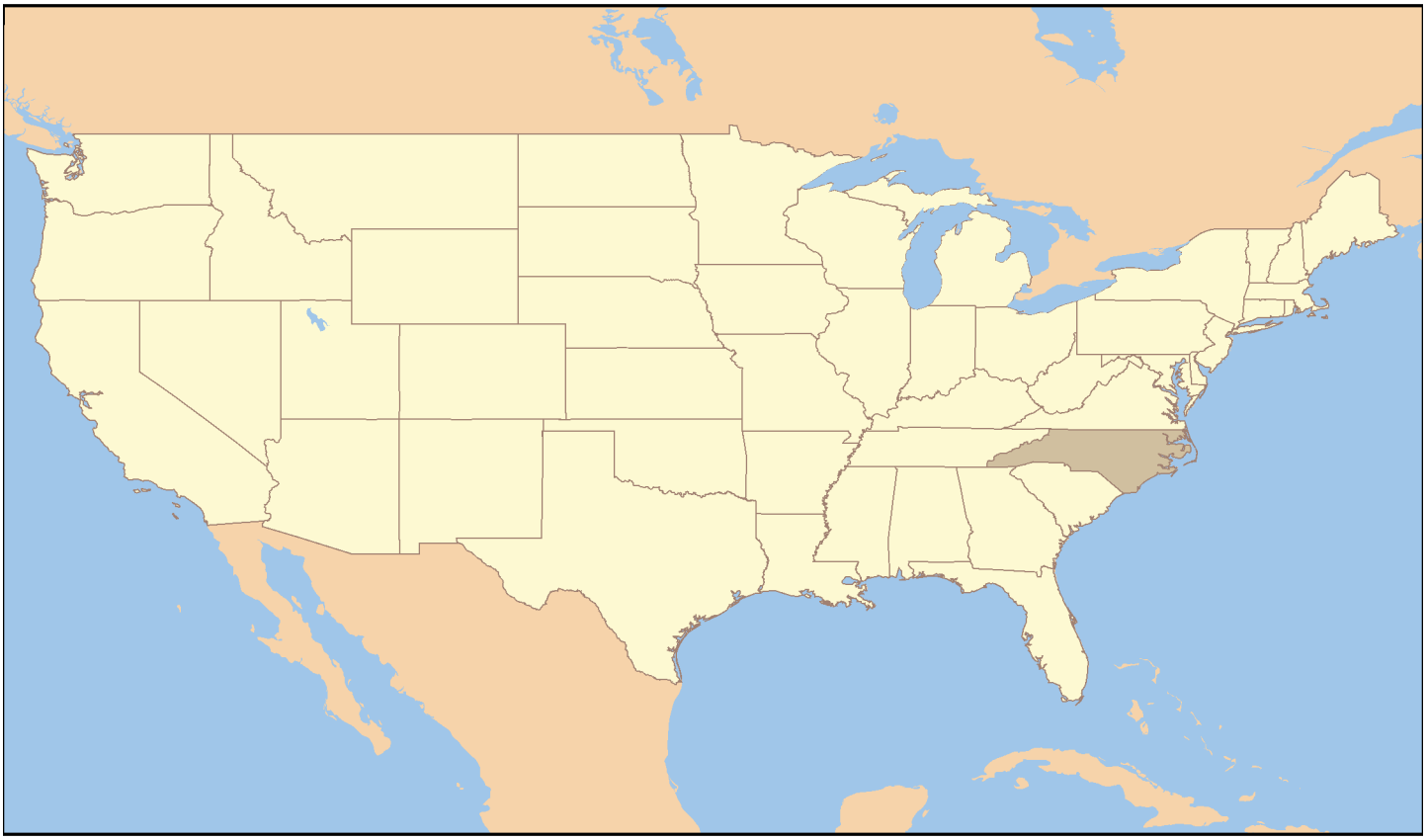
Phillips, S. J. 2018. A Brief Tutorial on Maxent. Available from url: http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 2018-02/21.

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

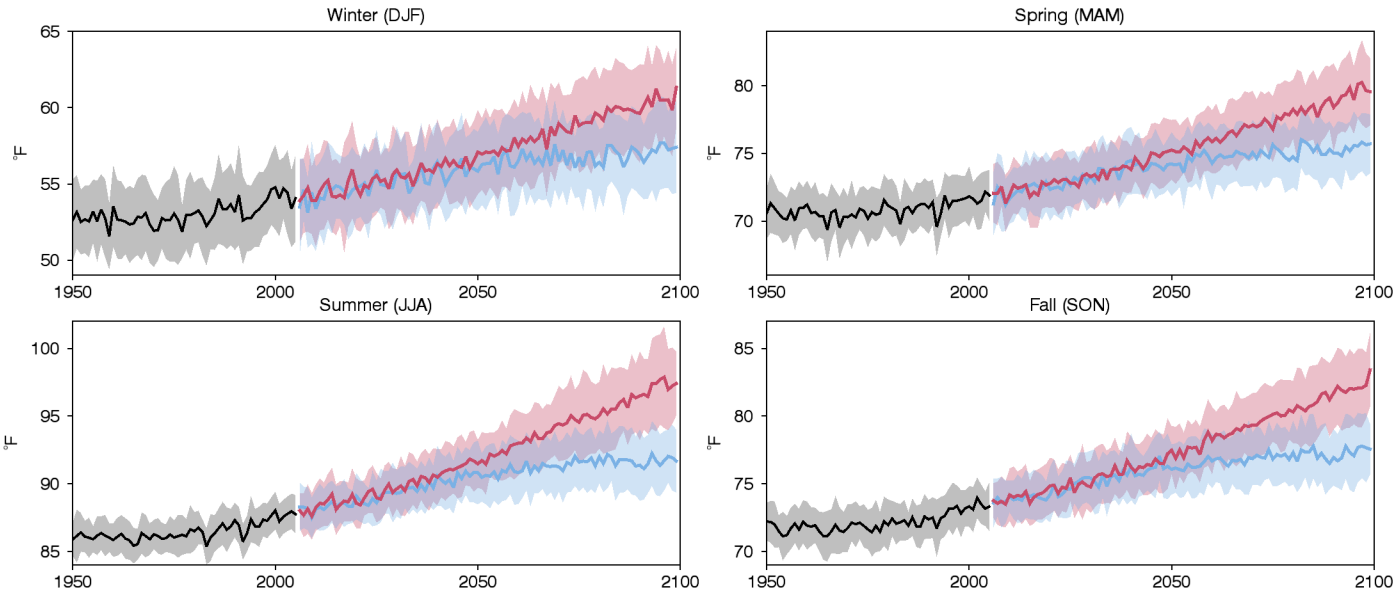


Figure 1: Seasonal average time series of maximum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

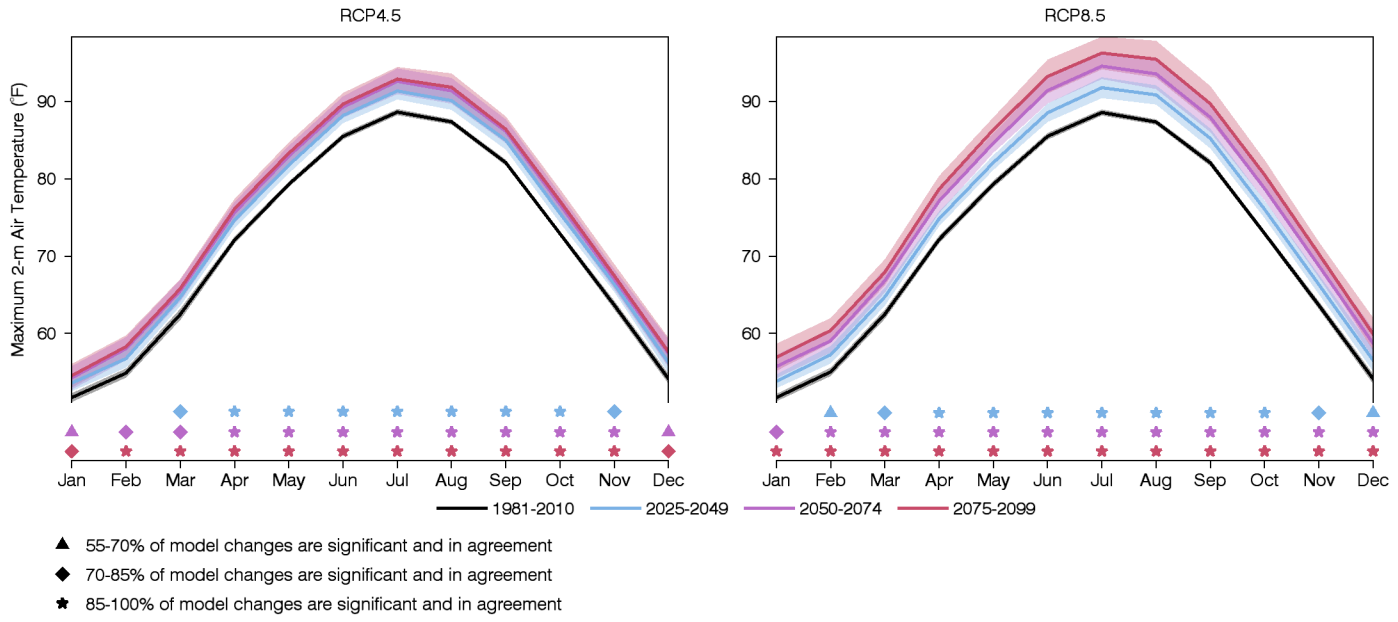


Figure 2: Monthly averages of maximum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square 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

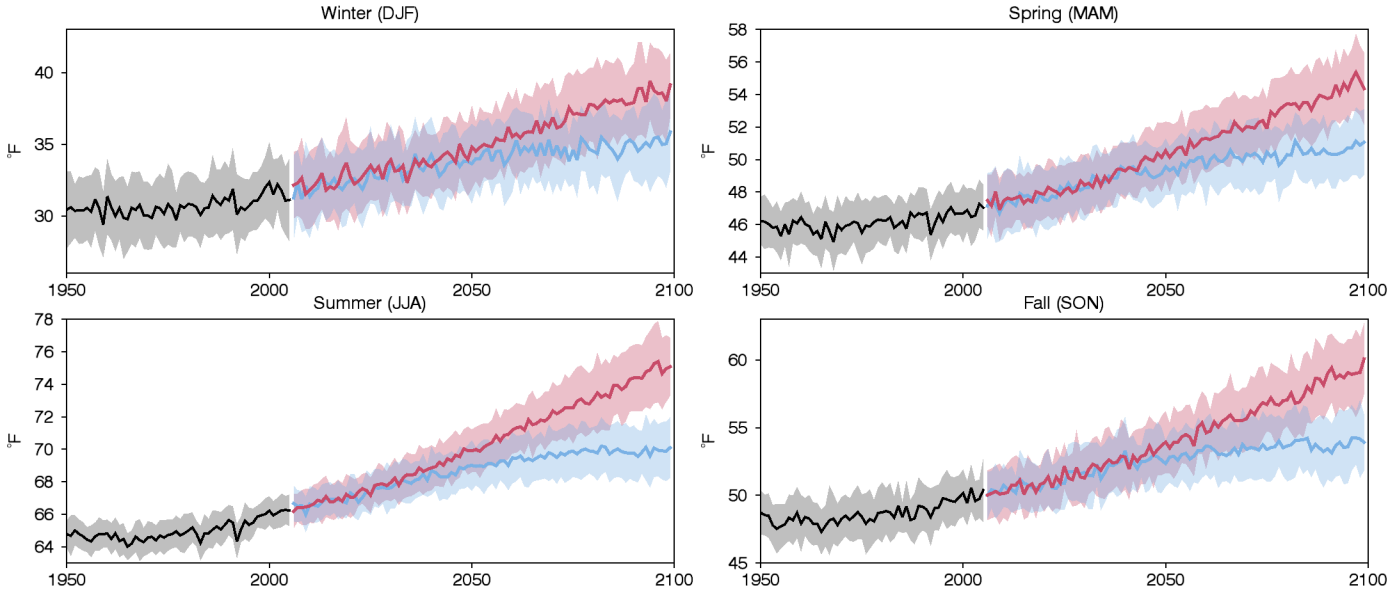


Figure 3: Seasonal average time series of minimum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

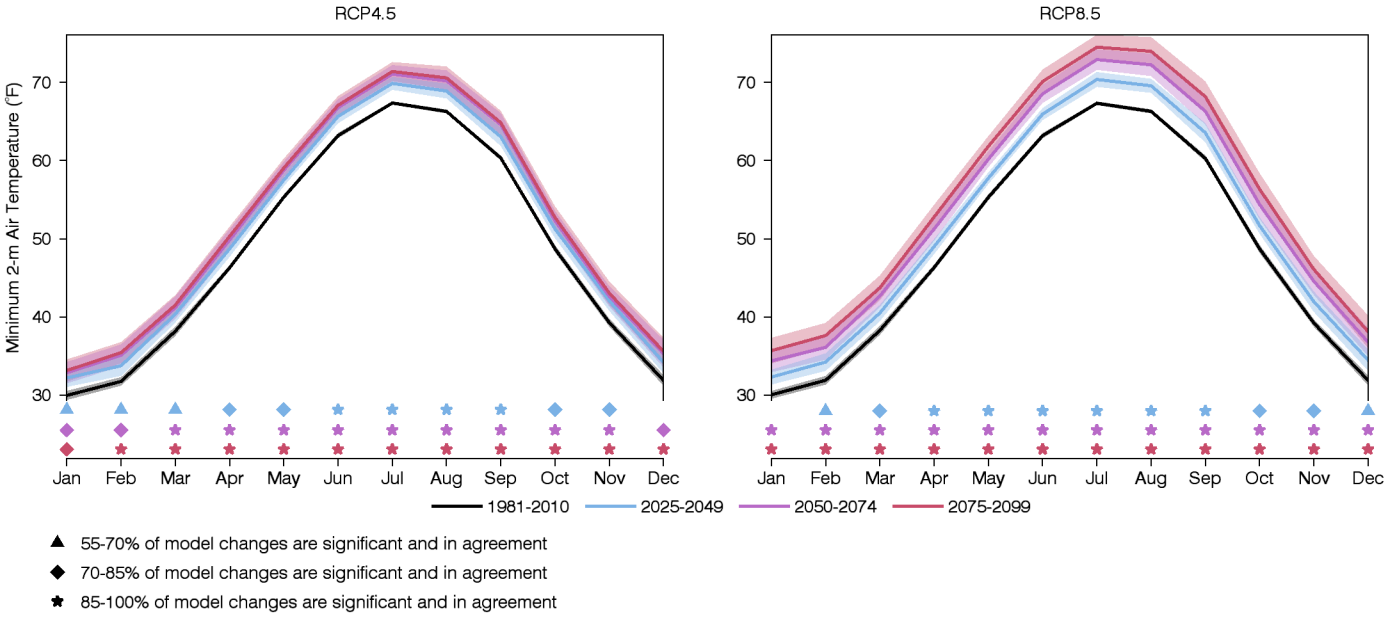


Figure 4: Monthly averages of minimum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square 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

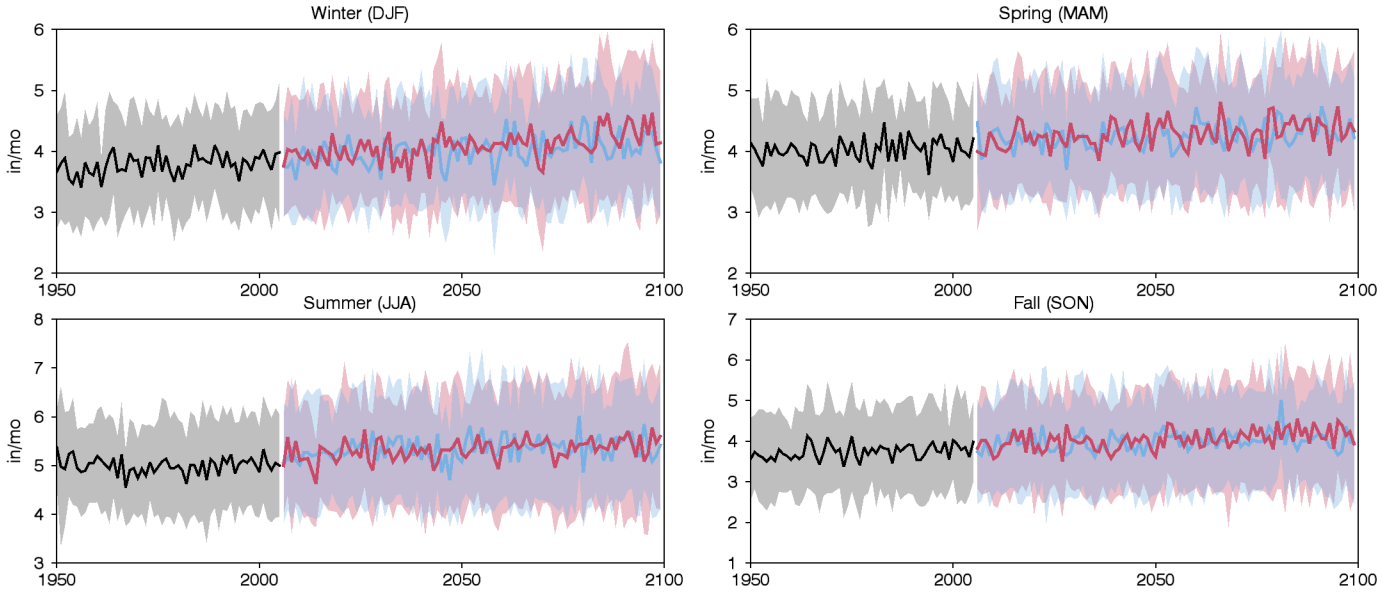


Figure 5: Seasonal average time series of precipitation for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

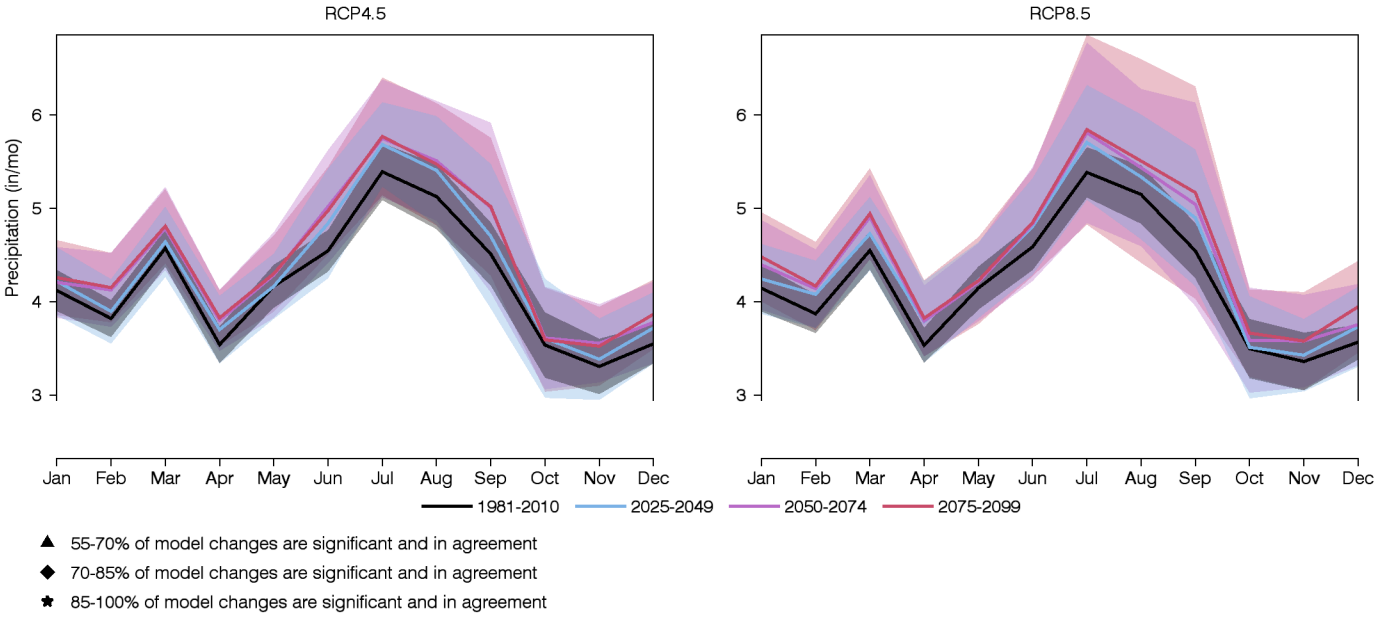


Figure 6: Monthly averages of precipitation for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate 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

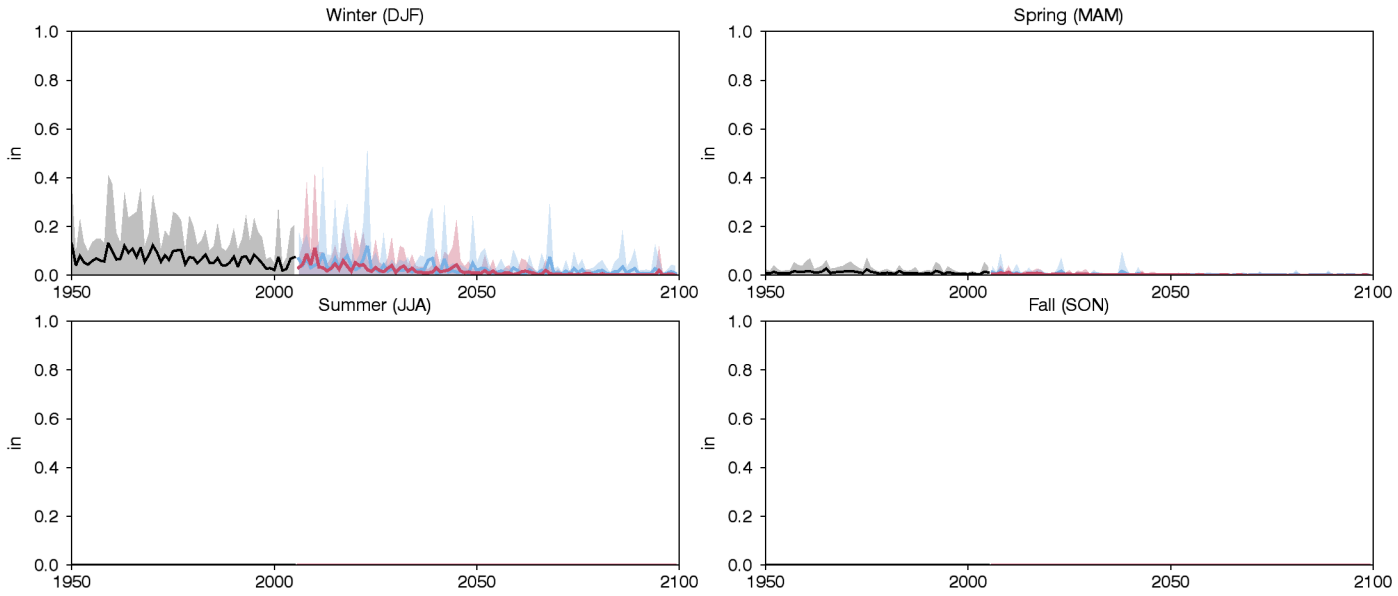


Figure 7: Seasonal average time series of snow water equivalent for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

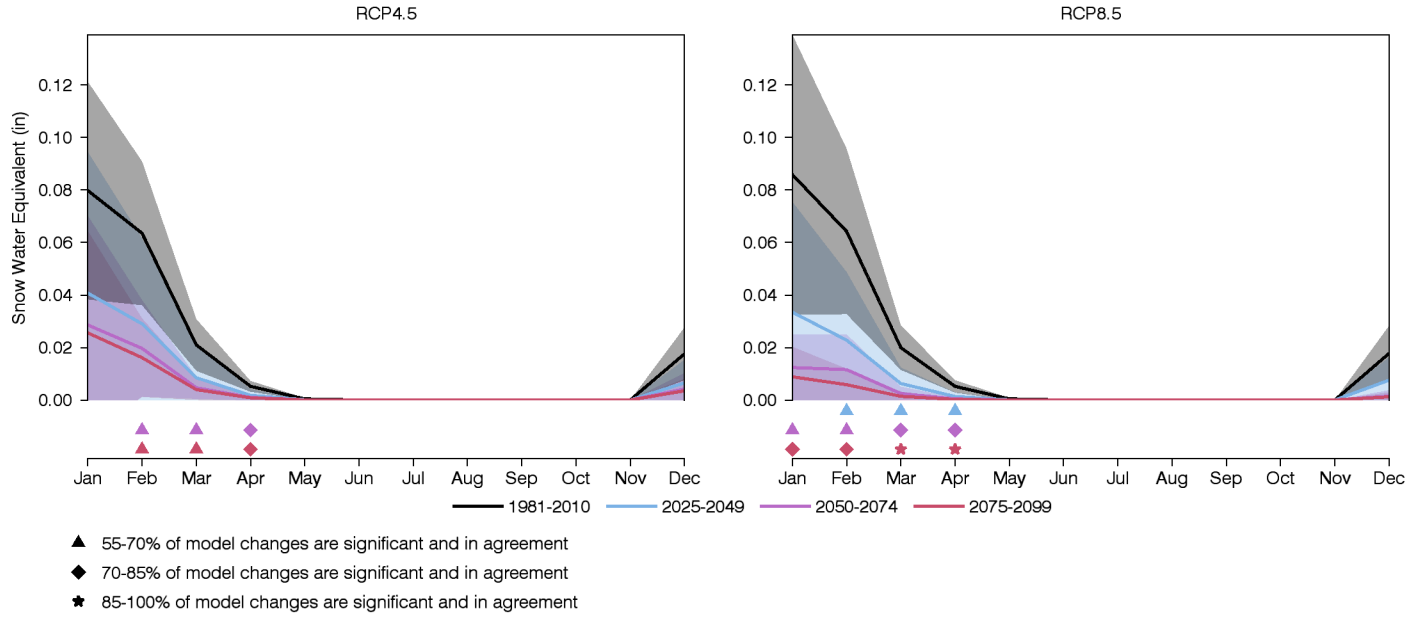


Figure 8: Monthly averages of snow water equivalent for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols 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

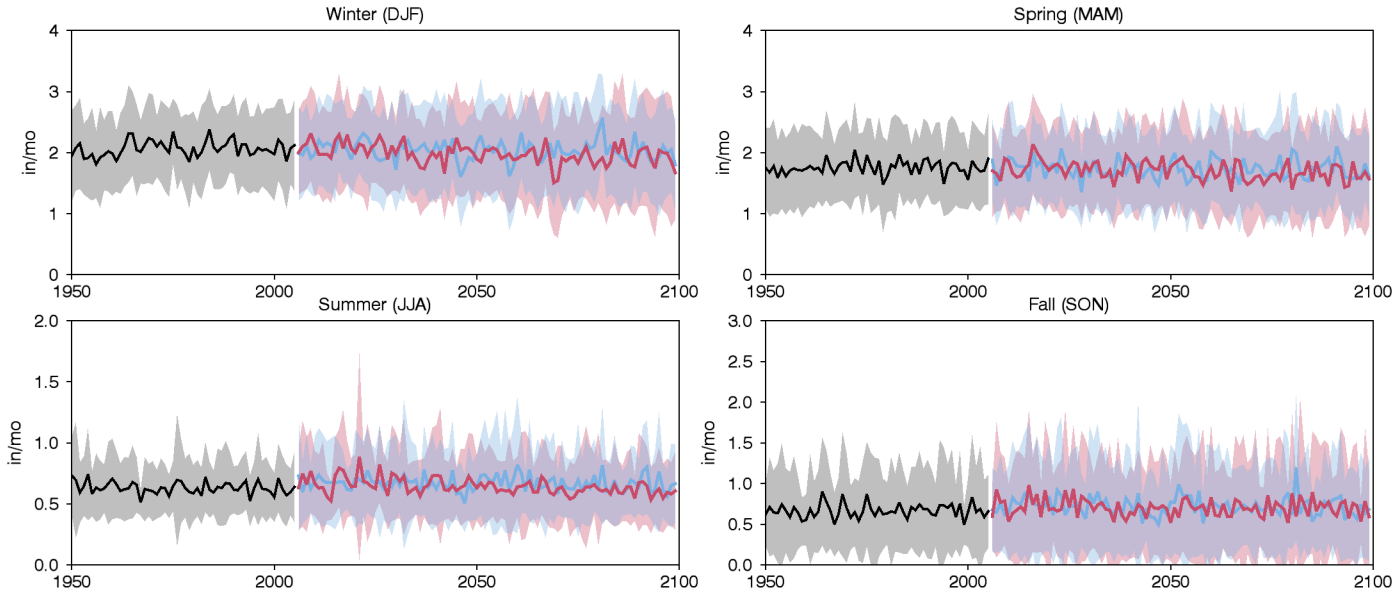


Figure 9: Seasonal average time series of runoff for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

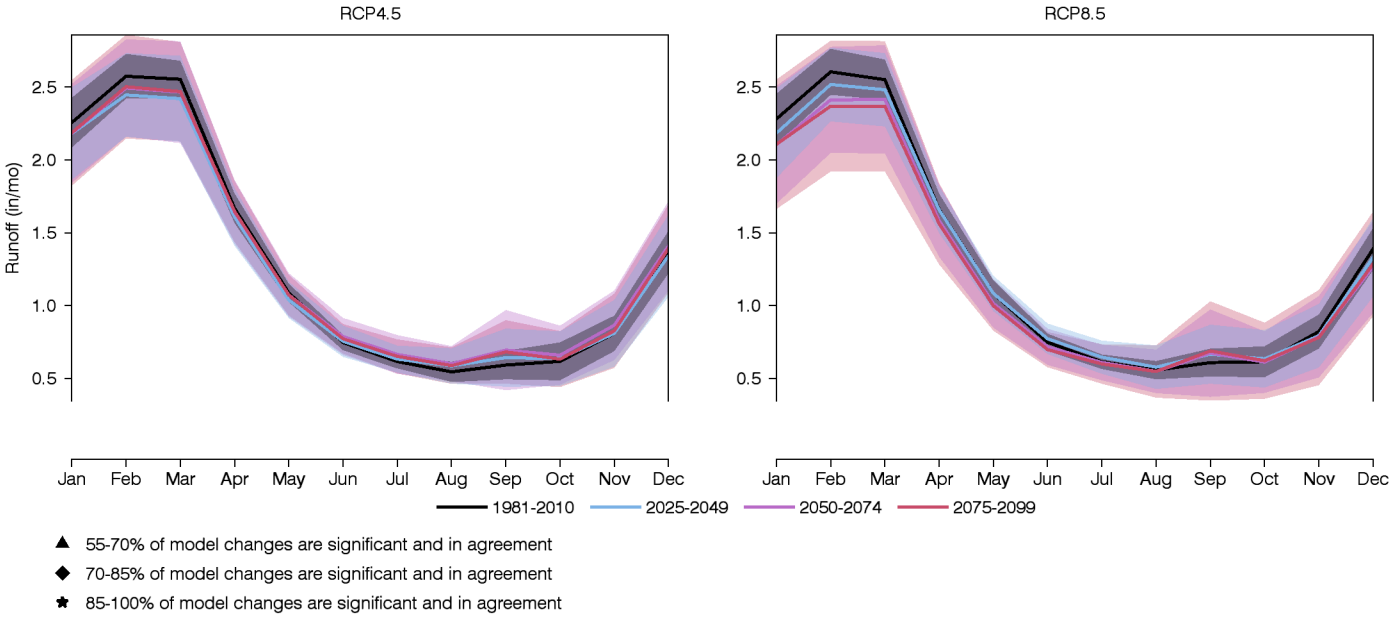


Figure 10: Monthly averages of runoff for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate 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

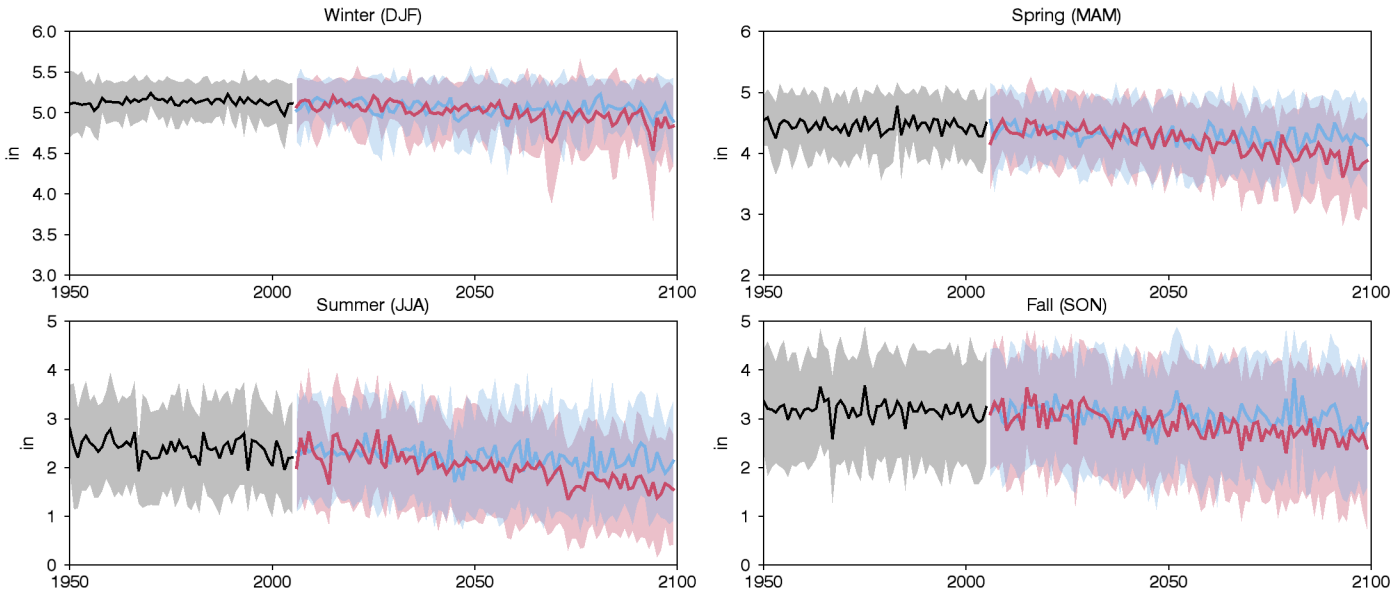


Figure 11: Seasonal average time series of soil water storage for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

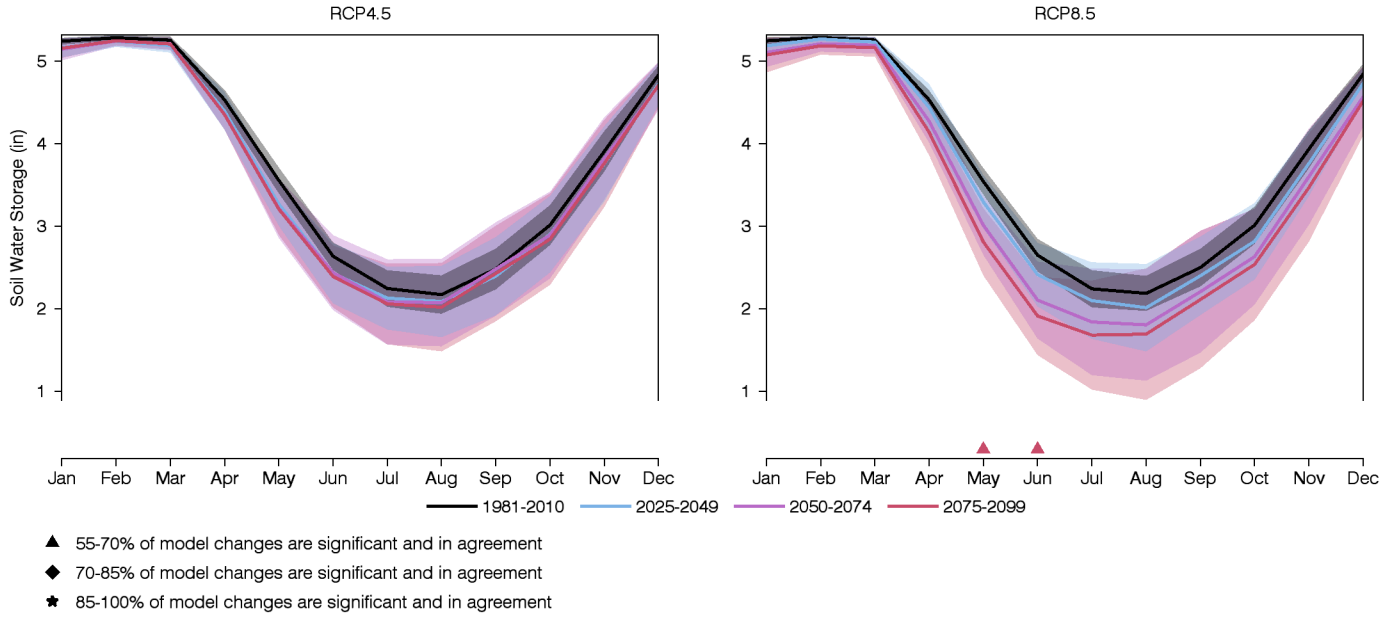


Figure 12: Monthly averages of soil water storage for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols 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

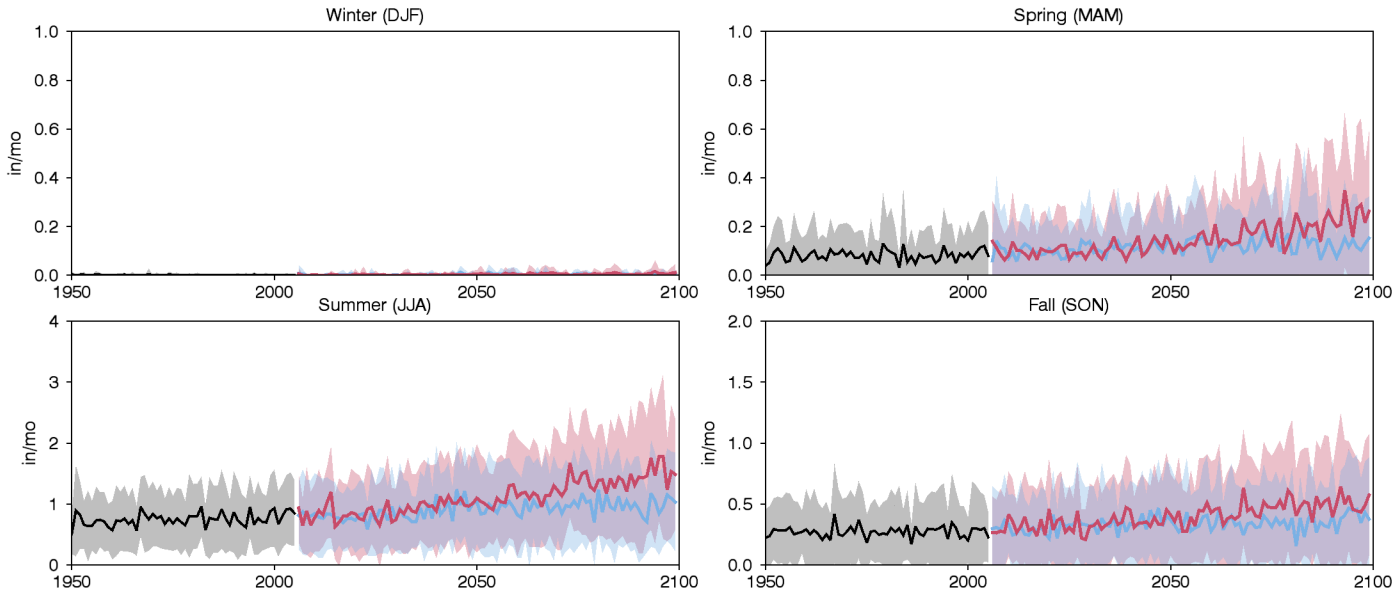


Figure 13: Seasonal average time series of evaporative deficit for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

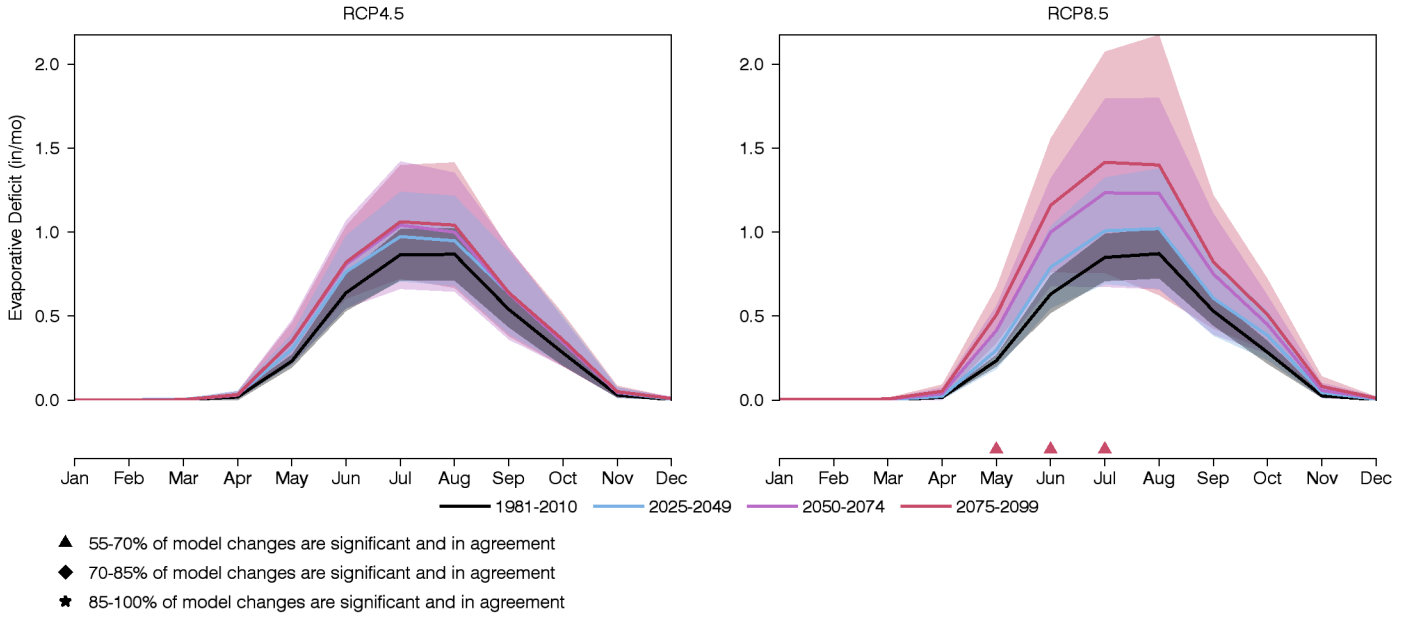


Figure 14: Monthly averages of evaporative deficit for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols 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.

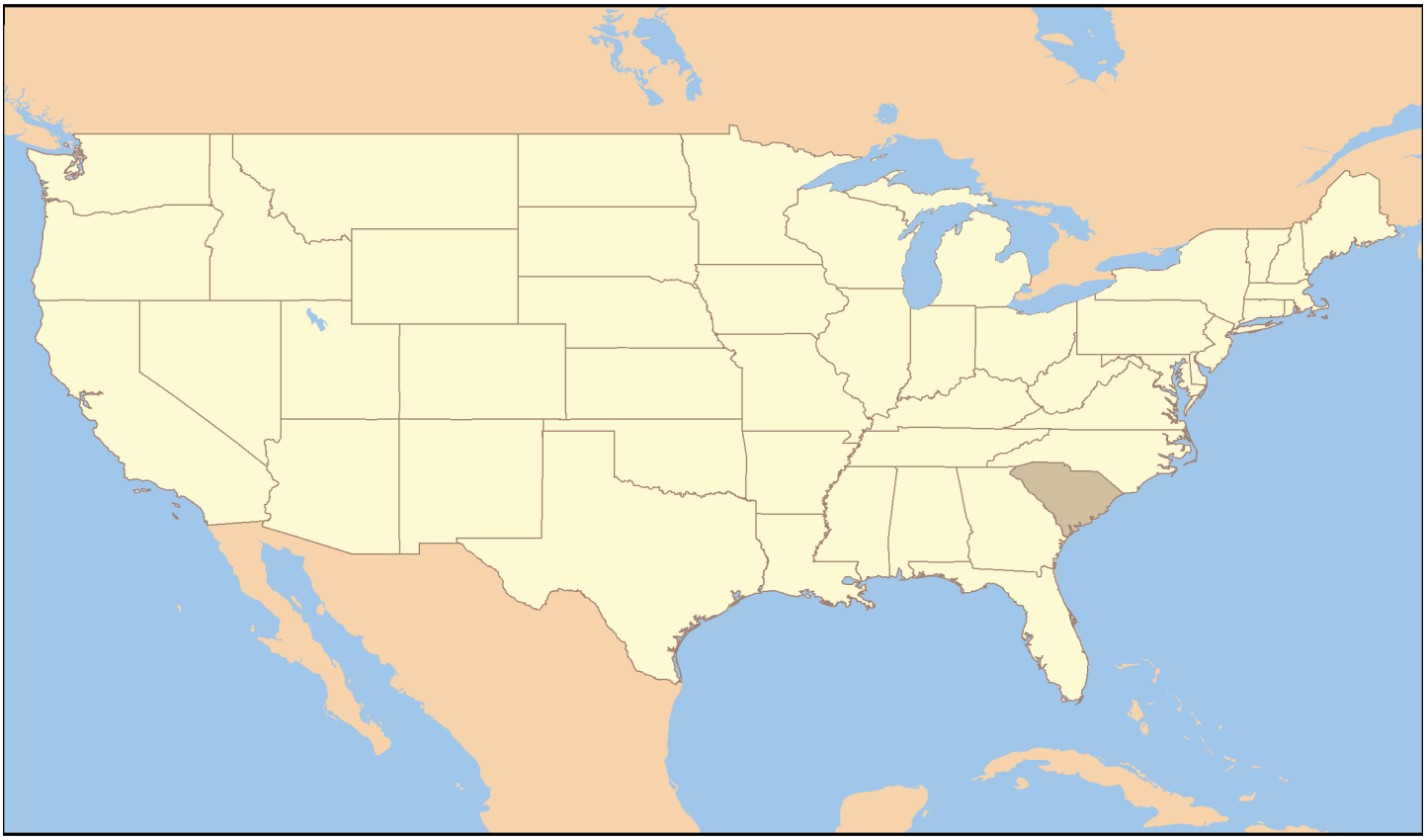
11 Disclaimer

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

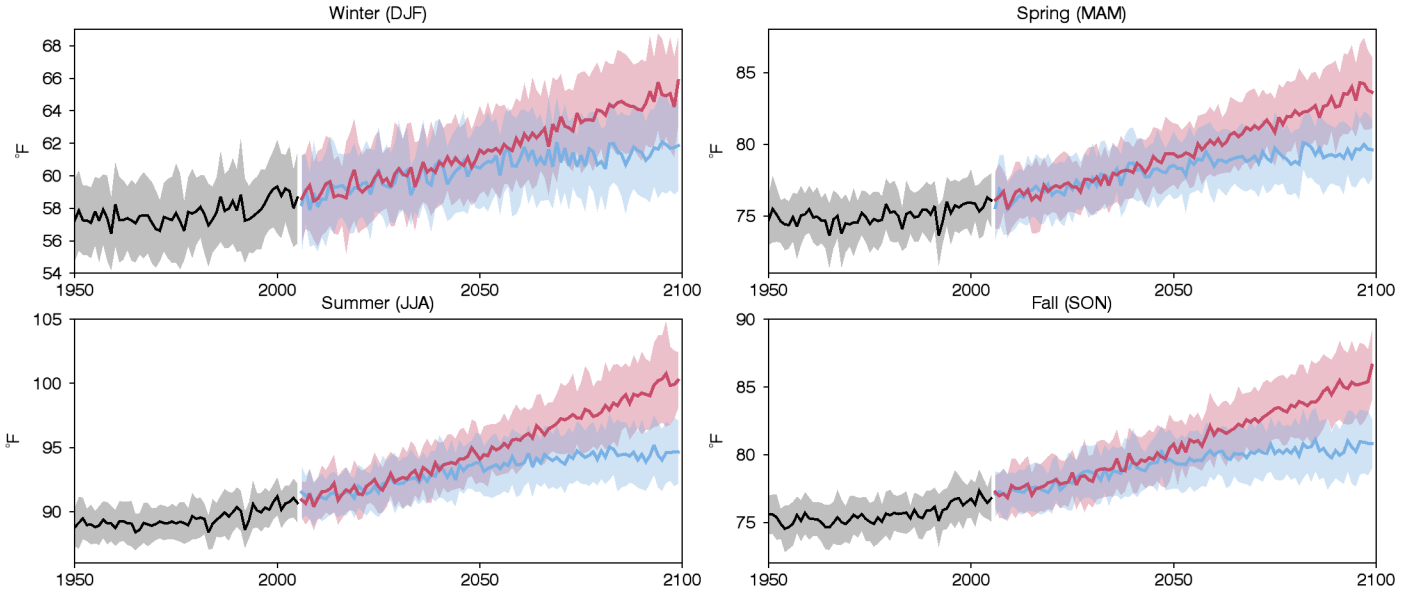


Figure 1: Seasonal average time series of maximum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

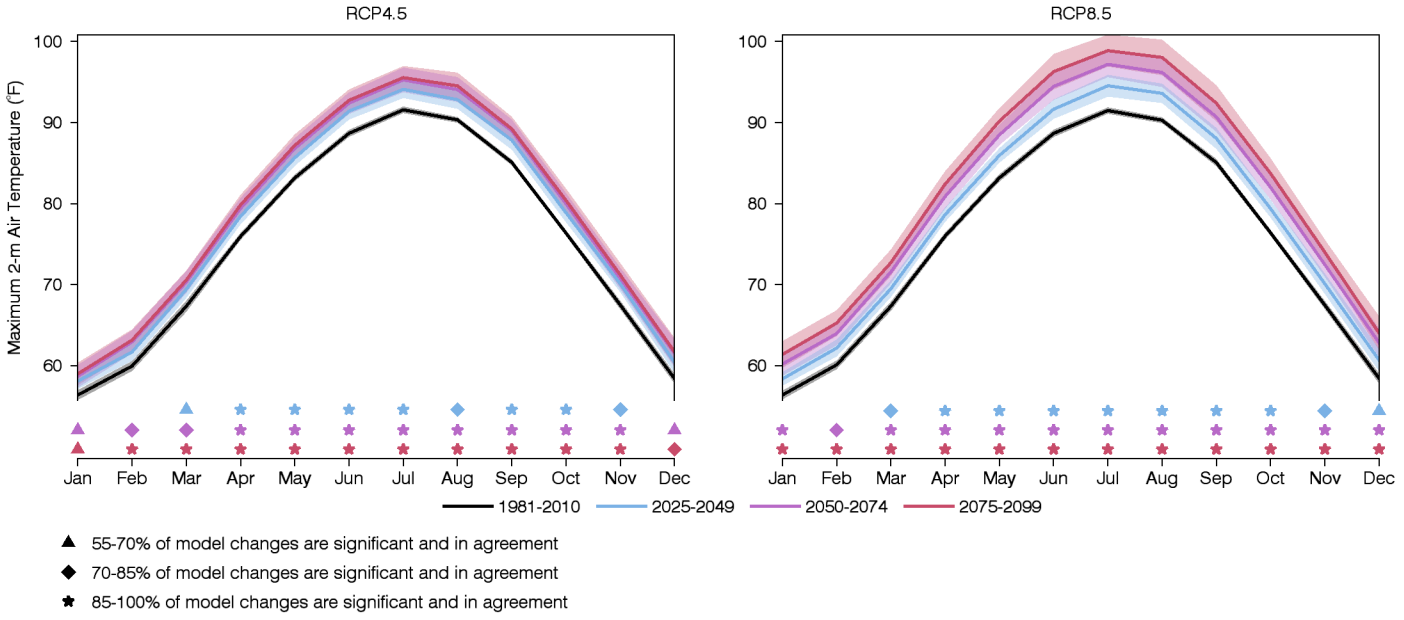


Figure 2: Monthly averages of maximum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square 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

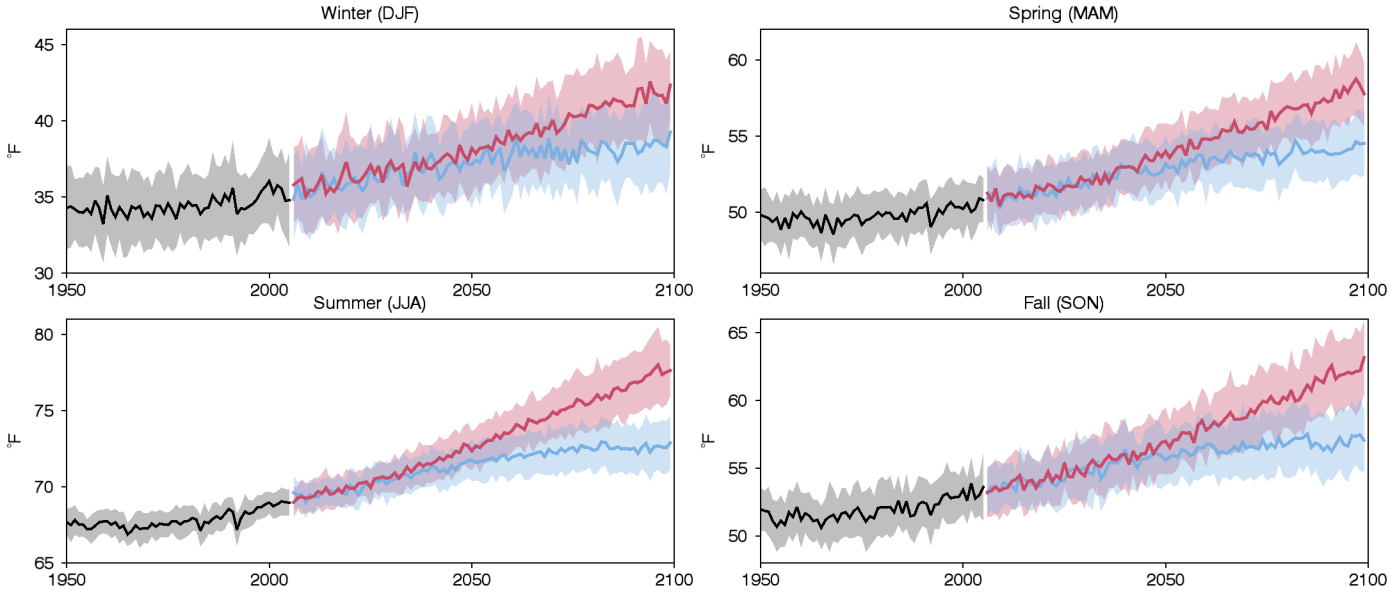


Figure 3: Seasonal average time series of minimum 2-m air temperature for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

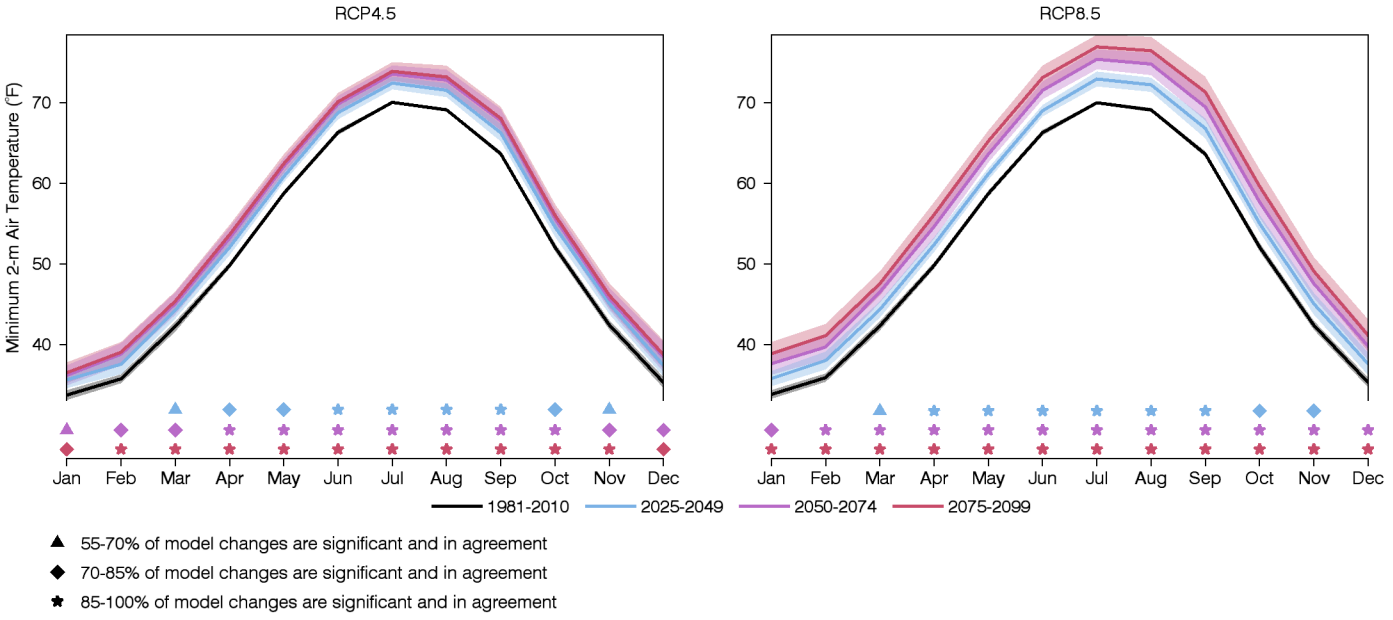


Figure 4: Monthly averages of minimum 2-m air temperature for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square 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

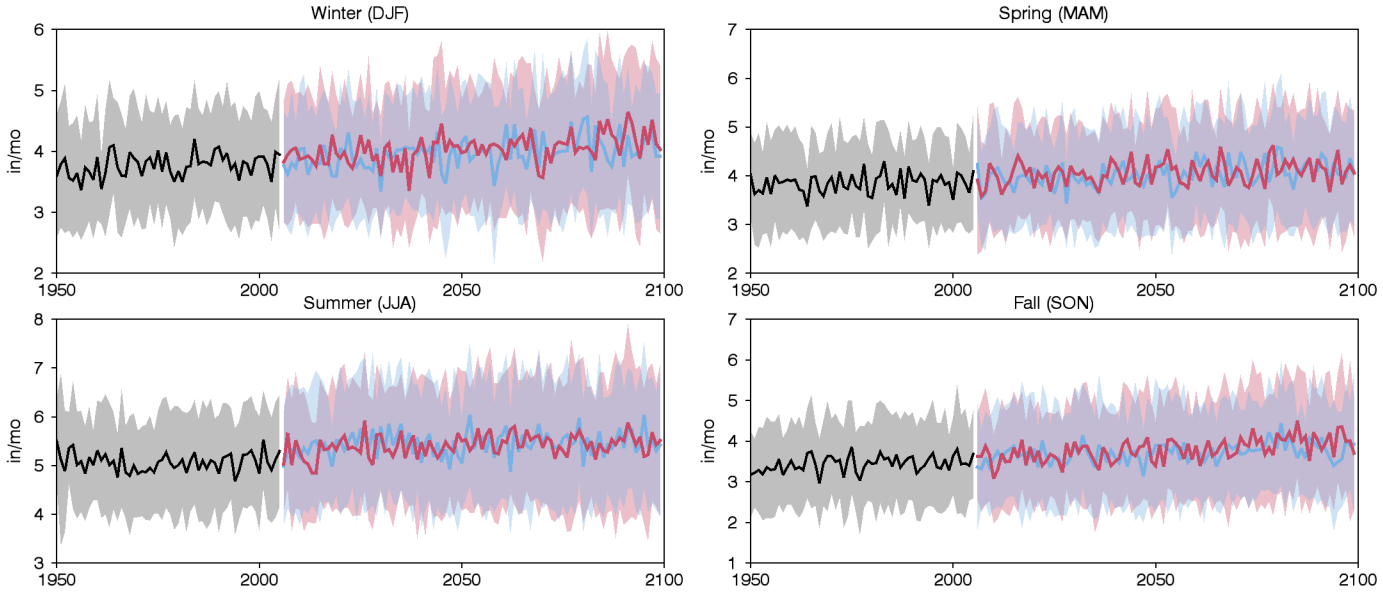


Figure 5: Seasonal average time series of precipitation for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

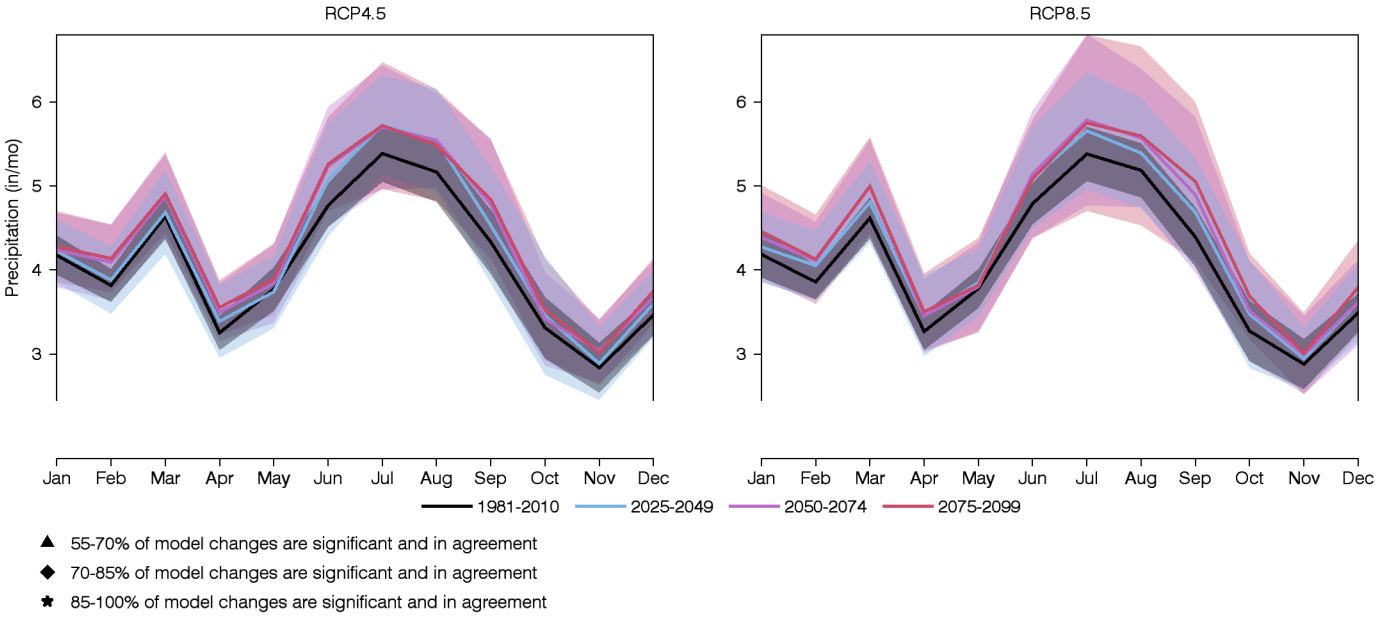


Figure 6: Monthly averages of precipitation for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate 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

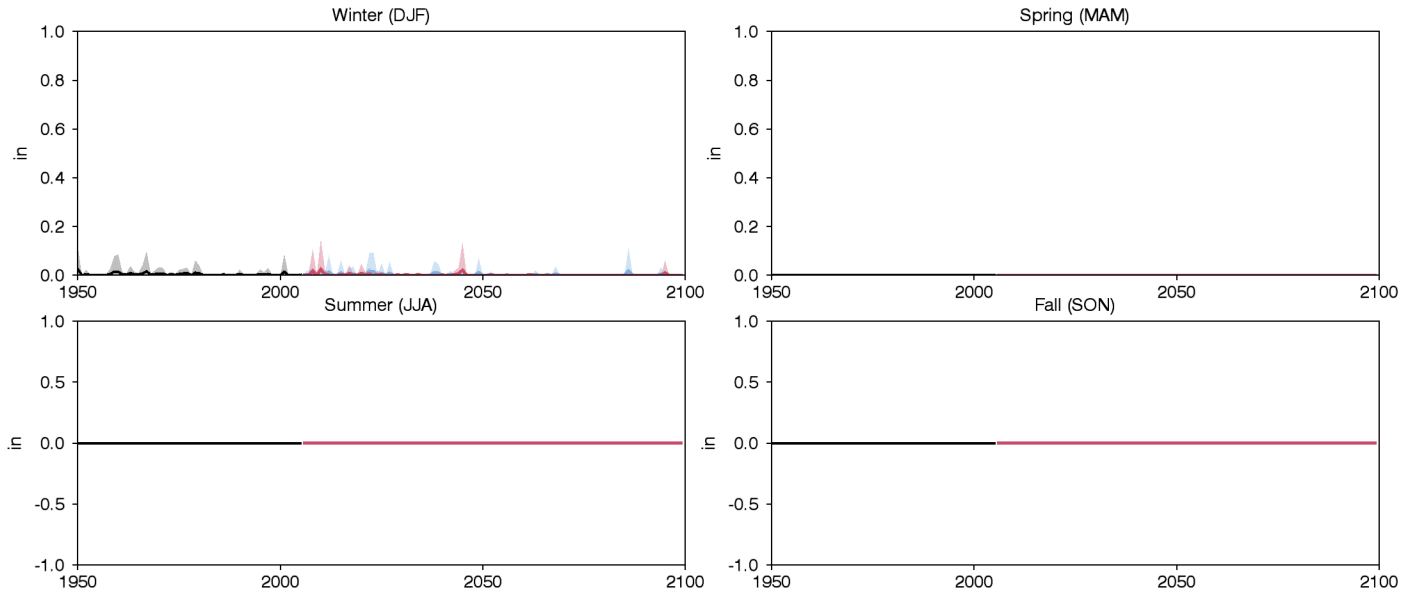


Figure 7: Seasonal average time series of snow water equivalent for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

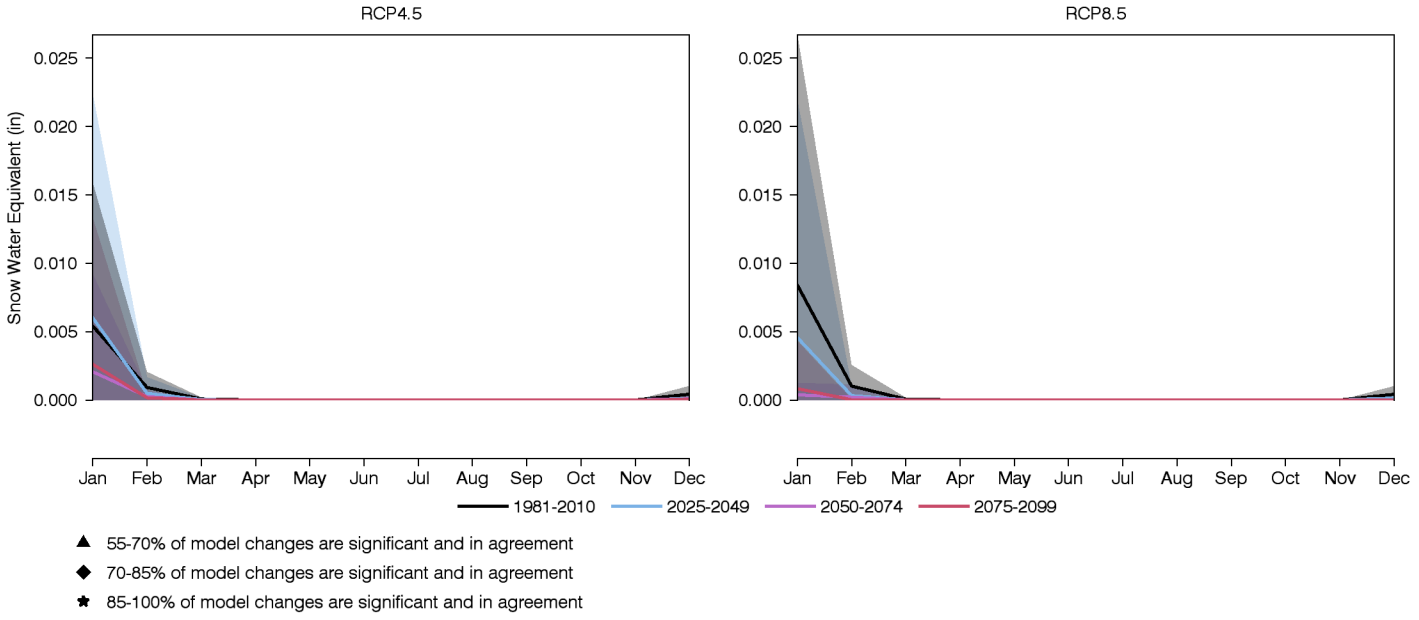


Figure 8: Monthly averages of snow water equivalent for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols 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

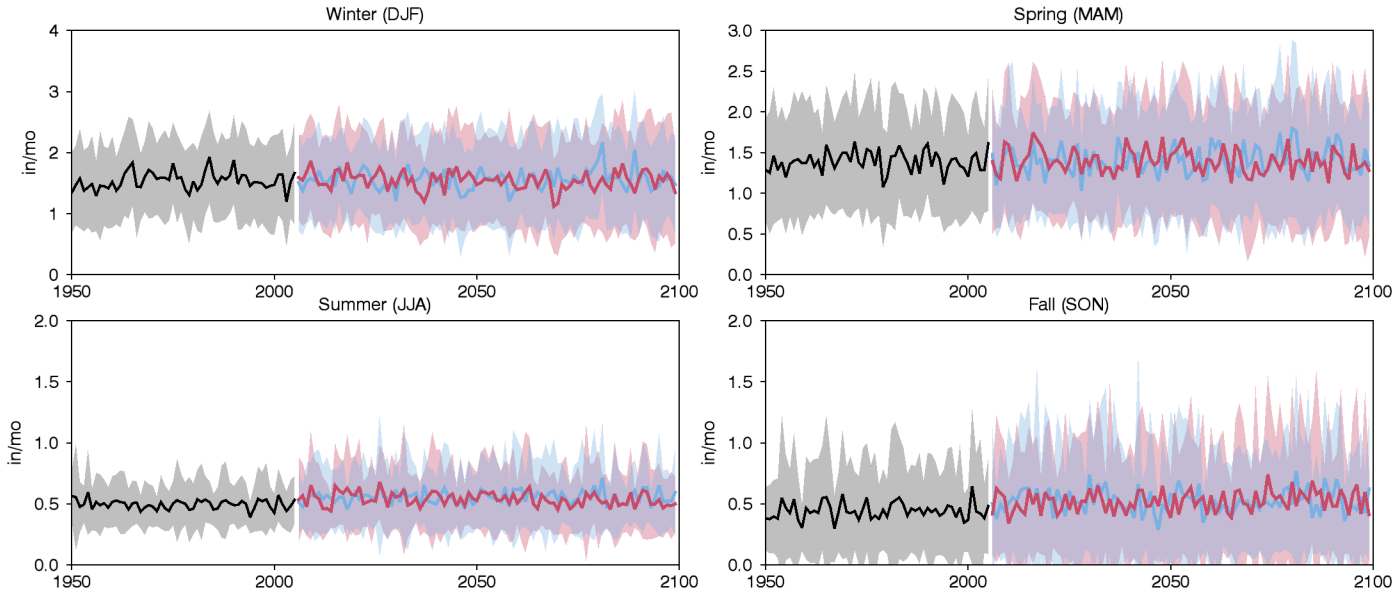


Figure 9: Seasonal average time series of runoff for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

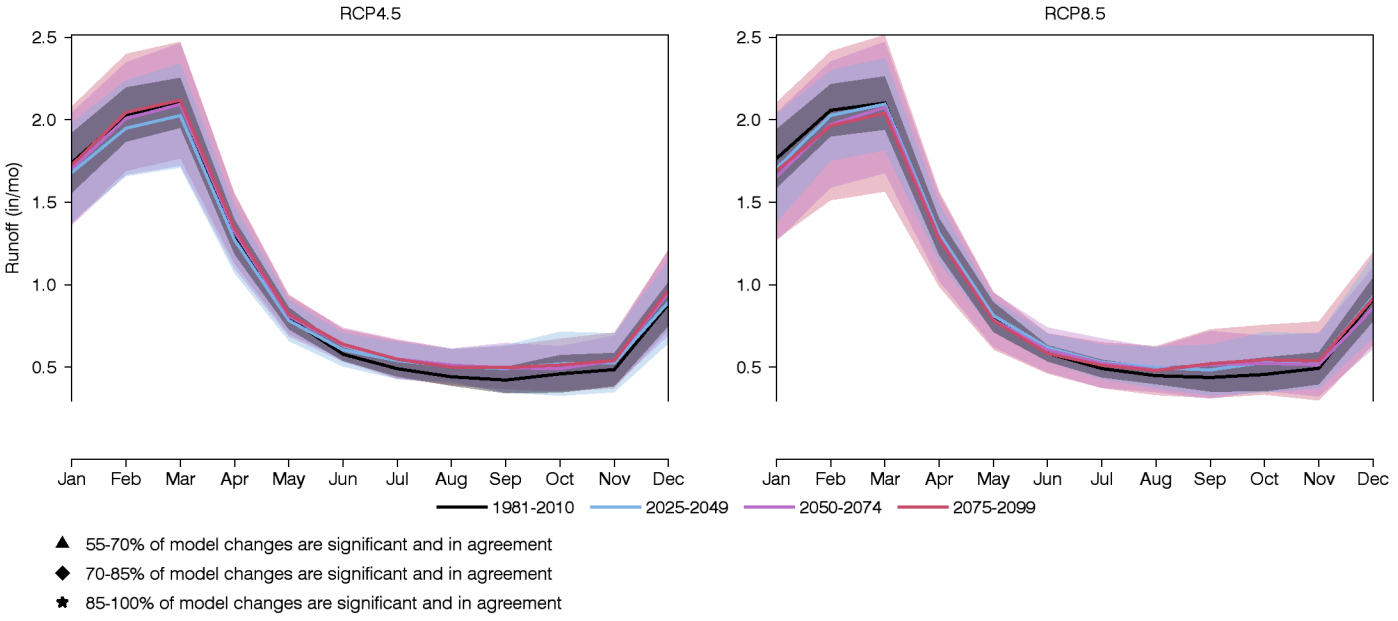


Figure 10: Monthly averages of runoff for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols indicate 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

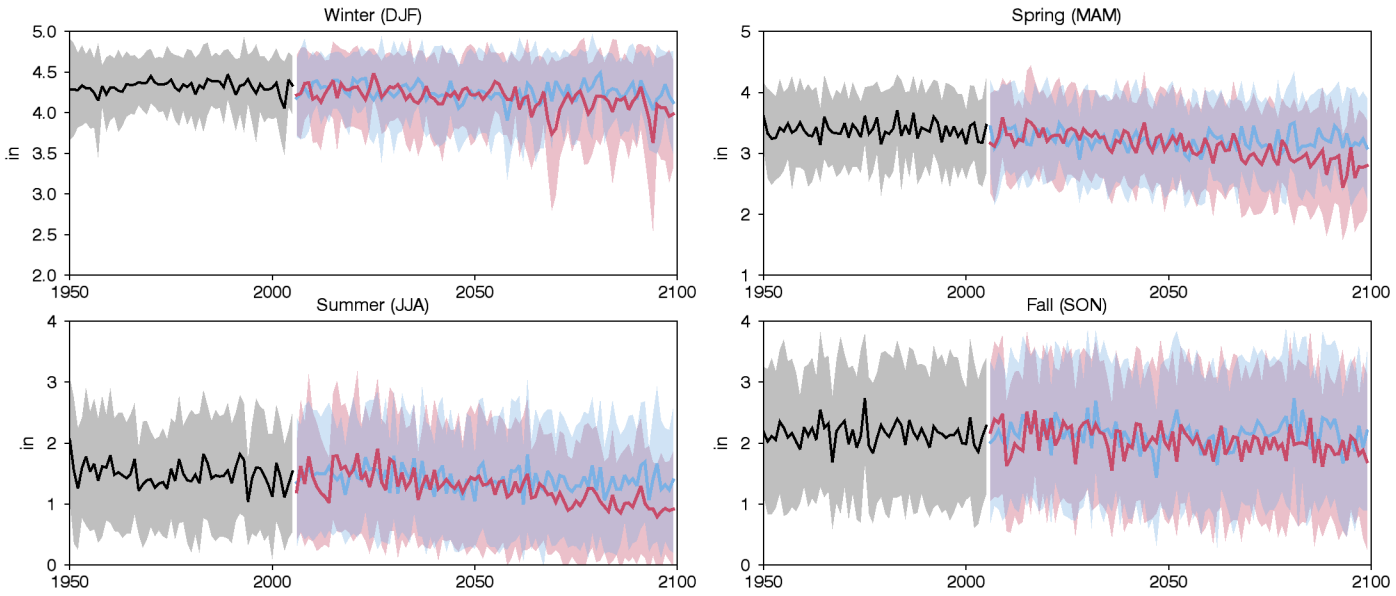


Figure 11: Seasonal average time series of soil water storage for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

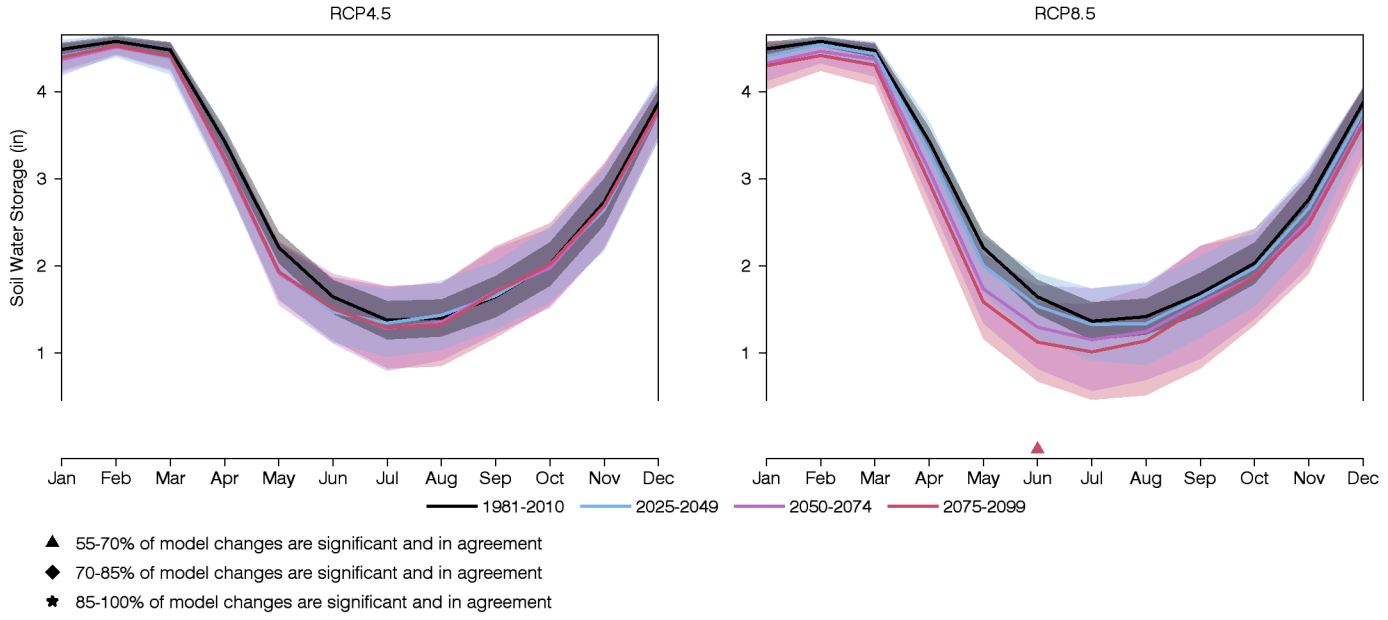


Figure 12: Monthly averages of soil water storage for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols 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

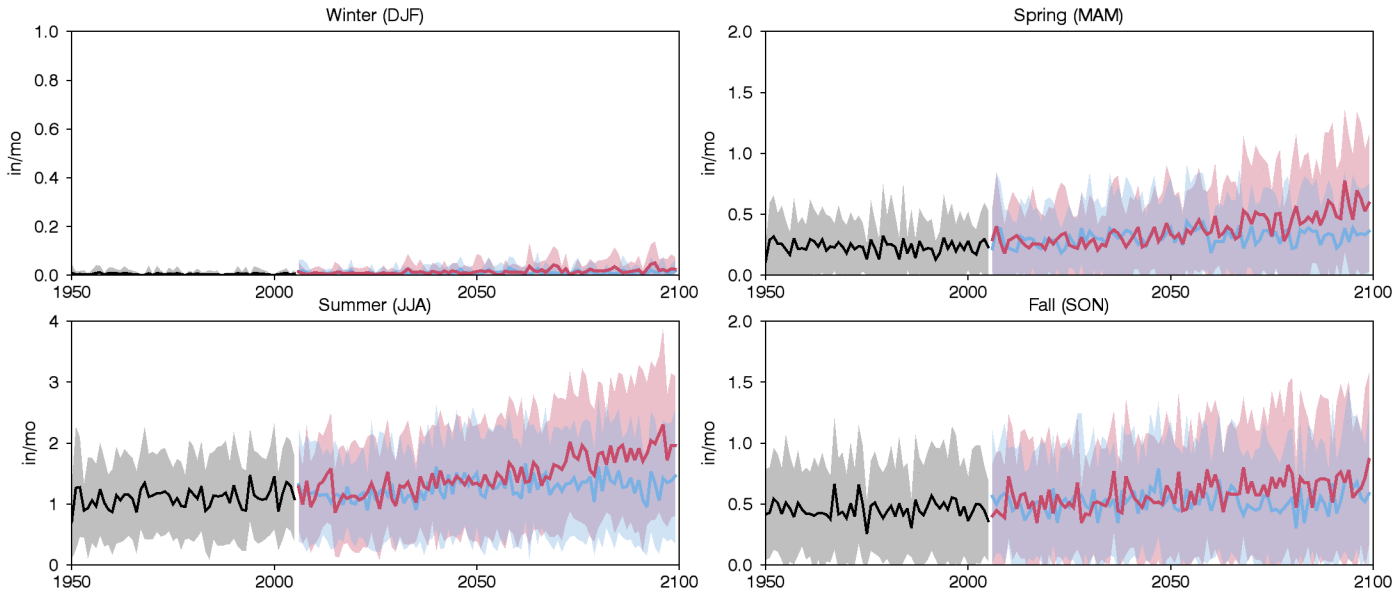


Figure 13: Seasonal average time series of evaporative deficit for historical (black), RCP4.5 (blue) and RCP8.5 (red). The historical period ends in 2005 and the future periods begin in 2006. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes.

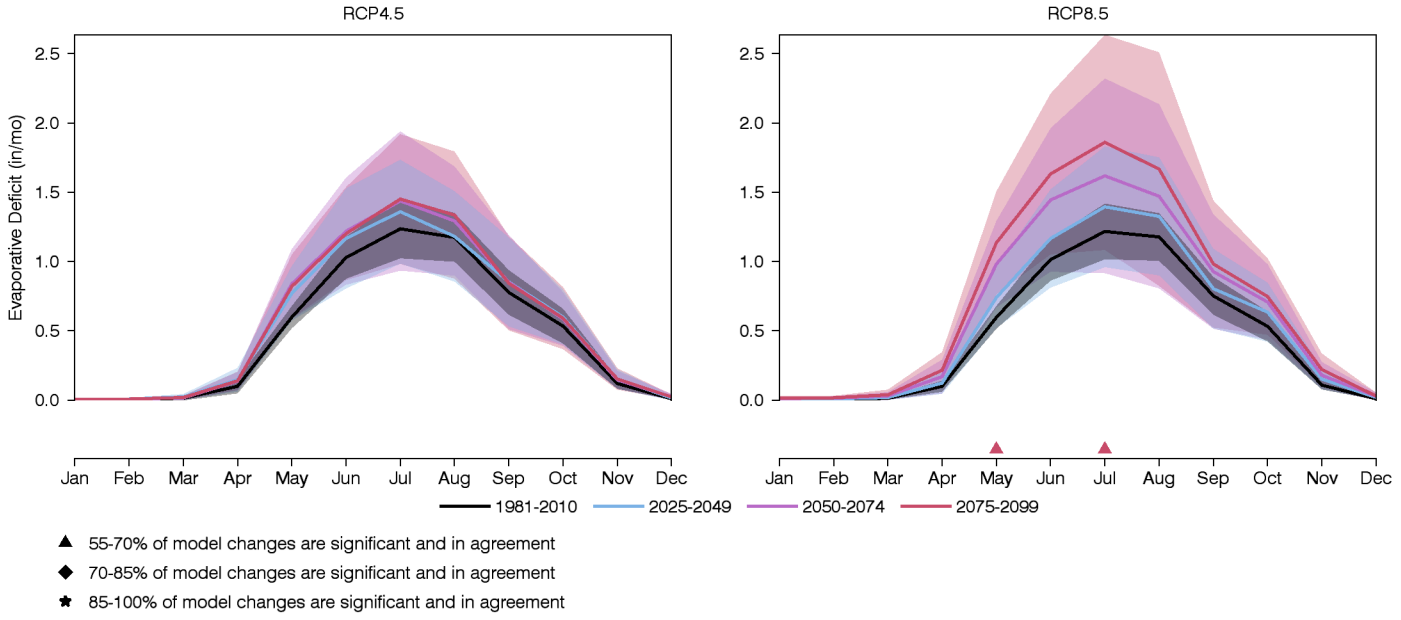


Figure 14: Monthly averages of evaporative deficit for four time periods for the RCP4.5 (left) and RCP8.5 (right) simulations. The average of 30 CMIP5 models is indicated by the solid lines and their standard deviations are indicated by the respective shaded envelopes. Triangle, diamond and square symbols 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

[EXTERNAL] Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment

Rayner, Doug A. <RaynerDA@wofford.edu>

Sat 5/19/2018 11:29 AM

To: London, Paula K <paula_london@fws.gov>; wesley.knapp@ncdcr.gov <wesley.knapp@ncdcr.gov>; tpbassette@ncdot.gov <tpbassette@ncdot.gov>; gnewberry@uscupstate.edu <gnewberry@uscupstate.edu>; L L Gaddy <llgaddy2@gmail.com>; Zack Murrell <murrellze@appstate.edu>; brownh@dnr.sc.gov <brownh@dnr.sc.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>; Merritt, Timothy <timothy_merritt@fws.gov>; Reid, Rebekah N <rebekah_reid@fws.gov>; Marshall, Michael E <michael_marshall@fws.gov>; gnewberry@charter.net <gnewberry@charter.net>

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

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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

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Dwarf-flowered heartleaf meeting

Marshall, Michael E <michael_marshall@fws.gov>

Tue 5/22/2018 9:09 AM

To: Becker, Drew N <Drew_Becker@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>; Reid, Rebekah N <rebekah_reid@fws.gov>
Cc: Stephanie DeMay <Stephanie.DeMay@ag.tamu.edu>

Hey guys,

Can we schedule a call to discuss the upcoming recommendation meeting? The first opportunity for both Rebekah and myself to be on such a call would be May 29th. Can you guys do that?

We'll need to discuss roles and responsibilities for the meeting, specifically, who runs the decision portion....also, if we need to run through slides prior to the meeting, we need to discuss how that might work. We also have the SSA out for peer review, and need to discuss the timing of that and getting a draft to the decision makers.

Because I need to prioritize my travel funds, it looks like I will be participating remotely...Rebekah and I discussed tag teaming the presentation, and are currently putting together a slide deck.

Talk soon!

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
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Re: Florida Golden Aster & Florida Scrub Jay Decision Support

Marshall, Michael E <michael_marshall@fws.gov>

Tue 5/22/2018 2:03 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>; Reid, Rebekah N <rebekah_reid@fws.gov>
Cc: Stephanie <stephanie.demay@ag.tamu.edu>; Mecklenborg, Todd <todd_mecklenborg@fws.gov>; Becker, Drew N <Drew_Becker@fws.gov>

Thank you Byron!

FYI Rebekah.....

Mike

On Tue, May 22, 2018 at 2:00 PM, Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Mike,
>
> Angela Romito will handle decision support for the Dwarf- flowered heartleaf.
>
> On Tue, May 22, 2018 at 1:01 PM, Hamilton, Byron <byron_hamilton@fws.gov> wrote:
>
> > Still working on it. Erin isn't available on the 12th. I will see if Angela has the same conflict.
> >
> > On Tue, May 22, 2018 at 12:59 PM, Marshall, Michael <michael_marshall@fws.gov> wrote:
> >
> > > Awesome! Any idea on who is handling the decision support for dwarf-flowered heartleaf meeting on June 12?
> > >
> > > On Tue, May 22, 2018 at 12:55 PM, Hamilton, Byron <byron_hamilton@fws.gov> wrote:
> > >
> > > > Hello all,
> > > >
> > > > Erin Rivenbark has confirmed that she will be handling decision support for the FL Golden Aster and the FL Scrub Jay on June 26th.
> > > >
> > > > --
> > > > **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
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Re: Florida Golden Aster & Florida Scrub Jay Decision Support

Becker, Drew N <Drew_Becker@fws.gov>

Wed 5/23/2018 6:11 AM

To: Hamilton, Byron <byron_hamilton@fws.gov>; stephanie.demay@agnet.tamu.edu <stephanie.demay@agnet.tamu.edu>

Hey Byron,

I didn't see Victoria in the office yesterday, but we still need to decide on a location for the scrub jay/aster meeting. I am MIA for a few days could you please discuss with Victoria.

Drew

Drew Becker
Recovery Coordinator
U.S. Fish and Wildlife Service
Southeast Region
1875 Century Boulevard
Atlanta, GA 30345
404-679-7226
drew_becker@fws.gov

Our Mission is to work with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people.

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On Tue, May 22, 2018 at 1:01 PM, Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Still working on it. Erin isn't available on the 12th. I will see if Angela has the same conflict.
>
> On Tue, May 22, 2018 at 12:59 PM, Marshall, Michael <michael_marshall@fws.gov> wrote:
>
> > Awesome! Any idea on who is handling the decision support for dwarf-flowered heartleaf meeting on June 12?
> >
> > On Tue, May 22, 2018 at 12:55 PM, Hamilton, Byron <byron_hamilton@fws.gov> wrote:
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> > > Erin Rivenbark has confirmed that she will be handling decision support for the FL Golden Aster and the FL Scrub Jay on June 26th.
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> > > --
> > > **Byron Hamilton, Sr.**
> > > **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
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U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
Work - (404) 679-4119
Cell - (803) 707-9518

Re: Dwarf-flowered heartleaf meeting

Reid, Rebekah N <rebekah_reid@fws.gov>

Tue 5/29/2018 9:03 AM

To: Marshall, Michael E <michael_marshall@fws.gov>
Cc: Becker, Drew N <Drew_Becker@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>; Stephanie DeMay <Stephanie.DeMay@ag.tamu.edu>

Works for me.

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

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On Tue, May 29, 2018 at 9:01 AM Marshall, Michael <michael_marshall@fws.gov> wrote:

> Good morning,
>
> We did not set a time....but I'll start by suggesting we talk at 1:00 pm est today. Does that work for folks?
>
> Thanks,
>
> Mike
>
> On Tue, May 29, 2018 at 8:02 AM, Rebekah Reid <rebekah_reid@fws.gov> wrote:
>
> > I was out last week and may have missed it. Did we set a time to talk today?
> >
> > 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 Tue, May 22, 2018 at 9:09 AM Marshall, Michael <michael_marshall@fws.gov> wrote:

> Hey guys,
>
> Can we schedule a call to discuss the upcoming recommendation meeting? The first opportunity for both Rebekah and myself to be on such a call would be May 29th. Can you guys do that?
>
> We'll need to discuss roles and responsibilities for the meeting, specifically, who runs the decision portion....also, if we need to run through slides prior to the meeting, we need to discuss how that might work. We also have the SSA out for peer review, and need to discuss the timing of that and getting a draft to the decision makers.
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> Because I need to prioritize my travel funds, it looks like I will be participating remotely...Rebekah and I discussed tag teaming the presentation, and are currently putting together a slide deck.
>
> Talk soon!
>
> Mike
>
> --
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> SSA Program Specialist
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>
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U.S. Fish and Wildlife Service Region 4
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Dwarf-flowered Heartleaf SSA

Marshall, Michael E <michael_marshall@fws.gov>

Wed 5/30/2018 11:10 AM

To: Miranda, Leopoldo <Leopoldo_Miranda@fws.gov>; Arnold, Jack <jack_arnold@fws.gov>; Mizzi, Janet <janet_mizzi@fws.gov>; McCoy, Thomas <thomas_mccoy@fws.gov>
Cc: Romito, Angela M <angela_romito@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>; Becker, Drew N <Drew_Becker@fws.gov>; Reid, Rebekah N <rebekah_reid@fws.gov>

Good afternoon all,

In anticipation of our scheduled Recommendation meeting in Atlanta on June 12 for the dwarf flowered heartleaf, please find attached, a draft SSA report, with separate attached appendices. This draft incorporates the Expert and Core Team reviews. We sent this out for peer review several weeks ago, and the review period closes on June 4th....no peer reviews have been returned to us so far, but figured it was time to get you guys a draft to look through in advance of our meeting.

If you have any questions or concerns about the SSA, please do not hesitate to contact myself or Rebekah Reid (species lead-Asheville).

Have a great day!

Mike

--
Mike Marshall
SSA Program Specialist
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Re: Dwarf-flowered Heartleaf SSA

Becker, Drew N <Drew_Becker@fws.gov>

Wed 5/30/2018 11:13 AM

To: Marshall, Michael E <michael_marshall@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>

Byron please print a copy for Jack/Leo. In my experience they expect a printed version on their desk.

Drew Becker
Recovery Coordinator
U.S. Fish and Wildlife Service
Southeast Region
1875 Century Boulevard
Atlanta, GA 30345
404-679-7226
drew_becker@fws.gov

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On Wed, May 30, 2018 at 11:10 AM, Marshall, Michael <michael_marshall@fws.gov> wrote:

> Good afternoon all,
>
> In anticipation of our scheduled Recommendation meeting in Atlanta on June 12 for the dwarf flowered heartleaf, please find attached, a draft SSA report, with separate attached appendices. This draft incorporates the Expert and Core Team reviews. We sent this out for peer review several weeks ago, and the review period closes on June 4th....no peer reviews have been returned to us so far, but figured it was time to get you guys a draft to look through in advance of our meeting.
>
> If you have any questions or concerns about the SSA, please do not hesitate to contact myself or Rebekah Reid (species lead-Asheville).
>
> Have a great day!
>
> Mike
>
> --
> Mike Marshall
> SSA Program Specialist
> U.S. Fish and Wildlife Service Region 4
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Heartleaf SSA meeting

Marshall, Michael E <michael_marshall@fws.gov>

Mon 6/4/2018 9:44 AM

To: Reid, Rebekah N <rebekah_reid@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>; Becker, Drew N <Drew_Becker@fws.gov>; Romito, Angela M <angela_romito@fws.gov>

Happy Monday all!

I just wanted to touch base with all of you as we approach our recommendation meeting....Rebekah and I have worked through our slides, so let me know if you guys would find it useful to look at these...not sure how much time we have to do an actual run through, but comments on content would be welcome.

Also...typically someone kicks off the meeting....introduces the nexus of the SSA...sets the stage...this has been Drew for Key Deer and Nashville crayfish....wondering if someone wants to do that, or if me or Rebekah need to just start the whole meeting off ourselves?

Finally....I know handouts are used typically, and wasn't sure if anyone needed anything from us on that front....let me know.

Thanks, and talk soon!

Mike

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

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

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Re: [EXTERNAL] Re: Dwarf-Flowered Heartleaf- Request for Peer Review for USFWS Species Status Assessment

Merritt, Timothy <timothy_merritt@fws.gov>

Tue 6/5/2018 1:29 PM

To: Marshall, Michael E <michael_marshall@fws.gov>
Cc: London, Paula K <paula_london@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>

We are only required under our peer review policy to solicit input from 3 individuals and we are not required to get any responses back in order to meet our policy.
Tim

On Tue, Jun 5, 2018 at 12:06 PM, Marshall, Michael <michael_marshall@fws.gov> wrote:

> Thanks Kaye! Makes sense.
>
> Mike
>
> On Tue, Jun 5, 2018 at 12:01 PM, Kaye London <kaye_london@fws.gov> wrote:
>
> > Mike,
> > There isn't alot you can do other than explain that we did send it out to 7 reviewers with no response. Doug Rayner did express interest in providing comments so maybe it fell off his radar. Since you did have expert input on the SSA and provided reviews and comments, that should be sufficient for the recommendation team. There is the possibility that some comments may come in late, also.
> >
> > Kaye
> >
> > Kaye London
> > Division of Conservation and Classification
> >
> > 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 11:35 AM, Marshall, Michael <michael_marshall@fws.gov> wrote:
> >
> > > 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

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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

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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.
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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

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--

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

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Monday-Thursday --> In Office 7:30-4:30 CST

Work Schedule 2nd Week
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--

_____
Timothy Merritt

Chief, Division of Conservation and Classification
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615-574-8812 cell

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Fwd: Heartleaf SSA

Becker, Drew N <Drew_Becker@fws.gov>
Fri 6/8/2018 10:46 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>; Davis, Victoria <victoria_davis@fws.gov>

Hi Victoria,

I requested Byron get a paper copy of the SSA to Leo and Jack. I do believe they have received a copy via e-mail as well. Byron could you please confirm Leo has a paper copy?

Drew

Drew Becker
Assistant Field Supervisory (Detail)
Tennessee Ecological Services Field Office
931-525-4982

Recovery Coordinator
U.S. Fish and Wildlife Service
Southeast Region
1875 Century Boulevard
Atlanta, GA 30345
404-679-7226
drew_becker@fws.gov

Our Mission is to w*ork with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people.*

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---------- Forwarded message ----------
From: **Davis, Victoria** <victoria_davis@fws.gov>
Date: Fri, Jun 8, 2018 at 9:28 AM
Subject: Heartleaf SSA
To: Drew Becker <drew_becker@fws.gov>

Hi Drew,

Please let me know if you have provided Leo with the SSA to review prior to the recommendation meeting.

--
--victoria

Victoria Davis
U.S. Fish and Wildlife Service
Ecological Services, Chief of Staff
1875 Century Boulevard, Suite 200
Atlanta, Georgia 30345

Telephone: 404/679-4176
Facsimile: 404/679-7081

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Dwarf flowered heartleaf

Merritt, Timothy <timothy_merritt@fws.gov>

Mon 8/6/2018 5:42 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>

1 attachments (5 MB)

Dwarf-flowered Heartleaf Proposed Rule_tbm edits.docx;

Lets talk before you start making these edits.
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
404-679-7081 fax
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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 Wildlife (List) due to recovery. 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 has recovered and 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 Florida Golden Aster 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: Michael Gale, Acting Field Supervisor, U.S. Fish and Wildlife Service, Tennessee Ecological Services Field Office, 446 Neal Street,

Cookeville, TN 38506; telephone 931-528-6481. 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 Wildlife in title 50 of the Code of Federal Regulations (50 CFR 17.11(h)) based on the species' recovery. 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. We may delist a species 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 based on recovery.

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 sought the expert opinions of

seven appropriate specialists regarding the SSA Report, which informed the proposed rule to delist the species. The purpose of peer review is to ensure that our classification 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:

(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 Action

On April 14, 1989, we published a final rule in the *Federal* Register (FR 54 14964) listing the dwarf-flowered heartleaf as endangerd 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.

Background

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).

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, entire; NCNHP 2016, entire). 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.

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

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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.

Dwarf-flowered heartleaf occurs on piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, entire; 1987, 52(3):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, entire; Weakley 2015, entire; 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) 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.

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

Deleted: 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.

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 conservation biology principles of resiliency, redundancy, and representation (together, the 3Rs) to evaluate individual life-history needs. The next stage involved an assessment of the historical and current condition of species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. The final stage of the SSA involved making 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 occupancy, thereby increasing resiliency of populations.

The species also needs to exhibit some degree of redundancy. We measured redundancy for the Dwarf-flowered heartleaf in terms of 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.

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

Delineating Populations

As stated in the Service's five-year review, biologist working with dwarf-flowered heartleaf have used several terms such as "sub site," "site," "location," "occurrence" (often, but not always, in reference to Natural Heritage Program Element Occurrence Records), and "population" interchangeably, while other biologist 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

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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 dwarfed flowered heartleaf, 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.

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 1.1; Estep pers. Comm. 2018). The genetic analysis to

Deleted: USFWS

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Commented [MT8]: Do these reports use the method described above to come up with populations, if so, then we should state that, if not, then explain the differences.

Maybe say Based off of recent reports using the methods described above……

Commented [MT9]: What is this referring to? I don't see a Figure 1.1 anywhere.

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.

Current Resilience

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). 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. 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.

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.

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).

After applying our resilience categories listed above, there are 78 populations of dwarf-flowered heartleaf that have been observed since 2005, 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.

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Table 1.1. 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

Site Name	State	County	Last Observed	Total plants	Resilience
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
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

Site Name	State	County	Last Observed	Total plants	Resilience
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 1.2. Population resilience categories by county for Dwarf-flowered heartleaf.

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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 1.3 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 1.3. 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).

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Trend	Survey	Site	2016 estimated number of plants (Rosettes)	2016 ar 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

Summary of Threats and Conservation Measures that Affect the Species

We completed a comprehensive assessment of the biological status of the Dwarf-flowered Heartleaf, and prepared a report of the assessment, which provides a thorough account of the species' overall viability. 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.

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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.

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

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 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.

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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

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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).

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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 federally listed in 1989, this was not known to be a significant factor 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 provides limited protection from 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. 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 (Appendix B, Table B.9). 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.

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.

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

Invasive exotic plant species are rampantly 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.

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), 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.

As discussed above, the trend for North/South Carolina 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, 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.

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.

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,

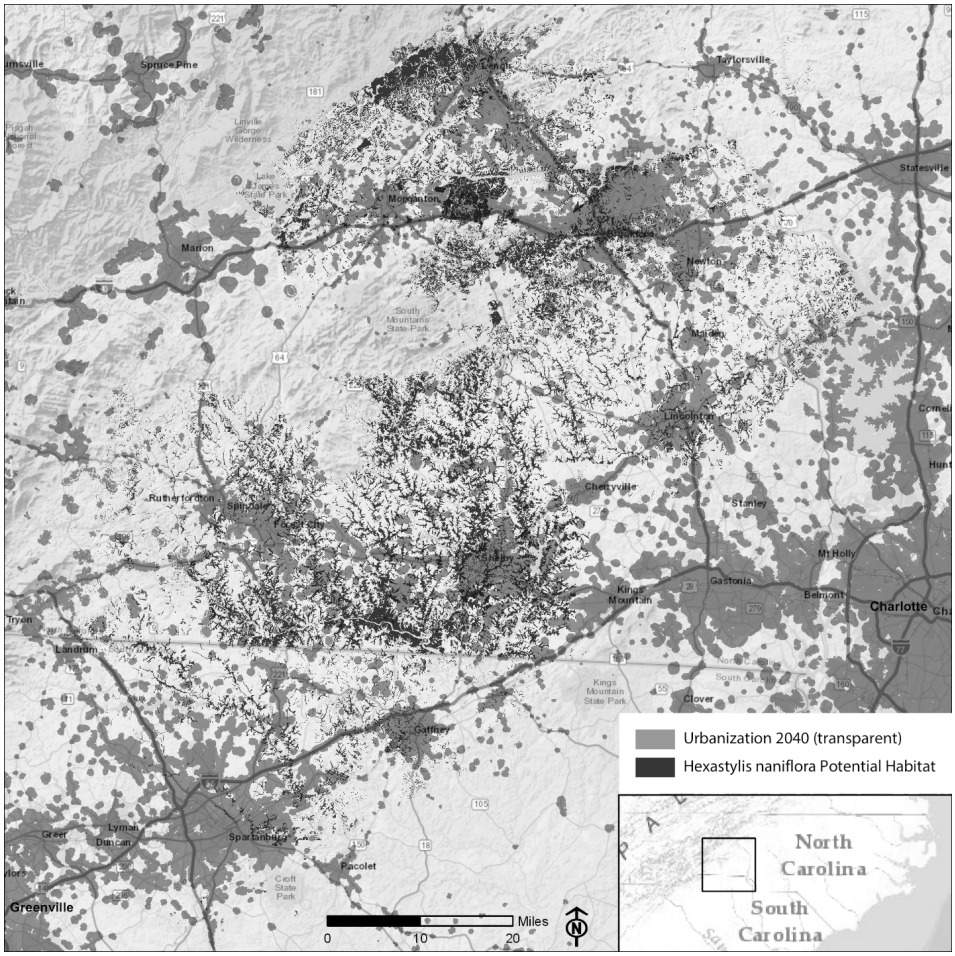
and lack of knowledge about where additional populations may persist on the landscape, we chose to project populations out to the year 2040 under each scenario, but no further.

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 1.4). 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 1.4. Results of the SLEUTH model with *Hexastylis naniflora* potential habitat predicted by the MAXENT model overlaid.

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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 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. This is appropriate for several reasons. First, location of new EOs

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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 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 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 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 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 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.

Table 1.5. 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.

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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. 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).

High Development Scenario

In the High Development scenario, there are predicted to be 72 populations of Dwarf-flowered heartleaf on the landscape in 2040. 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.

Targeted Conservation Scenario

In the Targeted Conservation scenario, there are predicted to be 79 populations of Dwarf-flowered heartleaf on the landscape in 2040. 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).

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, 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.

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Table 1.6. 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

Section 4 of the Act, and its implementing regulations at 50 CFR part 424, set forth the procedures for listing species, reclassifying species, 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 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.

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 due to recovery. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted due to recovery 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 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, Asheville, North Carolina 28801 (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 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 is staff members of the Service's Southeastern Region Recovery Team and the South Carolina/ 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.

Re: Dwarf Flowered Heartleaf Proposed Delisting Rule

Stevens, Michael P <Mike.Stevens@sol.doi.gov>

Tue 11/13/2018 9:29 AM

To: Merritt, Timothy <timothy_merritt@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>

I've reviewed the draft rule and I'm sending it back for major revisions. Primary concerns:

1. The Factor D analysis seems to rely on regulatory mechanisms (especially site protections) that are based on the species' being listed under the ESA. However, once the species is delisted, any regulatory protections that are based on listing will no longer apply. Only those site protections that will remain in place after delisting may be considered "existing" regulatory mechanisms. So the Factor D analysis must be revised to clarify which of these site protections created for the benefit of the species while it is listed will remain in place afterward, and only consider their adequacy.

2. The Factor E analysis acknowledges that invasive species pose the greatest threat to sites occupied by the species that are currently in protective ownership, and that active management is required. Yet there is no further analysis, and no discussion of whether active management is taking place or how effective it is, and this threat is not considered in the future conditions discussion that follows. This inconsistency needs to be explained.

3. The "Future Condition" analysis needs major rework. It seems overly long, given that other sections (such as the background) are condensed with the reader referred to the SSA Report. The discussion is hard to follow, shifting back and forth between methodology and findings. Despite stating initially (see bottom of page 19) that climate change is one of the two key risks to the future condition of the species, and that it would be addressed qualitatively, there is barely a mention of how climate change affects the three future development scenarios.

4. The determination needs to be reworked. It focuses entirely on the 3Rs and does not address the listing factors. It needs to state expressly how the species no longer meets the definition of endangered species and, especially, threatened species, using the definitions found in the Act, and better connect those conclusions with the previous analyses (especially the "threatened" determination).

Specific comments are found in the Track Changes version of the document that is attached to this e-mail. Please let me know if you have any questions.

Michael Stevens
Attorney-Advisor
Office of the Regional Solicitor
Southeast Region
404-331-5617

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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.***

Re: Heartleaf rule

Reid, Rebekah N <rebekah_reid@fws.gov>

Tue 5/14/2019 8:45 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>

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

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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**

Dwarf-flowered Heartleaf Proposed Rule_clean to RSOL_SOL20181113_SOL20190417 (2) - Invitation to edit

Gary Peeples (via Google Docs) <drive-shares-noreply@google.com>

Thu 6/6/2019 12:47 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>

gary_peeples@fws.gov has invited you to **edit** the following document:

Dwarf-flowered Heartleaf Proposed Rule_clean to RSOL_SOL20181113_SOL20190417 (2)

Unknown profile photo Hopefully this will get it.

Open in Docs

Google Docs: Create and edit documents online.

Google LLC, 1600 Amphitheatre Parkway, Mountain View, CA 94043, USA

You have received this email because someone shared a document with you from Google Docs.

Logo for Google Docs

Fwd: Dwarf-flower Heartleaf PDM Draft

Merritt, Timothy <timothy_merritt@fws.gov>
Fri 8/9/2019 11:16 AM

To: Hamilton, Byron <byron_hamilton@fws.gov>; Young, Kristi <kristi_young@fws.gov>

Heads up on the type of comments were are going to get back from HQ.

---------- Forwarded message ---------
From: **Ketram, Natchanon** <natchanon_ketram@fws.gov>
Date: Fri, Aug 9, 2019 at 10:04 AM
Subject: Re: Dwarf-flower Heartleaf PDM Draft
To: Merritt, Timothy <timothy_merritt@fws.gov>

Hi Tim,

Yes that is helpful. After Don does his review and you receive the draft from us, I would recommend we put some of that information into the rule. The rule itself contains a lot of information on how threats are addressed up to the present, but it needs more information on what we or our partners plan to do after we delist the species. For example, the rule stated that Section 7 coordination plays a major role in protecting the species habitat. If we do delist the species, my question then is what measures do we have in place to continue to conserve the species when we can no longer rely on section 7. You or Byron don't need to answer my question here but those are the types of feedback you will be receiving.

On Fri, Aug 9, 2019 at 10:33 AM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Does this answer your question?
>
> ---------- Forwarded message ---------
> From: **Hamilton, Byron** <byron_hamilton@fws.gov>
> Date: Fri, Aug 9, 2019 at 9:26 AM
> Subject: Re: Dwarf-flower Heartleaf PDM Draft
> To: Merritt, Timothy <timothy_merritt@fws.gov>
> Cc: Kristi Young <kristi_young@fws.gov>
>
> Good morning,
>
> The State of North Carolina Natural Heritage Program and NC Department of Transportation have monitored a total of 25 sites. The PDM proposes continuation of this monitoring, by the agencies, so that we can compared pre- and post-delisting population numbers. They would continue to be our partners and we would continue to work with them on monitoring should the species be delisted.
>
> On Thu, Aug 8, 2019 at 2:23 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:
>
> > Can you answer Natchanon's question without sending him the PDM?

Tim

---------- Forwarded message ---------
From: **Ketram, Natchanon** <natchanon_ketram@fws.gov>
Date: Thu, Aug 8, 2019 at 1:34 PM
Subject: Re: Dwarf-flower Heartleaf PDM Draft
To: Merritt, Timothy <timothy_merritt@fws.gov>

Hi Tim,

Yes you are correct that HQ does not need to review the PDM anymore. The reason I wanted to look at the PDM is as a reference material. As I was reviewing the rule, it was not apparent to me what post-delisting coordination (if any) we would do with state or local partners if we delist the species. We had alluded to the contribution made by state partners. I wanted to skim the PDM to see if any of these contributions will continue into the post-delisting period. I do not plan to make any edits on the PDM itself.

On Thu, Aug 8, 2019 at 12:21 PM Merritt, Timothy <timothy_merritt@fws.gov> wrote:

> Natchanon,
> Our understanding in the RO is that the PDM stays in the RO and does not go to HQ for review.
> Tim
>
> On Thu, Aug 8, 2019 at 9:38 AM Ketram, Natchanon <natchanon_ketram@fws.gov> wrote:
>
> > Good morning Tim,
> >
> > I am doing the preliminary review of the dwarf-flowered heartleaf for Don. I was wondering if you have the draft PDM for this species that I can look at. 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

--

_____
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

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Re: HENA Updates

Peeples, Gary <gary_peeples@fws.gov>
Thu 8/22/2019 9:12 AM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Reid, Rebekah N <rebekah_reid@fws.gov>

Hey Byron,

Unfortunately I won't be able to be on the call, as I'll be helping with a session at the project leader's meeting during that time window. However, Rebekah will be on the call.

-G

On Thu, Aug 22, 2019 at 8:41 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good morning Gary,
>
> Will you be on the HENA HQ Briefing call next week? I may need your expertise with their questions.
>
> On Mon, Aug 19, 2019 at 9:15 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
>
> > Good morning Gary,
> >
> > You are correct, RO handles the HQ briefings. We got it.
> >
> > On Wed, Aug 14, 2019 at 4:48 PM Peeples, Gary <gary_peeples@fws.gov> wrote:
> >
> > > Greetings Byron,
> > >
> > > My understanding from Tim and past classification conference calls is that the RO does the HQ briefing. I'm confused about why this ask is being made of the field?
> > >
> > > -Gary
> > >
> > > On Fri, Aug 9, 2019 at 8:05 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
> > >
> > > > Byron,
> > > >
> > > > I am out of town the majority of next week. Since I have not given a presentation on HENA since October of last year, I would like adequate time to prepare. With that in mind, I can be ready and available anytime the week of August 26.
> > > >
> > > > Thank you for sending the guidance. A couple of questions:
> > > >
> > > > - How much time is allotted for the briefing?
> > > > - Is there a slide limit?
> > > > - Can you send an example or two of HQ briefing presentations? Bonus points if it's a plant example.
> > > > - What else do we need to do to be prepared for the briefing?
> > > > - I saw that the briefing is done off paper slides. I'm assuming we don't need to worry about screen sharing and they will have a conference call line set-up and ready to go?
> > > >
> > > > 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

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On Thu, Aug 8, 2019 at 8:53 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Good morning,

Will you be available to give the heartleaf briefing to HQ in the next week or two?

On Thu, Aug 1, 2019 at 7:56 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

Thanks for the update!

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
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cell: 828-782-0090

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On Thu, Aug 1, 2019 at 7:34 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Good morning,

Thanks for all of your help. Dwarf-flowered heartleaf was sent to HQ on yesterday. The edits were exactly what the solicitor was looking for. Hopefully they won't have many comments and it can move along. I will keep you posted.

On Wed, Jul 31, 2019 at 2:44 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

Hi Byron,

Any updates on HENA? Were the responses to solicitor comments acceptable? Is the goal still to have the FR notice go out this FY?

Thanks!

Rebekah Reid

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gary_peeples@fws.gov
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Re: Dwarf-flowered Heartleaf HQ Briefing

Reid, Rebekah N <rebekah_reid@fws.gov>

Tue 8/27/2019 7:54 AM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Merritt, Timothy <timothy_merritt@fws.gov>; Peeples, Gary <gary_peeples@fws.gov>

Thanks, Byron. Can you also share the final proposed rule that went to HQ? I think I've got a close to final version but not the final one.

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
160 Zillicoa St.
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phone: 828-258-3939 x42238
cell: 828-782-0090

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On Mon, Aug 26, 2019 at 1:32 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Good afternoon,
>
> Great! I will need you to answer any questions asked by Don or Bridget. I'm finishing the PPT now and will send to you when it is complete.
>
> On Mon, Aug 26, 2019 at 1:09 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
>
> > Byron,
> >
> > I am available to be on the call Friday afternoon. So that I know how to prepare, can you tell me in what capacity the field is expected to participate in the call? Also, can you share the materials you will be using for the briefing so that I know what information is being presented?
> >
> > Thank you for organizing,
> >
> > Rebekah Reid
> >
> > US Fish and Wildlife Service
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Re: Dwarf-flowered heartleaf Briefing

Reid, Rebekah N <rebekah_reid@fws.gov>

Wed 8/28/2019 10:20 AM

To: Hamilton, Byron <byron_hamilton@fws.gov>

Yep, I'll be there.

Rebekah Reid

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On Wed, Aug 28, 2019 at 10:19 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> Hey Rebekah,
>
> Bridget rescheduled her 9 am on this Friday for us to use that slot. Will this work for you?
>
> On Wed, Aug 28, 2019 at 9:27 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
>
> > Hi Byron,
> >
> > I can be available most days in Sept. The exceptions are 3rd-4th and 19th-20th - I have previous commitments or leave those days. I can make any other days/times work.
> >
> > Have a nice long weekend,
> >
> > Rebekah Reid
> >
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> >
> > On Wed, Aug 28, 2019 at 9:06 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> > Good morning,
> >
> > I have to reschedule the Friday briefing for another time. Looking at your schedules there is not much availability over the next two weeks. Can we slide this briefing somewhere in the seams?
> >
> > --
> > **Byron Hamilton, Sr.**
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Re: Dwarf-flowered heartleaf Briefing

Reid, Rebekah N <rebekah_reid@fws.gov>

Thu 8/29/2019 2:22 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>

I've got more detailed notes on that if we need it, I just wasn't thinking they'd want to know about specific sites. Anything else we need to be super prepared for? Any questions that always come up? I saw the ones on the guidance document and reviewed a few from the RD briefing. Anything else?

Rebekah Reid

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On Thu, Aug 29, 2019 at 2:19 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

> This is great!. I know the question will come up.
>
> On Thu, Aug 29, 2019 at 2:17 PM Reid, Rebekah <rebekah_reid@fws.gov> wrote:
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> > Hey Byron,
> >
> > NC and SC both have laws or regulations that protect plants. They are not the most protective but they do exist. Anything that is in protection with a CE, DR, or fee simple purchase would continue to be protected if delisted. In SC there is a State Heritage Preserve, that will stay a preserve. There are Registered Heritage Agreements with private landowners, those agreements would still be in place. Is that helpful or do you need more info?
> >
> > Talk with you tomorrow,
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> > Rebekah Reid
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On Thu, Aug 29, 2019 at 10:49 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

Hey Rebekah,

Quick question: What conservation efforts/protections for HENA will remain in place after delisting?

On Wed, Aug 28, 2019 at 10:20 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

Yep, I'll be there.

Rebekah Reid

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Rebekah Reid

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Re: Dwarf-flowered heartleaf Briefing

Reid, Rebekah N <rebekah_reid@fws.gov>
Fri 8/30/2019 10:14 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>

Nice job, Byron! Have a great long weekend!

I'll get with Mark in our office about the modeling and see if we can beef-up our justification for FF and the modeling. I'll be in touch.

Rebekah Reid

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On Thu, Aug 29, 2019 at 2:37 PM Hamilton, Byron <byron_hamilton@fws.gov> wrote:

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>
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> > I've got more detailed notes on that if we need it, I just wasn't thinking they'd want to know about specific sites. Anything else we need to be super prepared for? Any questions that always come up? I saw the ones on the guidance document and reviewed a few from the RD briefing. Anything else?
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> I can be available most days in Sept. The exceptions are 3rd-4th and 19th-20th - I have previous commitments or leave those days. I can make any other days/times work.
>
> Have a nice long weekend,
>
> 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, Aug 28, 2019 at 9:06 AM Hamilton, Byron <byron_hamilton@fws.gov> wrote:
>
> > Good morning,
> >
> > I have to reschedule the Friday briefing for another time. Looking at your schedules there is not much availability over the next two weeks. Can we slide this briefing somewhere in the seams?
> >
> > --
> > **Byron Hamilton, Sr.**
> > **Fish & Wildlife Biologist (Ecological Services - Division of Conservation & Classification)**
> > **U.S. Fish & Wildlife Service**
> > **1875 Century Blvd.**
> > **Atlanta, GA 30345**
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> > **Cell - (803) 707-9518**

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Re: Dwarf-flowered heartleaf question

Reid, Rebekah N <rebekah_reid@fws.gov>

Thu 11/14/2019 7:18 AM

To: Lombardi, Melissa D <melissa_lombardi@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Peeples, Gary <gary_peeples@fws.gov>

Hi Melissa,

Thanks for reaching out. I'm adding Byron Hamilton to this email. He is the lead for the proposed rule. I've been in a supporting role but can tell you what I know. The dates on the list are the original targets (proposed FY19 and final FY20). I didn't hear that the proposed rule was published in the FR so I think we've missed the FY19 target. Byron can tell us for sure. I'm guessing we are in a FY20 (proposed) and FY21 (final) scenario at this point.

Byron - Can you help Melissa with her questions?

Rebekah Reid

US Fish and Wildlife Service
Asheville Ecological Services Field Office
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phone: 828-258-3939 x42238
cell: 828-782-0090

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On Wed, Nov 13, 2019 at 3:27 PM Lombardi, Melissa <melissa_lombardi@fws.gov> wrote:

> Rebekah,
> I'm currently detailing in the RO in Drew Becker's position and had a recovery-related question. HQ is going to publish (on the website) the Services national workplan for downlisting and delisting recommendations and the RO wanted to double check with FOs and species leads that the change in status and dates are what you expect.
> **For the dwarf-flowered heartleaf, they have a 12-month finding or proposed rule in FY19 and a final determination in FY20.**
> If you could let me know as soon as you get a chance, I'll get that info to our reviewers here. Thanks again. Meliss
>
> Melissa Lombardi, DVM, MS
> TDY: Section 6 Regional Coordinator
> Atlanta, GA
> Duty Station: Arkansas Ecological Services Field Office
> Conway, AR 72032
> C:501-733-2056

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Re: Dwarf-flowered heartleaf info for HQ

Hamilton, Byron <byron_hamilton@fws.gov>
Mon 12/9/2019 8:21 AM
To: Reid, Rebekah N <rebekah_reid@fws.gov>

Thanks for the feedback.

On Mon, Dec 9, 2019 at 8:19 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Hey Byron,
>
> It's easy to eat too much this time of year!
>
> We've always suspected that there were more Hexastylis populations on the landscape than we knew about. I think the increase in number of populations is due to additional survey efforts.
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
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> >
> > > FYI
> > >
> > > ---------- Forwarded message ---------
> > > From: **Morgan, Don** <don_morgan@fws.gov>
> > > Date: Thu, Sep 26, 2019 at 3:22 PM
> > > Subject: Re: Dwarf-flowered heartleaf info for HQ
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Cc: Byron Hamilton <byron_hamilton@fws.gov>, Kristi Young <kristi_young@fws.gov>, Natchanon Ketram <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

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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>
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> Subject: Dwarf-flowered heartleaf info for HQ
> To: Timothy Merritt <timothy_merritt@fws.gov>
>
> Tim,
>
> See attachments.
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Thanks!

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See attachments.

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Re: Dwarf-flowered heartleaf info for HQ

Hamilton, Byron <byron_hamilton@fws.gov>
Wed 12/18/2019 9:22 AM

To: Reid, Rebekah N <rebekah_reid@fws.gov>
Cc: Peeples, Gary <gary_peeples@fws.gov>

Thanks Rebekah! You are the Real MVP!

On Wed, Dec 18, 2019 at 7:15 AM Reid, Rebekah <rebekah_reid@fws.gov> wrote:

> Hi Byron,
>
> I'll take a look. I will not be able to get something back to you until after the first of the year.
>
> Thanks.
>
> Rebekah Reid
>
> US Fish and Wildlife Service
> Asheville Ecological Services Field Office
> 160 Zillicoa St.
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Fwd: Dwarf-flowered heartleaf info for HQ

Hamilton, Byron <byron_hamilton@fws.gov>

Tue 1/28/2020 6:44 AM

To: Young, Kristi <kristi_young@fws.gov>

1 attachments (119 KB)

20190724_Dwarf flowered heartleaf_pDeL_withPRB_nk DCC (1) (Repaired) RNR_JM Comments.docx;

FYI

---------- Forwarded message ---------
From: **Reid, Rebekah** <rebekah_reid@fws.gov>
Date: Fri, Jan 24, 2020 at 12:15 PM
Subject: Re: Dwarf-flowered heartleaf info for HQ
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Gary Peeples <gary_peeples@fws.gov>

Hi Byron,

See attached responses to highlighted comments and suggested edits. Thanks for your patience.

Have a nice weekend!

Rebekah Reid

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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

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Commented [KNN1]: Overall, I have concerns about our post-delisting commitments. We stated in the rule that the number of populations has increase from 24 at the time of listing, to 119 currently. However, it was unclear to me whether these new populations was the result of ongoing conservation efforts by the Service and our partners or solely additional survey efforts. If it is the later, do we have commitment with partners or the states to minimize the effects of future development and climate change? In the rule, we alluded to the high resiliency of many of these populations. However, we also noted that

"…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…"

If we delist this species, the protection provided under Section 7 consultation will no longer apply. What actions will we take then to help ensure the persistence of the species post delisting?

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Commented [RRN3R1]: I tried to address comments related to this one as they were asked throughout the document.

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Commented [FB4]: This document is well-written and organized well. I think that we need to do more in the threats section for current condition to convince the reader that development in particular is not a threat. We don't seem to have included any analysis on which populations or what percent of the range of the species is subject to the threat of development. I saw that some of this information comes later in the document, but should appear earlier.

Also, the first paragraph of the press release talks about all the conservation done by Duke Energy along the Broad River. That information is missing from this rule – if it's important enough for the press release, it should be discussed herein (and could help address the comment I provided above).

Commented [HB5R4]: Affirmative

Commented [FB6]: We are inconsistent in our use of the common and scientific names throughout. For plain language purposes, we should stick with the common name. Pls address throughout.

Commented [HB7R6]: Affirmative

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

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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

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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

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Commented [KNN14]: This paragraph somewhat contradicts the previous paragraph where we stated that the species has expanded into five new counties. Here we are saying that the species require very specific habitat conditions. If we want to retain this paragraph, we should include a transition sentence at the beginning of this paragraph reconciling the species range expansion versus its strict habitat requirements.

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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.

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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

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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

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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.

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Summary of Biological Status and Threats

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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

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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

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Commented [KNN18]: Up to this point, I don't think we have stated where these new populations come from. Is it the result of additional survey works? Conservation efforts? Both?

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Commented [FB20]: Not sure if we are saying that of these 119 pops, only 78 were observed since 2005, or we only assessed 78 of the populations observed since 2005. Can we clarify?

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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:

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- 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

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Commented [FB22]: We have to decide if we want to talk about 119 populations or 78. If 41 of these populations haven't been seen since before 2005, maybe we shouldn't consider them extant. If we do think they are extant, what is the role in conservation that we expect the other 41 populations to serve?

Commented [HB23R22]: We used 78 as a conservative estimate of the number of populations. Because those 41 had not been observed since 2005, we didn't want to use those populations as justification for reclassification and then have someone ask, "well, how do you know they are still there or what their status is if no one has observed them in 15 years?". Assuming those 41 populations are extirpated is not an accurate assumption. The species is long-lived and data shows we can go decades between observations. I think the original thought was, if we can justify reclassification with 78 populations, then we can also do it with 119. As far as conservation value of those 41, because they are spread throughout the range, they bolster the 3Rs (i.e. we have more representation with 119 populations than we do with 78 populations, etc.).

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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

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Commented [RRN33]: Here is the definition I have for 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.

I commented on this during solicitor review but will restate here. The description about EO distances above is how we defined populations in the SSA and does not describe how we define representation. For this species, how we define populations is not the same as how we define representation.

I've edited to describe how we define representation.

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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.

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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).

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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

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Commented [KNN43]: We have identified that NC and SC laws do not provide direct protection to the species. Have the Service undertake any coordination with state environmental agencies to help conserve the species? That will help strengthen our case that threats due to development is being addressed by state partners

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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

Commented [KNN51]: If we are so reliant on Section 7 consultation to conserve the species, what will happen once we delist the species? Section 7 consultation will no longer apply. What will we do then to help ensure that developers will not undertake projects that will harm the species?

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Commented [RRN53R51]: See comment above.

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Commented [KNN56]: What are the resilient categories for these populations? Including that information would help give context to the threat ranking that NHP uses below.

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(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

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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

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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,

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Commented [KNN82]: Since we are discussing foreseeable future in sections before the determination section, we should briefly include our definition of foreseeable future here. I have moved language from a section below.

Also since I have move this language up here, we may not need this additional sentence anymore. Please revise as needed.

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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-

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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

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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.

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Moved up [1]: 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 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.

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Commented [RRN114R112]: When we were working on the SSA, we looked at what others were using and found 80% referenced by the LLC network.

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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

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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 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

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Commented [FB119]: Is this correct? Seems odd to have a scenario where we presume a number a priori, wouldn't that force the scenario to end up a certain way?

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Commented [RRN121R119]: This was poor wording choice. We analyzed each scenario to determine how many populations would persist and based on the analysis, we assume (estimate) that 75 would persist. The "assumption" was made after analyzing each scenario. We didn't do the assumption first. The way the sentences has been edited is much clearer.

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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:

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- 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:

- 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

Commented [FB125]: Who is doing this targeted conservation? Is it likely to happen, in the absence of an ESA listing?

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Commented [RRN127R125]: 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. Between this scenario and current, we predict 5 extirpations and 6 predicted to persist so we are talking about a gain of 1 population in this scenario. In our RTM meeting, we indicated that the Status Quo was the likely scenario.

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- 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.

Commented [FB128]: And is this compared with the 113 populations that we know about, or the 78 populations we used for analysis of the current condition? Need to be clear whether we are acknowledging that some loss will occur but the spp will be OK, or if we are predicting the spp will stay relatively stable?

Commented [RRN129R128]: This is compared to the 78. In this scenario, we started with 78 pops, through the analysis we estimated that five populations will be extirpated but two will be persisting (78-5+2 = 75) (see summary table).

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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

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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.

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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.

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

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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

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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. ¶

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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

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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

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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.

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Analysis

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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

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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). ¶

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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.

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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.

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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.

Dated: _____

_____

Aurelia Skipwith
Director,
U.S. Fish and Wildlife Service,

Deleted: *Hexastylis naniflora*

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: Need ASAP - VI boa and dwarf-flowered heartleaf IMs in latest format

Young, Kristi <kristi_young@fws.gov>
Thu 4/30/2020 5:34 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>

Byron,

For your record, here's what we sent up to HQ. Just tried to make it shorter.

-Kristi

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Thursday, April 30, 2020 10:11 AM
To: Young, Kristi <kristi_young@fws.gov>; McRae, Sarah <sarah_mcrae@fws.gov>
Cc: Davidson, Chris <chris_davidson@fws.gov>
Subject: Re: Need ASAP - VI boa and dwarf-flowered heartleaf IMs in latest format

Good morning!

Please see attachment for the Heartleaf IM.

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: Thursday, April 30, 2020 10:50 AM
To: McRae, Sarah <sarah_mcrae@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Davidson, Chris <chris_davidson@fws.gov>
Subject: Need ASAP - VI boa and dwarf-flowered heartleaf IMs in latest format

Hi folks,

A last-minute addition to the Director's briefing on May 7; they want to include boa and heartleaf. I know these rules are already in HQ, but the IM is probably dated and not in the most-recent format (template is on the DCC teams page). Please update these IMs and send to Chris and I ASAP. Focus on making them as concise as possible, please.

-Kristi

>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<
Kristi Young
Deputy Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi Basin

Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<

Re: Dwarf-flowered heartleaf

Hamilton, Byron <byron_hamilton@fws.gov>

Fri 5/8/2020 8:03 AM

To: Morgan, Don <don_morgan@fws.gov>

Good morning!

Let's talk at 11 am. Is this ok?

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: Friday, May 8, 2020 7:57 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Dwarf-flowered heartleaf

Hi Byron,

I would like to discuss some of the responses provided to Bridget's edits on this rule. Would you have any time today to discuss this with me?

Thanks,

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

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Tuesday, May 5, 2020 9:42 AM
To: Morgan, Don <don_morgan@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>
Subject: Re: Dwarf-flowered heartleaf

Good morning Don

Please see attachments for dwarf-flowered heartleaf info.

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: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Monday, May 4, 2020 3:39 PM
To: Morgan, Don <don_morgan@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>
Subject: Re: Dwarf-flowered heartleaf

Ok, will do

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: Monday, May 4, 2020 3:35 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>
Subject: Re: Dwarf-flowered heartleaf

Hi Byron,

Please make the following changes to the documents

1. For the briefing paper:

VIII. Is timing critical? ☒ Yes. ☐ No.
Target date to clear DOI: Click here, or as priorities allow.
No-later-than date to clear DOI (if applicable): Click here.
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? We are reopening the comment period at the request of the Southern Environmental Law Center, Cumberland River Compact, and Mill Creek Watershed Association, who requested a public hearing and extension of the comment period.

We do not check the box as Yes unless it is court ordered, so please mark this No. We do not need to include the workplan as the driver, you can leave this blank. I do not understand what you have for b.? Is this just a cut and paste from Nashville crayfish? If so, please delete this as well.

2. For the NTR, please revise it to fit the format we are currently using (see attached "template" and example)

3. For the surname document, I have the RSOL surname that you sent (It will need to be updated with a more recent review) but what I really need is the surname from the RD, I do not have that.
In reviewing the Nashville crayfish documents - CBP and NTR- similar revisions need to be made.

Thanks!

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

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Monday, May 4, 2020 1:53 PM
To: Morgan, Don <don_morgan@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>
Subject: Re: Dwarf-flowered heartleaf

Hi Don,

Please see the attachments for the requested documents. Let me know if you need anything else.

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: Monday, May 4, 2020 12:50 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>
Subject: Dwarf-flowered heartleaf

Hi Byron,

In reviewing the documents I have for Dwarf-flowered heartleaf I have the following questions:

1. I appear to be missing the RO surname for this package
2. I am not sure I have the latest Clearance Briefing Paper? Attached is the latest version I can find and it still has track changes. Please send me a clean version
3. I do not see a Note To Reviewers for this package, it may be because they were not required when you first put the package together?

Your help with getting this information together will be most appreciated.

Thanks,

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

Re: Heartleaf

Hamilton, Byron <byron_hamilton@fws.gov>

Fri 5/15/2020 7:59 AM

To: Reid, Rebekah N <rebekah_reid@fws.gov>

Thanks Rebekah! You do the same!

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Friday, May 15, 2020 7:55 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Heartleaf

Hey Byron,

See what you think of the revision below. Feel free to change anything based on your notes...

The majority of known dwarf-flowered heartleaf populations were been discovered as a direct result of surveys efforts conducted in the late 1990s and early 2000s (NCNHP 2018). As a result of these efforts, 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.

I can get more specific with dates if we need to, just let me know. Have a great weekend!

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.

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Thursday, May 14, 2020 6:45 AM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Heartleaf

Good morning!

Great! I'm scheduling a Teams call for 2 pm this afternoon.

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Wednesday, May 13, 2020 4:47 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Heartleaf

Hey Byron,

I appreciate his concern. I'm free anytime tomorrow (8am-4pm) for a conference call or Teams chat. Let me know what time works for you both.

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.

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, May 13, 2020 2:27 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Heartleaf

Hey Rebekah,

Don Morgan is advising against you going into the office. Maybe we can get on a call tomorrow. What does your schedule look like?

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Wednesday, May 13, 2020 8:37 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Peeples, Gary <gary_peeples@fws.gov>
Subject: Re: Heartleaf

Hey Byron,

Let me see what info the data provides. I'm not sure if there is data on "why" something was protected, just that's it is protected or not and we know some was a result of Section 7 and some was voluntary. However, it doesn't change the fact that those populations are in protection.

Give me a few days, I may have to go by my office to grab some files.

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

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From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, May 13, 2020 8:29 AM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Heartleaf

Hey Rebekah,

I have another comment on the Heartleaf that needs to be addressed. The question is how many populations are based on section 7 vs. voluntary conservation actions....

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.

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Thursday, March 12, 2020 12:54 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Heartleaf

Hey Byron,

See my comments.

After thinking more about the population persistence vs. plant longevity question, I understand the issue and we can't necessarily relate the two (persistence and plant longevity) without more intense demography research...although I'm guessing there is a relation. Population persistence could be the result of a few things - long-lived plants, short-lived plants with a lot of recruitment, etc. So, I get where that question is coming from. We could remove the reference to populations?

Thanks. I'm around tomorrow if we need to talk it through some more.

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.

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Monday, March 9, 2020 2:40 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Heartleaf

Please see attachment for the rule. Looking forward to speaking to you on Wednesday.

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: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Monday, March 9, 2020 2:20 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Heartleaf

Great! Wednesday will work for me. I will give you a call at 11am. I will send you the rule with only the new comments so they will be easy to find.

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Monday, March 9, 2020 2:15 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Heartleaf

Hey Byron,

I'm free Wednesday and Thursday. You can pick the time. I usually leave around 3:30.

Anything I need to brush up on? It's been a while since I've looked at it.

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.

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Monday, March 9, 2020 1:56 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Heartleaf

Hey Rebekah,

I was wondering if you had some time to get on the phone and talk about the heartleaf rule. What's your schedule?

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

Re: Dwarf-flowered heartleaf

Hamilton, Byron <byron_hamilton@fws.gov>

Fri 6/19/2020 12:16 PM

To: Mizzi, Janet <janet_mizzi@fws.gov>; Reid, Rebekah N <rebekah_reid@fws.gov>

My apologies... My device has a mind of its own today.

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: Mizzi, Janet <janet_mizzi@fws.gov>
Sent: Friday, June 19, 2020 12:06 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>; Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Dwarf-flowered heartleaf

Soo, you send an invite for Thursday morning, not Wednesday at 1. So which one are we going with?

Janet Mizzi
Field Supervisor
Asheville Field Office
U.S. Fish and Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
Cell: 828-215-1741
Office: 828-258-3939 x42223

During this pandemic I am teleworking 100% of the time so please contact me via cell phone or email.
Email: Janet_Mizzi@fws.gov

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Friday, June 19, 2020 11:51 AM
To: Mizzi, Janet <janet_mizzi@fws.gov>; Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Dwarf-flowered heartleaf

Thanks Janet! Let's schedule for Wednesday @ 1pm.

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: Mizzi, Janet <janet_mizzi@fws.gov>
Sent: Friday, June 19, 2020 11:45 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>; Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Dwarf-flowered heartleaf

Sure. I am open Monday the 22cd, except for 2:30-4; Tuesday 10-12 or 2-4, Wed. 11-4, Thursday 8-10 or 3:30-5, or Friday anytime

Janet Mizzi
Field Supervisor
Asheville Field Office
U.S. Fish and Wildlife Service
160 Zillicoa St.
Asheville, NC 28801
Cell: 828-215-1741
Office: 828-258-3939 x42223

During this pandemic I am teleworking 100% of the time so please contact me via cell phone or email.
Email: Janet_Mizzi@fws.gov

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Friday, June 19, 2020 11:36 AM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Cc: Mizzi, Janet <janet_mizzi@fws.gov>
Subject: Dwarf-flowered heartleaf

Greetings Rebekah,

Can you and I, along with Janet schedule about an half hour to discuss the Dwarf-flowered heartleaf next week? I need your input on how to address the species path forward minus the ESA protections. HQ is asking if the species is dependent upon the protections provided by the Act? What are the threats to the species absent the protections of the Act and what do we anticipate the species response to be? Let me know what your schedules look like and I will send out a calendar invite. 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

Dwarf-flowered Heartleaf and FL Golden Aster pDeL rules

McRae, Sarah <sarah_mcrae@fws.gov>

Tue 6/30/2020 9:14 AM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>

Good morning Byron!
I know you are out this week, but you had asked me to review the revisions to the rules that you said were available on the SAT drive. There wasn't a dated FL Golden Aster, so I just used the one that had a modified date of 6/26/2020.
Before we move these rules back to HQ, I'd like to better understand what edits were made to address the no ESA analysis, especially since you had recent conversations with the FOs.
For Dwarf-flowered Heartleaf, I see where the questions come up on p.19, but I do not see any recent edits to the text to address the no ESA issues. I also don't see any recent (meaning in the past week) edits to the text to incorporate no ESA considerations into the text. Maybe I just don't know where to look?
For FL Golden Aster, I see some edits related to the no ESA under the Factor A discussion (but think even this needs to be "beefed up" instead of just stating that we presume management will continue, and I do not see the "supporting language added" on p.41 in response to Bridget's conditional delisting comment, especially as it relates to "securing" the species, and I don't see any additional supporting information regarding management. Also, for this one, I see that several edits are outstanding... for example, you mention "still working on this" (p.44 for SPR), on p.33 there is just a "#" instead of the actual number inserted, and there are still sporadic scientific names instead of common name throughout. I also don't think that several of Bridget's highlighted comments are adequately addressed, particularly FF (p.26, p.37), discussing management (p.22 & p.28), and "speculations" for future scenarios (pp.30-31).

I think both of these still need work before we send them back to HQ.
Happy to discuss when we're all back next week.

Sarah McRae
Acting Deputy Chief, Division of Conservation and Classification
Regional Classification Biologist
Species Assessment Team (SAT) Project Manager
US Fish and Wildlife Service
South Atlantic-Gulf & Mississippi-Basin Unified Interior Regions
Remote Address:
PO Box 33726
Raleigh, NC 27636-3726
phone: 919-856-4520x16
email: sarah_mcrae@fws.gov
web: https://www.fws.gov/southeast/

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

Re: One question/edit for heartleaf

Hamilton, Byron <byron_hamilton@fws.gov>

Wed 8/5/2020 7:04 AM

To: Weller, Emily <emily_weller@fws.gov>; Young, Kristi <kristi_young@fws.gov>

Good morning!

Bridget's comments on the Dwarf flowered heartleaf have been addressed on the SAT drive. I failed to mention this when I informed you that the FL golden aster IM was complete. My apologies.....

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: Weller, Emily <emily_weller@fws.gov>
Sent: Wednesday, July 29, 2020 1:21 PM
To: Young, Kristi <kristi_young@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>
Subject: One question/edit for heartleaf

Bridget reviewed and is good with the heartleaf pkg. She made a few edits re: covid-related things (hand delivery, available by appointment,etc.). 2 questions: 1) p. 1, check the cost code. the code I thought should be used is in the comments section. 2) see page 17 for a new comment/edit from Bridget.

Let me know if you have any questions. Once you send it back, I'll route to Bridget in DTS to surname and move along to Gary.

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

From: Hamilton, Byron
To: Reid, Rebekah N
Subject: Re: Hexastylis rule
Date: Monday, November 30, 2020 10:42:42 AM
Attachments: 20200903_Dwarf flowered heartleaf PDL_31Oct2020-Dir-comments_bh (1).docx

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Here you go! 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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Monday, November 30, 2020 10:37 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Hexastylis rule

Hey Byron,

Can you send me the version where you addressed some of these comments? I'll look at all of them but wanted to make sure I hit the ones that were left unresolved.

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.

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Thursday, November 5, 2020 9:38 AM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Hexastylis rule

Greetings Rebekah,

We have a few comments from the Director on the heartleaf rule. Please see the attachment for the rule, the comments that need your attention are highlighted in the comment section. Hope all is well with you and yours. Thanks in advance!

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: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, July 29, 2020 1:59 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Re: Hexastylis rule

Awesome! Hopefully so.....

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: Reid, Rebekah N <rebekah_reid@fws.gov>
Sent: Wednesday, July 29, 2020 1:57 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Hexastylis rule

Hey Byron - The way she has edited it is fine. I would just say "these purchases"...there's been more than one.

Thanks! Do you think this will get published by the end of the FY?

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.

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, July 29, 2020 1:39 PM
To: Reid, Rebekah N <rebekah_reid@fws.gov>
Subject: Hexastylis rule

Good afternoon,

We only have one more comment from Bridget that needs to be addressed. Please see the attachment for the Hexastylis proposed rule, the comment is on page 17.

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

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.

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.

Commented [SA1]: We might not know what the expected effects are, just that we should be able to evaluate the effects and responses. Furthermore, this reads that if not expected and still a response then we won't consider those results

Commented [HB2R1]: Agreed, this is standard language

Commented [SA3]: See earlier comment

Commented [HB4R3]: Standard language

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 any season). 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.

Commented [SA5]: Need more specificity, because the climate changes with different seasons and need to distinguish that difference

Commented [HB6R5]: Affirmative

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.

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

Commented [SA7]: This framework is very general, because some species are believed to have small population numbers and this framework doesn't consider that. What if this is one of those species

Commented [HB8R7]: There are enough very high and high resilient populations that the species will be fine.

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).

Commented [SA9]: How is this relevant to this species, because on page 35 when discussin the redundancy of the population and populations trending upwards.

Commented [HB10R9]: I believe it gives perspective

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 expectations)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).

Future Condition

Commented [SA11]: What is accelerated climate change? This should be defined, as it is a new term. And it has been more than 10 years since that citation, and need to state if it has proven true in the past 10 year.

Commented [HB12R11]: Defined

Commented [SA13]: The populations have been doing well the past 10 years, so this logical does not follow

Commented [HB14R13]: True, but this is still an potential ongoing threat

Commented [SA15]: The general weather pattern is that it is warmer in the South than the North. So, it is unclear what the value of this statement.

Commented [HB16R15]: This explains the predicted drought.

Commented [SA17]: This document does not show that climate change is the greatest threat. Changes in climate have been occurring and the species has does well, see page 35. This is not consistent.

Commented [HB18R17]: We say it's the greatest because of the uncertainty of it.

Deleted: That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of more imminent threats.

Commented [SA19]: What was the impact on the heartleaf. These statements are general, but applicability to dwarf is not logical

Commented [HB20R19]: Droughts leads to unsubscribed burns

Deleted: presumably brought on or at least exacerbated by drought conditions

Commented [SA21]: Move earlier when this inceidnet is first mentioned

Commented [HB22R21]: Moved

Commented [SA23]: This needs to be move as well

Commented [HB24R23]: Moved

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***.

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

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Commented [SA25]: What changed the circumstance so this is no longer considered a threat

Commented [HB26R25]: 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.

Commented [SA27]: Was this increase due to more surveys and sightings of more conservation work, or was it something else

Commented [HB28R27]: Conservation work

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.

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.

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"

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Commented [SA29]: We are not experts for weather and climate. This is problematic; we should evaluate the species responses to the threats within the foreseeable future.

Commented [HB30R29]: Revised

Commented [HB32R31]: Accept deleting

Deleted: Plant species with restricted ranges may experience population declines as a result of the effects of climate change

(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 2.6) 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.

Commented [SA33]: 2.6 is more conservative, this is misleading

Commented [HB34R33]: Changed to 2.6

Deleted: 4.5

Commented [HB36R35]: Accepted

Deleted: 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).

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.

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

Commented [SA37]: Provide citation

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Commented [SA39]: Define this term, see earlier comment

Commented [HB40R39]: Defined earlier in the document.

Commented [SA41]: Sentence is repeated from earlier. Delete this.

Commented [HB42R41]: Accepted

Deleted: 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

Deleted: 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).

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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. 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

Commented [SA47]: Why has the population increased dramatically and with delveopment low, it contradicts the development section.

Commented [HB48R47]: Over time the populations has increased because of the low development in those areas. In areas where development is hig

Commented [SA49]: Should clarify that this time frame was slected because it represented being able to predict reliably into the future, if this is reaon wny you selected 2040

Commented [HB50R49]: Revised

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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

Commented [SA51]: How do you know? When the earlier statement is that development is low and the population is trending upward. Re-evaluate

Commented [HB52R51]: Revised to certain populations

Commented [SA53]: Were development maps consulted in order to generate these maps

Commented [HB54R53]: Yes

Commented [SA55]: IF you consulted development plans, why have these two thresholds for development Also, mentioned that the plant could withstand development.

Commented [HB56R55]: This specifically for evaluation for future potential impacts

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.

Commented [SA57]: Is this population still there today or was it surveyed since 2001?

Commented [HB58R57]: Still there today

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.

Commented [SA59]: Voluntary protection is resulting in positive trend so, why the drop in resilience (see page 35). This is not reflective of current conditions

Commented [HB60R59]: These are likely scenarios

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.

Commented [SA61]: This does not follow logically, if protected in perpetuity. Reevaluate

Commented [HB62R61]: Only likely/unlikely scenarios

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.

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.

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.

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.

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. 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 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).

Commented [SA63]: Citatiosn for both of these, because they do not logically flow from the information in this document.

Commented [HB64R63]: Tracking down the citation for these statements. This section was added by the field office.

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 proposed delisting

Hamilton, Byron <byron_hamilton@fws.gov>

Thu 9/3/2020 5:04 PM

To: Young, Kristi <kristi_young@fws.gov>
Cc: Rankin, Nicole <nicole_rankin@fws.gov>

Good afternoon!

The dwarf-flowered heartleaf is ready to go back to HQ. It is saved on the SAT drive.

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: Thursday, September 3, 2020 10:33 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Rankin, Nicole <nicole_rankin@fws.gov>
Subject: Fw: dwarf-flowered heartleaf proposed delisting

Aloha Byron,

Heartleaf is back with us again!

Once you're done with FL golden aster edits, please take a look at Gary's comments on dwarf-flowered heartleaf. First, make sure he was looking at the correct version. Is it possible Emily uploaded an older version into DTS? I'm pretty sure we'd addressed all RSOL comments.

Thanks!

>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<
Kristi Young
Acting Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi Basin
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<

From: Blomquist, Sean M <sean_blomquist@fws.gov>
Sent: Thursday, September 3, 2020 5:43 AM
To: Young, Kristi <kristi_young@fws.gov>

Cc: Rankin, Nicole <nicole_rankin@fws.gov>
Subject: Fw: dwarf-flowered heartleaf proposed delisting

Kristi,
Can you guys please address Gary's concerns regarding the # of populations and the RSOL comment in DTS?

Thanks,
Sean

Sean M. Blomquist, PhD, CWB
Chief, Branch of Delisting and Foreign Species
U.S. Fish and Wildlife Service
Ecological Services, MS: ES
5275 Leesburg Pike
Falls Church, VA 22041-3803
Phone: 850-890-8308
Fax: 703-358-1800

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: Frazer, Gary D <gary_frazer@fws.gov>
Sent: Wednesday, September 2, 2020 9:13 PM
To: Blomquist, Sean M <sean_blomquist@fws.gov>
Cc: Fahey, Bridget <bridget_fahey@fws.gov>
Subject: dwarf-flowered heartleaf proposed delisting

Sean -- This proposed rule needs a little clean-up. It confusingly switched back and forth between 119 known populations and 78 known populations, with the 78 number reflecting those documented since 2005. I think it is unnecessarily confusing, and I know that Billy and Aurelia are going to comment on that if we send it forward. If, as seems to be the case, the field considers there to be 78 populations for the purpose of describing current status and redundancy, and as the baseline for projecting future conditions, it would seem cleaner to use that metric throughout. But for some reason they cite in various places to 119 populations in the Natural Heritage database and use 119 pops to describe resiliency. Can you see if the Region can clear that up?

There's also a comment from the RSOL in the draft that came to me in DTS that doesn't appear to have been addressed.

Just upload a revised draft to the DTS record let me know when it's ready for me to clear. Thanks. -- GDF

Gary Frazer
Assistant Director - Ecological Services
gary_frazer@fws.gov
Ph. (202) 208-4646
Cell (202) 253-4578

Re: Director comments--Proposed Delisting of dwarf-flowered heartleaf

Hamilton, Byron <byron_hamilton@fws.gov>

Mon 11/30/2020 10:31 AM

To: Blomquist, Sean M <sean_blomquist@fws.gov>

Hey Sean!

Thanksgiving was great, we ate entirely too much! hope you guys enjoyed as well. I had to ask Rebekah Reid for assistance because the FO made those additions. She has been transitioning to another position, so her plate has been full. We spoke this morning and she is working on those now.

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: Blomquist, Sean M <sean_blomquist@fws.gov>
Sent: Monday, November 30, 2020 9:56 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: Director comments--Proposed Delisting of dwarf-flowered heartleaf

Hey Byron!
Hope you had a great Thanksgiving! Just getting this back to the top of your inbox since it looks like you had a few more comments to address from the draft last week. Please let me know when you are done.

Thanks,
Sean

Sean M. Blomquist, PhD, CWB
Chief, Branch of Delisting and Foreign Species
U.S. Fish and Wildlife Service
Ecological Services, MS: ES
5275 Leesburg Pike
Falls Church, VA 22041-3803
Phone: 703-358-2455
Fax: 703-358-1800

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: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Tuesday, November 24, 2020 6:41 AM
To: Blomquist, Sean M <sean_blomquist@fws.gov>
Cc: Rankin, Nicole <nicole_rankin@fws.gov>; Young, Kristi <kristi_young@fws.gov>
Subject: Re: Director comments--Proposed Delisting of dwarf-flowered heartleaf

Thanks Sean. I'm going through them now.

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: Blomquist, Sean M <sean_blomquist@fws.gov>
Sent: Monday, November 23, 2020 3:38 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Rankin, Nicole <nicole_rankin@fws.gov>; Young, Kristi <kristi_young@fws.gov>
Subject: Re: Director comments--Proposed Delisting of dwarf-flowered heartleaf

Hi Byron,
I took a look through your revisions and uploaded a new version with today's date with a few highlighted areas in yellow that I thought still needed further addressing. I also beefed up a few of your comments to ensure the Dir's comments were explained well enough. Please take a look to ensure I didn't go too far astray and modify the response as needed. Let me know if you have any questions.

Thanks,
Sean

Sean M. Blomquist, PhD, CWB
Chief, Branch of Delisting and Foreign Species
U.S. Fish and Wildlife Service
Ecological Services, MS: ES
5275 Leesburg Pike
Falls Church, VA 22041-3803
Phone: 703-358-2455
Fax: 703-358-1800

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: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, November 18, 2020 10:18 AM
To: Blomquist, Sean M <sean_blomquist@fws.gov>
Cc: Rankin, Nicole <nicole_rankin@fws.gov>; Young, Kristi <kristi_young@fws.gov>
Subject: Re: Director comments--Proposed Delisting of dwarf-flowered heartleaf

Greetings Sean

The updated dwarf-flowered heartleaf proposed rule is saved on the L:Drive with today's date. All comments have been addressed except two where the Dir is asking for citations and I'm still tracking those down. Let me know if you have additional comments or 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: Young, Kristi <kristi_young@fws.gov>
Sent: Monday, November 2, 2020 11:50 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Rankin, Nicole <nicole_rankin@fws.gov>
Subject: Fw: Director comments--Proposed Delisting of dwarf-flowered heartleaf

Byron,

Can you review the Director's comments and respond to them? Let me know if we need to discuss. Let Sean know when you're done.

-Kristi

>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<
Kristi Young
Deputy Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi Basin
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<

From: Blomquist, Sean M <sean_blomquist@fws.gov>
Sent: Monday, November 2, 2020 9:39 AM
To: Young, Kristi <kristi_young@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>
Subject: Director comments--Proposed Delisting of dwarf-flowered heartleaf

Kristi/Nicole,
Please help address the comments by the Director on the proposed rule. I took a quick look and they need a more informed eye than mine to address. Please let me know if you want to discuss.

L:\Packages\De_and_Downlisting_Packages\Plants\Dwarf-flowered heartleaf -- 20200903_Dwarf flowered heartleaf PDL_31Oct2020-Dir-comments

Thanks,
Sean

Sean M. Blomquist, PhD, CWB
Chief, Branch of Delisting and Foreign Species

U.S. Fish and Wildlife Service
Ecological Services, MS: ES
5275 Leesburg Pike
Falls Church, VA 22041-3803
Phone: 703-358-2455
Fax: 703-358-1800

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From: DTS@fws.gov <DTS@fws.gov>
Sent: Monday, November 2, 2020 9:08 AM
To: Parker, Alison L <alison_parker@fws.gov>; Snyder, Caitlin <caitlin_snyder@fws.gov>; VanGelder, Ellen <ellen_vangelder@fws.gov>; Young, Emma I <emma_young@fws.gov>; Daskin, Joshua H <joshua_daskin@fws.gov>; Ketram, Natchanon N <natchanon_ketram@fws.gov>; Huber, Nic <nic_huber@fws.gov>; Blomquist, Sean M <sean_blomquist@fws.gov>
Subject: DTS Assignment--Proposed Delisting of dwarf-flowered heartleaf

Hello and welcome to the DTS automated email alert!

Your office (AES-DCC-BDFS) has a task assigned.

Please log in to the Data Tracking System at the following URL Address: https://dts.fws.gov/dts/preLogin.do?officeId=3889 and review Document Control Number (DCN)** FR00004110.

To move the document to the next office in the routing process, enter the task completed date for your office's routing in the routing screen and save the record.

Document Subject: Proposed Delisting of dwarf-flowered heartleaf
Synopsis: We 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.
Action Required: 6-Revise
Assigned By Office: AES User: Lois Wellman

Thank you.

HENA Rule - Director Comments

Reid, Rebekah N <rebekah_reid@fws.gov>

Fri 12/4/2020 12:55 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Mizzi, Janet <janet_mizzi@fws.gov>

Hi Byron,

Please find attached our FO's response to Director comments. Let us know if you need any other info.

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.

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.

Dwarf-flowered heartleaf is historically known to have a restricted range due to its

Commented [RRN1]: Distribution as of 2018 is 119 populations but we only analyzed 78. Not sure if we need to make that distinction here but just wanted to clarify.

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.

Commented [SA2]: We might not know what the expected effects are, just that we should be able to evaluate the effects and responses. Furthermore, this reads that if not expected and still a response then we won't consider those results

Commented [HB3R2]: Agreed, this is standard language

Commented [SA4]: See earlier comment

Commented [HB5R4]: Standard language

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, global climate change due to greenhouse gases). 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: climate changes in any season

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.

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

Commented [SA9]: This framework is very general, because some species are believed to have small population numbers and this framework doesn't consider that. What if this is one of those species

Commented [HB10R9]: There are enough very high and high resilient populations that the species will be fine.

Commented [RRN11R9]: We do consider small populations in the "low" category. Additionally, these categories are an outgrowth of EO ranks which are vetted and widely used.

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).

Representation

Commented [SA12]: How is this relevant to this species, because on page 35 when discussin the redundancy of the population and populations trending upwards.

Commented [HB13R12]: I believe it gives perspective

Commented [RRN14R12]: "Redundancy" is defined as a species' ability to withstand a catastrophic event. Here, we have defined what we consider a catastrophic event for the purposes of our analysis and it provides an introduction to further review.

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 expectations)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).

Future Condition

Commented [SA15]: What is accelerated climate change? This should be defined, as it is a new term. And it has been more than 10 years since that citation, and need to state if it has proven true in the past 10 year.

Commented [HB16R15]: Defined

Commented [RRN17R15]: The climate change research in this paper is on a much larger time scale and I'm not qualified to evaluate the accuracy of the long-term prediction based on 10 years. For the southeast, the research makes predictions 50-100 years in the future. Although we are not in a place to evaluate the validity of the prediction, it is widely accepted that climate change is accelerating and the referenced paper was put together by the USGCRP which is comprised of 13 federal member ...

Commented [SA18]: The populations have been doing well the past 10 years, so this logical does not follow

Commented [HB19R18]: True, but this is still an potential ongoing threat

Commented [RRN20R18]: Agree. As mentioned above, the time-scale for climate change is much longer than 10 ...

Commented [SA21]: The general weather pattern is that it is warmer in the South than the North. So, it is unclear ...

Commented [HB22R21]: This explains the predicted drought.

Commented [RRN23R21]: Yes, it's generally warmer in the Summer in the south. But, this is talking about a ...

Commented [SA24]: This document does not show that climate change is the greatest threat. Changes in climate ...

Commented [HB25R24]: We say it's the greatest because of the uncertainty of it.

Commented [RRN26R24]: We're not saying climate change is the greatest threat, we are say that the greatest ...

Deleted: That is, factors associated with a changing climate may act as risk multipliers by increasing the risk and sever ...

Commented [SA27]: What was the impact on the heartleaf. These statements are general, but applicability ...

Commented [HB28R27]: Droughts leads to unsubscribed burns

Commented [RRN29R27]: Increased fire frequency and intensity, and drought are known to increase with climate ...

Deleted: presumably brought on or at least exacerbated by drought conditions

Commented [SA30]: Move earlier when this inceidnet is first mentioned

Commented [HB31R30]: Moved

Commented [SA32]: This needs to be move as well

Commented [HB33R32]: Moved

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***.

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

Deleted: change

Commented [SA34]: What changed the circumstance so this is no longer considered a threat

Commented [HB35R34]: 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.

Commented [RRN36R34]: Byron – I'd say your statement above was true before the referenced study was complete. NNIS were likely identified as a threat because NNIS were present in the habitat and some plants were likely impacted but I don't think there was quantitative data. After the referenced study, we had quantitative data to show that HENA was doing well against NNIS and the assumed impacts weren't as bad as thought.

Commented [SA37]: Was this increase due to more surveys and sightings of more conservation work, or was it something else

Commented [HB38R37]: Conservation work

Commented [RRN39R37]: The increase in total populations was due to increased survey effort.

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.

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.

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"

Deleted: our expert

Commented [SA40]: We are not experts for weather and climate. This is problematic; we should evaluate the species responses to the threats within the foreseeable future.

Commented [HB41R40]: Revised

Commented [HB43R42]: Accept deleting

Commented [RRN44R42]: This is talking about plant species in general and is part of the introduction to this climate change section. We talk specifics further down.

Deleted: Plant species with restricted ranges may experience population declines as a result of the effects of climate change

(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.

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).

Commented [SA45]: 2.6 is more conservative, this is misleading

Commented [HB46R45]: Changed to 2.6

Commented [RRN47R45]: We can't just change this!!! The results are based on calculations for 4.5 which has data specific to that RCP. 4.5 is the more conservative scenario when compared to 8.5. These were the two RCPs we were asked to evaluate.

Deleted: 2.64.5

Commented [HB49R48]: Accepted

Commented [RRN50R48]: We provide support for this statement in the paragraphs that follow. Long-lived perennial species, myrmecochory, habitat variability…

Deleted: 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.

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)+

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Accelerated climate change is expected to increase the frequency and extent of drought conditions across the Southeast (Karl et al. 2009, p. 111).).

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.

Development

Commented [SA51]: Provide citation

Commented [HB52R51]: Tracking down citations

Commented [SA53]: Define this term, see earlier comment

Commented [HB54R53]: Defined earlier in the document.

Commented [SA55]: Sentence is repeated from earlier. Delete this.

Commented [HB56R55]: Accepted

Deleted: 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

Deleted: 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).

Deleted: change

Deleted: 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.

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. 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

Commented [SA61]: Why has the population increased dramatically and with delveopment low, it contradicts the development section.

Commented [HB62R61]: Over time the populations has increased because of the low development in those areas. In areas where development is hig

Commented [RRN63R61]: Total population numbers have increased because of increased survey effort. We are specific to saying development is low for the largest populations many of which are protected.

Commented [SA64]: Should clarify that this time frame was slected because it represented being able to predict reliably into the future, if this is reaon wny you selected 2040

Commented [HB65R64]: Revised

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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,

Commented [SA66]: How do you know? When the earlier statement is that development is low and the population is trending upward. Re-evaluate

Commented [HB67R66]: Revised to certain populations

Commented [RRN68R66]: Yes, Byron. We said development is low for the largest populations. We know that some were extirpated because of data held by the NHPs.

Commented [SA69]: Were development maps consulted in order to generate these maps

Commented [HB70R69]: Yes

Commented [RRN71R69]: We did not use development maps. We used SLEUTH data which is a model that gives probabilities of urban development at timesteps. This data is widely used for predicting urban development.

Commented [SA72]: IF you consulted development plans, why have these two thresholds for development Also, mentioned that the plant could withstand development.

Commented [HB73R72]: This specifically for evaluation for future potential impacts

Commented [RRN74R72]: Since we are projecting into the future, we don't know for sure what will be developed and what will not. Using the thresholds along with SLEUTH data allows for a range of development prossibilities to be evaluated.

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.

Commented [SA75]: Is this population still there today or was it surveyed since 2001?

Commented [HB76R75]: Still there today

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

Commented [SA77]: Voluntary protection is resulting in positive trend so, why the drop in resilience (see page 35). This is not reflective of current conditions

Commented [HB78R77]: These are likely scenarios

Commented [RRN79R77]: Voluntary means that someone could remove the protections at will if they wanted. Removal of voluntary protection is a scenario we needed to consider.

Commented [SA80]: This does not follow logically, if protected in perpetuity. Reevaluate

Commented [HB81R80]: Only likely/unlikely scenarios

Commented [RRN82R80]: Agreed, these are just scenarios. Protected sites could be impacted by actions outside the protected area in a highly urbanized setting. Just something we needed to consider.

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.

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.

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.

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.

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. 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).

Commented [SA83]: Citatiosn for both of these, because they do not logically flow from the information in this document.

Commented [HB84R83]: Tracking down the citation for these statements. This section was added by the field office.

Commented [RRN85R83]: I'm not sure how to cite the second sentence. If a private property is for sale, it could be sold for development. It a property is on public lands or protected, it would not be for sale for development. I think you could take that sentence out if there's future issue.

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: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

Koches, Jennifer <jennifer_koches@fws.gov>
Wed 1/20/2021 9:59 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>

Thank you, Byron!!

Jennifer M. Koches, Public Affairs Specialist
U.S. Fish and Wildlife Service - External Affairs
Interior Region 2 - South Atlantic-Gulf
Interior Region 4 - Mississippi Basin
Mobile - (843) 670-7902
jennifer_koches@fws.gov

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, January 20, 2021 9:43 AM
To: Koches, Jennifer <jennifer_koches@fws.gov>
Subject: Re: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

Good morning Jennifer

Please see attachment for the Dwarf-flowered heartleaf proposed rule.

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: Koches, Jennifer <jennifer_koches@fws.gov>
Sent: Wednesday, January 20, 2021 7:33 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Re: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

Morning, Byron!! Can you please forward along an electronic copy of the rule?

Thanks...and Happy New Year!!

Jennifer M. Koches, Public Affairs Specialist
U.S. Fish and Wildlife Service - External Affairs
Interior Region 2 - South Atlantic-Gulf
Interior Region 4 - Mississippi Basin
Mobile - (843) 670-7902
jennifer_koches@fws.gov

From: Young, Kristi <kristi_young@fws.gov>
Sent: Tuesday, January 19, 2021 5:49 PM
To: FWHQ FR Pub List <FWHQ_FR_Pub_List@fws.gov>
Cc: Phillips, Catherine <catherine_phillips@fws.gov>; Tirpak, John <John_Tirpak@fws.gov>; Mizzi, Janet <janet_mizzi@fws.gov>; Peeples, Gary <gary_peeples@fws.gov>; McCoy, Thomas <thomas_mccoy@fws.gov>; Caldwell, Mark <mark_caldwell@fws.gov>; Benjamin, Pete <pete_benjamin@fws.gov>; Augspurger, Tom <tom_augspurger@fws.gov>
Subject: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

The proposed rule to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*) from the Federal List of Endangered and Threatened Plants (Docket No. FWS–R4–ES–2019–0081) was delivered to the Office of the Federal Register on January 19, 2021.

We will notify you when we receive a publication date.

Please let Byron Hamilton know if you would like an electronic copy of the document.

Cheers,
Kristi

>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<
Kristi Young
Deputy Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi Basin
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>

Re: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

Young, Kristi <kristi_young@fws.gov>
Wed 1/20/2021 2:12 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>; Phillips, Catherine <catherine_phillips@fws.gov>

Thanks for preparing the email for Catherine, Byron.

A couple points of clarification - the rule was sent to the OFR yesterday, so you can send this email out as soon as you have time.

Before you send it out, please correct the contact information - no longer Sean, but should be Nicole.

Thanks!

>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<
Kristi Young
Deputy Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi Basin
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, January 20, 2021 10:56 AM
To: Phillips, Catherine <catherine_phillips@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>
Subject: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

Good afternoon,

I've drafted this email to send to State Agency Directors as soon as we know the proposed rule has been delivered to OFR and a follow-up e-mail informing of the publishing date. I've also compiled a list of their emails.

Lesley Starke, Head of the N.C. Plant Conservation Program, Lesley.Starke@ncagr.gov
Misty Buchanan, Director of the N.C. Natural Heritage Program, misty.buchanan@ncdcr.gov
Director of the N.C. Wildlife Resources Commission, Cam Ingram, cameron.ingram@ncwildlife.org

Dear ...,

We wanted to inform you that we are planning to publish in the Federal Register our proposed rule for the removal of the Dwarf-flowered heartleaf from the Federal List of Endangered and Threatened Plants (List). The Dwarf-flowered heartleaf occurs in the upper Piedmont region of western North Carolina and upstate South Carolina.

The proposed rule was sent to the Federal Register on January 19, 2021. We will contact you again as soon as we learn of the exact publication. We ask that you not share this information outside of your agency until the publication date is confirmed.

If you have any questions or need additional information, please contact Sean Blomquist, Acting Chief, Division of Conservation and Classification, at 850-769-0552 or sean_blomquist@fws.gov, or Janet Mizzi, Field Supervisor, Asheville Ecological Services Field Office, at 828-258-3939 or janet_mizzi@fws.gov.

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: FWS Documents Pending Publication Withdrawn from the Office of the Federal Register

Young, Kristi <kristi_young@fws.gov>

Thu 1/21/2021 10:31 AM

To: Phillips, Catherine <catherine_phillips@fws.gov>; Tirpak, John <John_Tirpak@fws.gov>; Mizzi, Janet <janet_mizzi@fws.gov>; Peeples, Gary <gary_peeples@fws.gov>; Pitchford, Daffny <Daffny_Pitchford@fws.gov>; Koches, Jennifer <jennifer_koches@fws.gov>
Cc: Rankin, Nicole <nicole_rankin@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>

Confirmation that dwarf-flowered heartleaf has been withdrawn from OFR. No word yet how long this will last.

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Kristi Young
Deputy Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi Basin
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119

>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<

From: Blomquist, Sean M <sean_blomquist@fws.gov>
Sent: Thursday, January 21, 2021 8:00 AM
To: Backsen, Sarah <Sarah_Backsen@fws.gov>; Young, Kristi <kristi_young@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>; Russell, Daniel <daniel_russell@fws.gov>
Cc: Hoffmann, Scott L <scott_hoffmann@fws.gov>; Constantino, Maricela <maricela_constantino@fws.gov>
Subject: Fw: FWS Documents Pending Publication Withdrawn from the Office of the Federal Register

Sigh! Our 4 DDL packages that are still at OFR have now been withdrawn and sent back to PRB. More when we know it...

Thanks,
Sean

Sean M. Blomquist, PhD, CWB
Chief, Branch of Delisting and Foreign Species
U.S. Fish and Wildlife Service
Ecological Services, MS: ES
5275 Leesburg Pike
Falls Church, VA 22041-3803
Phone: 703-358-2455
Fax: 703-358-1800

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: Baucum, Madonna L <madonna_baucum@fws.gov>
Sent: Thursday, January 21, 2021 8:07 AM
To: Canterbury, Grant <grant_canterbury@fws.gov>; Riley, Deborah <deborah_riley@fws.gov>; Purdy, Barry E <barry_purdy@fws.gov>; Horton, Andrew M <andrew_horton@fws.gov>; Reed, Marissa R <Marissa_Reed@fws.gov>; Ansty, Martha <Martha.Ansty@sol.doi.gov>; Thewis, Kevin A <kevin_thewis@fws.gov>; Ford, Jerome <jerome_ford@fws.gov>; Matson, Noah P <noah_matson@fws.gov>; Richkus, Ken <ken_richkus@fws.gov>; Matson, Noah P <noah_matson@fws.gov>; Kershner, Eric <Eric_Kershner@fws.gov>; Frazer, Gary D <gary_frazer@fws.gov>; Blomquist, Sean M <sean_blomquist@fws.gov>; Ellis, Lisa A <Lisa_Ellis@fws.gov>; Hornaday, Kelly <Kelly_Hornaday@fws.gov>; Kershner, Eric <Eric_Kershner@fws.gov>; Siekaniec, Greg E <greg_siekaniec@fws.gov>; Clark, Karen <karen_clark@fws.gov>; Matuskowitz, Theo TM <theo_matuskowitz@fws.gov>
Cc: Velasco, Janine M <janine_velasco@fws.gov>; Chang, Henry <henry_chang@fws.gov>; Gale, Michael <michael_gale@fws.gov>; Wilkinson, Susan <susan_wilkinson@fws.gov>; Craghead, Anissa <anissa_craghead@fws.gov>; Baucum, Madonna L <madonna_baucum@fws.gov>; Prigan, Sara <sara_prigan@fws.gov>; Whitacre, Kathryn <Kathryn_Whitacre@fws.gov>; Eanett, Jillian H <jillian_eanett@fws.gov>; Bibb, Krista <krista_bibb@fws.gov>
Subject: FWS Documents Pending Publication Withdrawn from the Office of the Federal Register

Good morning,

Yesterday, the Department of the Interior's Office of the Executive Secretariat and Regulatory Affairs (OES) directed all DOI bureaus to remove all documents that had been submitted to the Office of the Federal Register. Accordingly, the following documents have been withdrawn from the scheduling process at Office of the Federal Register (OFR):

OFR document number: 2021-01320
FWS Docket No. FWS–R1–ES–2020–N089
Endangered and Threatened Wildlife and Plants; Draft Recovery Plan for Five Species from American Samoa
Grant Canterbury, Deborah Riley, Barry Purdy
Scheduled Publication Date: January 22, 2021

OFR document number: 2021-01344
FWS Docket No. FWS–R3–ES–2020–0121
Bitter Ridge Wind Project habitat conservation plan, environmental assessment; Scout Clean Energy's Bitter Ridge Wind Farm, LLC (applicant)
Andrew Horton, Marissa Reed, Martha Ansty, Kevin Thewis
Scheduled Publication Date: January 22, 2021

OFR document number: 2021-24718
FWS Docket No. FWS-HQ-MB-2017-0092
Updated Collision Risk Model Priors for Estimating Eagle Fatalities at Wind Energy Facilities
Jerome Ford, Ken Richkus, Noah Matson
Scheduled Publication Date: January 22, 2021

OFR document submission: December 29, 2020
FWS Docket No. FWS–R6–ES–2019–0055; RIN 1018–BD49
Endangered and Threatened Wildlife and Plants; Removing the Kanab Ambersnail from the List of Endangered and Threatened Wildlife
Gary Frazer, Sean Blomquist
Scheduled Publication Date: Under review – Not yet scheduled

OFR document submission: January 7, 2021
FWS Docket No. FWS–R6–ES–2018–0045; RIN 1018–BC03

Endangered and Threatened Wildlife and Plants; Removing the Water Howellia from the List of Endangered and Threatened Plants
Gary Frazer, Sean Blomquist
Scheduled Publication Date: Under review – Not yet scheduled

OFR document submission: January 8, 2021
FWS Docket No. FWS-R1-ES-2018-0033; RIN 1018–BC65
Endangered and Threatened Wildlife and Plants; Establishment of a Nonessential Population of the California Condor in the Pacific Northwest
Gary Frazer, Lisa Ellis, Kelly Hornaday
Scheduled Publication Date: Under review – Not yet scheduled

OFR document submission: January 11, 2021
FWS Docket No. FWS–HQ–MB–2020–0032; RIN 1018–BE34
Migratory Bird Hunting; Proposed 2021–22 Frameworks, and Special Procedures for Issuance of Annual Hunting Regulations
Jerome Ford, Ken Richkus, Eric Kershner
Scheduled Publication Date: Under review – Not yet scheduled

OFR document submission: January 19, 2021
FWS Docket No. FWS–R7–SM–2020–0077; RIN 1018–BF10
Subsistence Management Regulations for Public Lands in Alaska—2022–23 and 2023–24 Subsistence Taking of Wildlife Regulations
Greg Siekaniec, Theo Matuskowitz
Scheduled Publication Date: Under review – Not yet scheduled

OFR document submission: January 19, 2021
FWS Docket No. FWS–R4–ES–2019–0081; RIN 1018–BD95
Endangered and Threatened Wildlife and Plants; Removal of the Dwarf-flowered Heartleaf from the Federal List of Endangered and Threatened Plants
Gary Frazer, Sean Blomquist
Scheduled Publication Date: Under review – Not yet scheduled

OFR document submission: January 19, 2021
FWS Docket No. FWS–R8–ES–2020–0074; RIN 1018–BE73
Endangered and Threatened Wildlife and Plants; Removing Five Species from San Clemente Island from the Federal Lists of Endangered and Threatened Wildlife and Plants
Gary Frazer, Sean Blomquist
Scheduled Publication Date: Under review – Not yet scheduled

The Policy and Regulations Branch is currently waiting for instructions from OES regarding a process to allow resubmission of these documents to OFR. Our office will forward those instructions as soon as we receive them.

This is all of the information that we have at this time.

Thank you,

Madonna L. Baucum
Regulations and Policy Chief and Information Collection Clearance Officer
Division of Policy, Economics, Risk Management, and Analytics (PERMA)
Policy and Regulations Branch
JOINT ADMINISTRATIVE OPERATIONS | U.S. Fish & Wildlife Service
5275 Leesburg Pike, MS: PRB (JAO/3W), Falls Church, VA 22041-3803
madonna_baucum@fws.gov | Office: (703) 358-2503 | Mobile: (202) 480-0723

JAO Mission: To deliver innovative administrative services that advance the mission of the U.S. Fish and Wildlife Service.

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Fw: new exec orders

Young, Kristi <kristi_young@fws.gov>

Thu 1/21/2021 4:19 PM

To: Evans, Brian <brian_evans@fws.gov>; Rivenbark, Erin <erin_rivenbark@fws.gov>; London, Paula K <paula_london@fws.gov>; Lombardi, Melissa D <melissa_lombardi@fws.gov>; McRae, Sarah <sarah_mcrae@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>; Wardell, Jonathan A <jonathan_wardell@fws.gov>; Commins, William B <william_commins@fws.gov>

Hi folks,

As you've probably heard in the news, the new administration quickly issued a variety of executive orders and memoranda yesterday. Some detail below from Steve Guertin.

Of most immediate interest to us is the "Regulatory Freeze Pending Review Memorandum." This requires that all rules that have been sent to the OFR but not published in the Federal Register be immediately withdrawn from the OFR for review and approval. This affected our dwarf-flowered heartleaf proposed delisting rule, which was sent back to HQ earlier today. No idea how long the freeze will remain in place.

Additionally, for rules that have been published in the Federal Register, but have not yet taken effect, we are to consider postponing the rules' effective dates for 60 days to allow a thorough review. This could potentially affect the final rule to delist Interior least tern, which doesn't take effect until February 12, but Sean is already advocating that this rule be allowed to take effect on time.

-Kristi

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Kristi Young
Deputy Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi Basin
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>

From: Phillips, Catherine <catherine_phillips@fws.gov>
Sent: Thursday, January 21, 2021 6:25 AM
To: FW4 ES Field Leadership and Deputies Team <FW4_ES_Field_Leadership_and_Deputies_Team@fws.gov>; FW4 ES RO Leadership Team <FW4_ES_RO_Leadership_Team@fws.gov>
Subject: Fw: 11/21/21 am updates

Good morning, team. Please see info below regarding the new exec orders. More guidance will come. . .

C

Catherine T. Phillips, Ph.D.
Assistant Regional Director, Ecological Services
South-Atlantic Gulf and Mississippi Basin Interior Regions
1875 Century Blvd
Atlanta, GA 30345
404-450-7563 (cell)

From: Miranda, Leopoldo <Leopoldo_Miranda@fws.gov>
Sent: Thursday, January 21, 2021 7:20 AM
To: FW4 RDT <FW4_RDT@fws.gov>; Eversen, Michelle <michelle_eversen@fws.gov>
Subject: Fwd: 11/21/21 am updates

FYI

Leo

Leopoldo Miranda-Castro
Regional Director
USFWS, South Atlantic-Gulf &
Mississippi-Basin
404-679-4000

Sent from my iPhone

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.

Begin forwarded message:

> **From:** "Guertin, Stephen" <Stephen_Guertin@fws.gov>
> **Date:** January 21, 2021 at 6:39:39 AM EST
> **To:** FWS Directorate & Deputies <fwsdirectanddep@fws.gov>
> **Cc:** "Mogadam, Roya" <roya_mogadam@fws.gov>
> **Subject: 11/21/21 am updates**
>
> Good morning Directorate and Deputies, and welcome to the new Administration.
>
> Late last night, the Department announced a number of appointments for the Biden – Harris leadership team. From what we can determine, about a dozen of them were sworn in and reported on board yesterday. Among them are:
>
> Shannon Estenoz as our Principal Deputy Assistant Secretary for Fish and Wildlife and Parks. Shannon was our primary POC for the Biden – Harris Agency Review

Team. Shannon has been sworn in and has reported for duty.

Martha Williams as our Principal Deputy Director for the US Fish and Wildlife Service. Martha previously served as Deputy Solicitor Parks and Wildlife at the Department of the Interior, as a professor at the Blewett School of Law at the University of Montana, and most recently Director for Montana Department of Fish, Wildlife and Parks. (It appears that Martha has not yet reported for duty but we expect her in a day or two. Will advise once we get confirmation). We will certainly prioritize lots of briefings and opportunities for Martha to meet folks once she reports on board!

http://www.doi.gov/pressreleases/interior-department-announces-members-biden-harris-leadership-team

The President signed a number of Executive Orders, Memorandums, and actions yesterday. You can find them all here:

https://www.whitehouse.gov/briefing-room/

A number of them provide immediate guidance to Federal agencies like us, and we will more than likely receive stepped down guidance from DOI on some of them. We will also do our reviews here in HQ to get the ball rolling on what the expectations are.

Of note, the

> "Regulatory Freeze Pending Review Memorandum" requires that all rules that have been sent to the OFR but not published in the Federal Register, shall be immediately withdrawn from the OFR for review and approval. With respect to rules that have been published in the Federal Register, or rules that have been issued in any manner, but have not taken effect, consider postponing the rules' effective dates for 60 days from the date of this memorandum after a thorough review. The Department's new Chief of Staff already issued a data call last night for agencies to report in.

Here is what is in there:

Modernizing Regulatory Review Memorandum

Executive Order on Preventing and Combating Discrimination on the Basis of Gender Identity or Sexual Orientation

Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crises

Executive Order on Revocation of Certain Orders Concerning Federal Regulation

Executive Order on Organizing and Mobilizing the United States Government to Provide a Unified and Effective Response to Combat COVID-19 and to Provide United States Leadership on Global Health and Security

Executive Order on Protecting the Federal Workforce and Requiring Mask Wearing

Executive Order on Advancing Racial Equity and Support for Underserved Communities Through the Federal Government

Paris Climate Agreement

Regulatory Freeze Pending Review Memorandum

(I'm back home. Was deployed to an undisclosed location early Monday as part of the Department COOP team when the Department activated COGNOG Level 2 given the heightened security concerns around the Inauguration).

Fw: update regarding status of 4 rules pulled back from OFR last month

Young, Kristi <kristi_young@fws.gov>

Wed 2/10/2021 5:19 PM

To: Phillips, Catherine <catherine_phillips@fws.gov>; Tirpak, John <John_Tirpak@fws.gov>; Mizzi, Janet <janet_mizzi@fws.gov>; Peeples, Gary <gary_peeples@fws.gov>; Pitchford, Daffny <Daffny_Pitchford@fws.gov>; Koches, Jennifer <jennifer_koches@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>

Hi folks,

Not totally unexpected, but dwarf-flowered heartleaf proposed delisting will have to go through re-surnaming from the new Acting Director on up. Given everything that was in the Department on January 20 has also been sent back to the Director's office, it may take a while.

-Kristi

>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<
Kristi Young
Deputy Chief, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi Basin
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>

From: Constantino, Maricela <maricela_constantino@fws.gov>
Sent: Wednesday, February 10, 2021 2:49 PM
To: Young, Kristi <kristi_young@fws.gov>; Russell, Daniel <daniel_russell@fws.gov>; Backsen, Sarah <Sarah_Backsen@fws.gov>
Cc: Hoffmann, Scott L <scott_hoffmann@fws.gov>
Subject: update regarding status of 4 rules pulled back from OFR last month

Hello Everyone,
I have some news to share regarding the status of the following rules that were pulled back from the OFR last month.

- Removing the Kanab Ambersnail from the List of Endangered and Threatened Wildlife; RIN 1018–BD49 (FR4147)
- Removing the Water Howellia from the List of Endangered and Threatened Plants; RIN 1018–BC03 (FR4156)
- Removal of the Dwarf-flowered Heartleaf from the List of Endangered and Threatened Plants; RIN 1018–BD95 (FR4110)
- Removing Five Species from San Clemente Island from the Lists of Endangered and Threatened Wildlife and Plants; RIN 1018–BE73 (FR4128)

PRB confirmed for us today that the Office of the Executive Secretary has instructed that all FR documents need to be approved with political officials in the Administration. Thus, we will need to put these documents back into the clearance process again. We have updated the signature blocks for all of

these rules and uploaded clean versions into the existing DTS FR records (noted above). Please let me know if you have any questions.

Thanks,
Maricela

Maricela Constantino
Acting Branch Manager
Delisting and Foreign Species
Ecological Services Program
US Fish and Wildlife Service - Headquarters Office
571/969-9804 cell
pronouns: she/her/hers

Re: Dwarf-flowered heartleaf Compare & Contrast)

Rankin, Nicole <nicole_rankin@fws.gov>

Tue 4/13/2021 10:51 AM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>

Hey Byron,

Can you forward me the surname August email from Helen and/or Shannon?

Thanks!
Nicole

****
Nicole M. Rankin
Pronouns: she/her/hers

Manager, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi-Basin Regions
1875 Century Blvd NE
Atlanta, GA 30345

Office 404-679-7089
nicole_rankin@fws.gov

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****

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Tuesday, April 13, 2021 6:59 AM
To: Rankin, Nicole <nicole_rankin@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>
Subject: Dwarf-flowered heartleaf Compare & Contrast)

Good morning,

Please see attachments for the RSOL surnamed version, HQ version and Compare/Contrast doc.
Let me know if you need additional info.

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 proposed delisting rule

Hamilton, Byron <byron_hamilton@fws.gov>

Tue 4/13/2021 12:58 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: Tuesday, July 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>
Subject: Dwarf -flowered heartleaf proposed delisting rule

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

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Fw: Request for re-surname - Dwarf-flowered heartleaf

Hamilton, Byron <byron_hamilton@fws.gov>
Tue 4/13/2021 1:06 PM
To: Rankin, Nicole <nicole_rankin@fws.gov>

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: 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 Mississippi Basin
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<

FW: Request for Resurname - Dwarf flowered heartleaf proposed delisting rule

Speights, Helen H <helen.speights@sol.doi.gov>
Tue 4/13/2021 1:49 PM

To: Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Rankin, Nicole <nicole_rankin@fws.gov>; Young, Kristi <kristi_young@fws.gov>

Hi Byron,

I looked quickly through this and agree the changes since surname are minimal. I can package it quickly for Shannon's resurname. The only question I have is where did the 119 number come from if there are only 78 populations?

From: Rankin, Nicole <nicole_rankin@fws.gov>
Sent: Tuesday, April 13, 2021 1:42 PM
To: Goessling, Shannon L <shannon.goessling@sol.doi.gov>
Cc: Colbert, Janice B <Janice.Colbert@sol.doi.gov>; Speights, Helen H <helen.speights@sol.doi.gov>; Hamilton, Byron <byron_hamilton@fws.gov>; Young, Kristi <kristi_young@fws.gov>
Subject: Request for Resurname - Dwarf flowered heartleaf proposed delisting rule

Hi Shannon,

We are requesting to update your surname on the current version of the dwarf flowered heartleaf proposed delisting rule. We recognize that you provided resurname in August 2020, but we were asked by Exec Sec for an updated SOL surname (less than 6 months) before they proceeded with review.

I have attached the current draft proposed rule (20201208), the version that was previously surnamed (20200819), and a compare document (comparedoc).

Changes between these versions are minimal, so we are hoping that we can get resurname by Monday.

Byron Hamilton is the SAT project manager working on this rule.

Thank you,
Nicole

****

Nicole M. Rankin
Pronouns: she/her/hers

Manager, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi-Basin Regions
1875 Century Blvd NE
Atlanta, GA 30345

Office 404-679-7089
nicole_rankin@fws.gov

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****

RSOL Resurname for Proposed Delisting of Dwarf-Flowered Heartleaf

Speights, Helen H <helen.speights@sol.doi.gov>

Thu 4/15/2021 11:16 AM

To: Miranda, Leopoldo <Leopoldo_Miranda@fws.gov>; Phillips, Catherine <catherine_phillips@fws.gov>; Tirpak, John <John_Tirpak@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>; Young, Kristi <kristi_young@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Goessling, Shannon L <shannon.goessling@sol.doi.gov>

Attached is the Regional Solicitor's "resurname" on the proposed rule to delist the dwarf-flowered heartleaf. Surname was originally provided in August 2020 and Exec Sec requested a current surname. Minor changes were made since the original surname. I've attached the comparison document because Shannon did find a minor typo on page 23 and also noted the new Director as signatory.

Please let us know if you have any questions.

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

Fw: Dwarf-flowered heartleaf Proposed Rule Resurname

Young, Kristi <kristi_young@fws.gov>
Fri 4/16/2021 11:37 AM

To: Mizzi, Janet <janet_mizzi@fws.gov>; Peeples, Gary <gary_peeples@fws.gov>; Pitchford, Daffny <Daffny_Pitchford@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>

Happy Friday!

Good news about dwarf-flowered heartleaf. The Director still needs to sign the rule, but it is on its way to the Federal Register again. We'll let you know when it is actually delivered.

And if you do have any special requests for a pub date, please let us know ASAP; we just told them to avoid Mondays or Fridays.

Cheers, Kristi

>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<
Kristi Young
Deputy Manager, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi Basin
Unified Regions
Kristi_Young@FWS.gov
(404) 679-7119
>:<>:<>:<>:<>:<>:<><>:<>:<>:<>:<>:<>:<>:<>:<

From: Constantino, Maricela <maricela_constantino@fws.gov>
Sent: Friday, April 16, 2021 8:48 AM
To: Hamilton, Byron <byron_hamilton@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>; Young, Kristi <kristi_young@fws.gov>
Cc: Meister, Christina <christina_meister@fws.gov>; Hires, Brian K <brian_hires@fws.gov>
Subject: Re: Dwarf-flowered heartleaf Proposed Rule Resurname

Good news everyone! Dwarf-flowered heartleaf cleared today. Thanks to everyone for going the extra mile (and-a-half) to ensure we had what was needed to clear the rule. ES has assigned it to CCU for Director signature. Will let you all know when it is ready. Please let me know if you have any special requests in terms of publication date.

Thanks!

Maricela Constantino
Acting Branch Manager
Delisting and Foreign Species
Ecological Services Program
US Fish and Wildlife Service - Headquarters Office
571/969-9804 cell
pronouns: she/her/hers

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Thursday, April 15, 2021 2:45 PM
To: Rankin, Nicole <nicole_rankin@fws.gov>; Constantino, Maricela <maricela_constantino@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>
Subject: Re: Dwarf-flowered heartleaf Proposed Rule Resurname

This is the version to upload.

041521_Dwarf-flowered heartleaf PDR Clean.docx

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: Rankin, Nicole <nicole_rankin@fws.gov>
Sent: Thursday, April 15, 2021 2:35 PM
To: Constantino, Maricela <maricela_constantino@fws.gov>; Hamilton, Byron <byron_hamilton@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>
Subject: Re: Dwarf-flowered heartleaf Proposed Rule Resurname

I think there was a minor correction that Shannon found during her review. Byron - can you make sure that Maricela knows which version to upload?

Thanks!
Nicole

****

Nicole M. Rankin
Pronouns: she/her/hers

Manager, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi-Basin Regions
1875 Century Blvd NE
Atlanta, GA 30345

Office 404-679-7089
nicole_rankin@fws.gov

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From: Constantino, Maricela <maricela_constantino@fws.gov>
Sent: Thursday, April 15, 2021 2:14 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>

Cc: Young, Kristi <kristi_young@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>
Subject: Re: Dwarf-flowered heartleaf Proposed Rule Resurname

Thanks Byron,
I'll plan to upload the pdf of your surname to DTS for ExecSec. I'm not sure what the clean version of the document is for but I'll assume that was just for your review.

Maricela Constantino
Acting Branch Manager
Delisting and Foreign Species
Ecological Services Program
US Fish and Wildlife Service - Headquarters Office
571/969-9804 cell
pronouns: she/her/hers

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Thursday, April 15, 2021 1:42 PM
To: Constantino, Maricela <maricela_constantino@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>
Subject: Dwarf-flowered heartleaf Proposed Rule Resurname

Good afternoon,

The dwarf-flowered heartleaf proposed rule (clean) and the RSOL surname has been saved on the SAT drive with today's date. 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 proposed delisting rule ready for OFR submission

Rankin, Nicole <nicole_rankin@fws.gov>

Tue 4/20/2021 8:38 AM

To: Hamilton, Byron <byron_hamilton@fws.gov>

For your records.

****

Nicole M. Rankin
Pronouns: she/her/hers

Manager, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi-Basin Regions
1875 Century Blvd NE
Atlanta, GA 30345

Office 404-679-7089
nicole_rankin@fws.gov

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From: Constantino, Maricela <maricela_constantino@fws.gov>
Sent: Monday, April 19, 2021 5:09 PM
To: Docs, PRB <PRBDocs@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>; Hires, Brian K <brian_hires@fws.gov>
Subject: Dwarf-flowered Heartleaf proposed delisting rule ready for OFR submission

Good Afternoon,
We would like to request that PRB please submit to the OFR the attached proposed rule to delist the dwarf-flowered heartleaf.

Thank you,
Maricela

Maricela Constantino
Acting Branch Manager
Delisting and Foreign Species
Ecological Services Program
US Fish and Wildlife Service - Headquarters Office
571/969-9804 cell
pronouns: she/her/hers

Re: Dwarf-flowered heartleaf pDownlisting w/ 4(d) rule (FR4110)

Koches, Jennifer <jennifer_koches@fws.gov>

Tue 4/20/2021 3:48 PM

To: Peeples, Gary <gary_peeples@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>; Pitchford, Daffny <Daffny_Pitchford@fws.gov>; Young, Kristi <kristi_young@fws.gov>

Just heard from Kristi that this HAS gone to the FR so we'll await publication information.

Jennifer M. Koches, Public Affairs Specialist
U.S. Fish and Wildlife Service - External Affairs
Interior Region 2 - South Atlantic-Gulf
Interior Region 4 - Mississippi Basin
Mobile - (843) 670-7902
jennifer_koches@fws.gov

From: Peeples, Gary <gary_peeples@fws.gov>
Sent: Monday, March 29, 2021 10:36 AM
To: Koches, Jennifer <jennifer_koches@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>; Pitchford, Daffny <Daffny_Pitchford@fws.gov>
Subject: Re: Dwarf-flowered heartleaf pDownlisting w/ 4(d) rule (FR4110)

Looks good. Thanks Jennifer.

-G

Gary Peeples
Deputy Field Office Supervisor/Public Affairs Officer
Asheville Field Office
U.S. Fish & Wildlife Service, South Atlantic/Gulf Region
160 Zillicoa St.
Asheville, NC 28801
gary_peeples@fws.gov
cell 828/216-4970
fax 828/258-5330
he/him/his

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: Koches, Jennifer <jennifer_koches@fws.gov>
Sent: Monday, March 29, 2021 10:24 AM
To: Rankin, Nicole <nicole_rankin@fws.gov>; Pitchford, Daffny <Daffny_Pitchford@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>; Peeples, Gary <gary_peeples@fws.gov>
Subject: Re: Dwarf-flowered heartleaf pDownlisting w/ 4(d) rule (FR4110)

HQ approved outreach is in this folder:

Dwarf flowered heartleaf

Gary - did you have a chance to review and make sure there were no fatal flaws in outreach?

Jennifer M. Koches, Public Affairs Specialist
U.S. Fish and Wildlife Service - External Affairs
Interior Region 2 - South Atlantic-Gulf
Interior Region 4 - Mississippi Basin
Mobile - (843) 670-7902
jennifer_koches@fws.gov

"*Let's end this*!!"

From: Rankin, Nicole <nicole_rankin@fws.gov>
Sent: Monday, March 29, 2021 10:22 AM
To: Koches, Jennifer <jennifer_koches@fws.gov>; Pitchford, Daffny <Daffny_Pitchford@fws.gov>
Cc: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: Fw: Dwarf-flowered heartleaf pDownlisting w/ 4(d) rule (FR4110)

FYI. The dward-flowered heartleaf rule is with Exec Sec.

Nicole

****
Nicole M. Rankin
Pronouns: she/her/hers

Manager, Division of Conservation and Classification
U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi-Basin Regions
1875 Century Blvd NE
Atlanta, GA 30345

Office 404-679-7089
nicole_rankin@fws.gov

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From: Constantino, Maricela <maricela_constantino@fws.gov>
Sent: Monday, March 29, 2021 10:20 AM
To: Young, Kristi <kristi_young@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>
Subject: Dwarf-flowered heartleaf pDownlisting w/ 4(d) rule (FR4110)

Good Morning,

Wanted to point out that Dwarf-flowered heartleaf went to ExecSec today. Not sure how quickly they will clear it but wanted to confirm that the outreach was ready to go on this one.

Thanks!

Maricela Constantino
Acting Branch Manager
Delisting and Foreign Species
Ecological Services Program
US Fish and Wildlife Service - Headquarters Office
571/969-9804 cell
pronouns: she/her/hers

SCHEDULED TO PUBLISH: Dwarf-flowered heartleaf delisting

Hamilton, Byron <byron_hamilton@fws.gov>

Wed 4/21/2021 4:44 PM

To: **FWHQ FR Pub List <FWHQ_FR_Pub_List@fws.gov>**
Cc: Phillips, Catherine <catherine_phillips@fws.gov>; Tirpak, John <John_Tirpak@fws.gov>; Mizzi, Janet <janet_mizzi@fws.gov>; Peeples, Gary <gary_peeples@fws.gov>; Caldwell, Mark <mark_caldwell@fws.gov>; Benjamin, Pete <pete_benjamin@fws.gov>; Augspurger, Tom <tom_augspurger@fws.gov>; McCoy, Thomas <thomas_mccoy@fws.gov>

The proposed rule to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*) from the Federal List of Endangered and Threatened Plants (Docket No. FWS–R4–ES–2019–0081) will publish **in the Federal Register on Monday, April 26, 2021.**

The document will be placed on public inspection on Friday, April 23, 2021, at 8:45 ET.

The comment period will close on June 25, 2021.

Public inspection: On the date of public inspection, the document will appear here: https://www.federalregister.gov/public-inspection.
This site is available to the public, and all documents on it are also available to the public when they visit the reading room of the Office of the Federal Register in Washington, DC.

Publication: On the date of publication, the document will appear here: https://www.federalregister.gov/documents/current --- and also in the hard copy version of the Federal Register.

After the date of publication, links to documents can be found here: http://www.gpo.gov/fdsys/browse/collection.action?collectionCode=FR

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

Re: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

Caldwell, Mark <mark_caldwell@fws.gov>
Wed 4/21/2021 6:11 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>

Thanks. I will share with my office

Get Outlook for iOS

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, April 21, 2021 4:49:03 PM
To: Caldwell, Mark <mark_caldwell@fws.gov>
Subject: Re: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

Here you go!

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: Caldwell, Mark <mark_caldwell@fws.gov>
Sent: Wednesday, April 21, 2021 4:12 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>
Subject: RE: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

Byron,

I would like a copy, thanks.

Mark A. Caldwell
Deputy Field Supervisor
US Fish and Wildlife Service
South Atlantic-Gulf Region
South Carolina Ecological Services
176 Croghan Spur Road, Suite 200
Charleston, SC 29407
843-300-0426 (direct line)
843-870-0041 (cell)
843-300-0189 – facsimile

Intentionally trying to lose at rock-paper-sissors is just as hard as trying to win.

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: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Wednesday, April 21, 2021 3:40 PM
To: FWHQ FR Pub List <FWHQ_FR_Pub_List@fws.gov>
Cc: Phillips, Catherine <catherine_phillips@fws.gov>; Tirpak, John <John_Tirpak@fws.gov>; Mizzi, Janet <janet_mizzi@fws.gov>; Peeples, Gary <gary_peeples@fws.gov>; McCoy, Thomas <thomas_mccoy@fws.gov>; Caldwell, Mark <mark_caldwell@fws.gov>; Benjamin, Pete <pete_benjamin@fws.gov>; Augspurger, Tom <tom_augspurger@fws.gov>
Subject: Re: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

The proposed rule to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*) from the Federal List of Endangered and Threatened Plants (Docket No. FWS–R4–ES–2019–0081) was delivered to the Office of the Federal Register on April 20, 2021.

The rule is scheduled to publish on April 26, 2021.

Please let me know if you would like an electronic copy of the document.

Thanks,
Byron

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: Hamilton, Byron
Sent: Tuesday, April 20, 2021 4:31 PM
To: FWHQ FR Pub List <FWHQ_FR_Pub_List@fws.gov>
Cc: Phillips, Catherine <catherine_phillips@fws.gov>; Tirpak, John <John_Tirpak@fws.gov>; Mizzi, Janet <janet_mizzi@fws.gov>; Peeples, Gary <gary_peeples@fws.gov>; McCoy, Thomas <thomas_mccoy@fws.gov>; Caldwell, Mark <mark_caldwell@fws.gov>; Benjamin, Pete <pete_benjamin@fws.gov>; Augspurger, Tom <tom_augspurger@fws.gov>
Subject: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

The proposed rule to remove the dwarf-flowered heartleaf (*Hexastylis naniflora*) from the Federal List of Endangered and Threatened Plants (Docket No. FWS–R4–ES–2019–0081) was delivered to the Office of the Federal Register on April 20, 2021.

We will notify you when we receive a publication date.

Please let me know if you would like an electronic copy of the document.

Thanks,
Byron

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

Re: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

Phillips, Catherine <catherine_phillips@fws.gov>
Thu 4/29/2021 12:26 PM
To: Hamilton, Byron <byron_hamilton@fws.gov>

Thanks. I'm almost done and about to send them!

Catherine T. Phillips, Ph.D.
Assistant Regional Director, Ecological Services
South-Atlantic Gulf and Mississippi Basin Interior Regions
1875 Century Blvd
Atlanta, GA 30345
404-450-7563 (cell)

From: Hamilton, Byron <byron_hamilton@fws.gov>
Sent: Tuesday, April 20, 2021 10:12 AM
To: Phillips, Catherine <catherine_phillips@fws.gov>
Cc: Young, Kristi <kristi_young@fws.gov>; Rankin, Nicole <nicole_rankin@fws.gov>
Subject: DELIVERED TO THE OFR: Dwarf-flowered Heartleaf Proposed Delisting

Good morning,

I've drafted this email to send to State Agency Directors as soon as we know the proposed rule has been delivered to OFR and a follow-up e-mail informing of the publishing date. I've also compiled a list of their emails. Please see the attachment for the letter.

Lesley Starke, Head of the N.C. Plant Conservation Program, Lesley.Starke@ncagr.gov
Misty Buchanan, Director of the N.C. Natural Heritage Program, misty.buchanan@ncdcr.gov
Director of the N.C. Wildlife Resources Commission, Cam Ingram, cameron.ingram@ncwildlife.org

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

Kudos to the Dwarf-flowered heartleaf team!

Phillips, Catherine <catherine_phillips@fws.gov>

Mon 5/3/2021 8:00 AM

To: FW4 ALL ES <FW4_ALL_ES@fws.gov>

ES team,

We want to recognize the great work performed by the dwarf-flowered heartleaf core team.

On April 26, a rule proposing 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) published in the Federal Register. Thanks to Rebekah Reid, Gary Peeples, Byron Hamilton, Drew Becker, our partners at Texas A&M, and others for their work to develop the Species Status Assessment and proposed delisting rule. Work began on the dwarf-flowered heartleaf SSA in 2018 and many efforts have been underway to recover this species. The move represents years of ESA-inspired collaborations between state, federal, and local stakeholders on behalf of the North Carolina and South Carolina plant. The proposed rule is currently undergoing public comment.

Congrats to the members of the SSA core team! Great job!

Catherine T. Phillips, Ph.D.
Assistant Regional Director, Ecological Services
South-Atlantic Gulf and Mississippi Basin Interior Regions
1875 Century Blvd
Atlanta, GA 30345
404-450-7563 (cell)

Frequently Asked Questions

Where does it live?
Dwarf-flowered heartleaf is known from Greenville, Spartanburg, and Cherokee counties, South Carolina; and Polk, Rutherford, Cleveland, Gaston, Lincoln, Burke, Catawba, Caldwell, Alexander, and Iredell counties, North Carolina. Thirteen counties total, three in South Caroline, ten in North Carolina.

What threats has the plant faced?
Dwarf-flowered heartleaf grows in rapidly growing urban areas, including Charlotte, Greenville/Spartanburg, and Hickory. As a result, habitat loss due to development has been the single largest threat to the plant. Other threats include invasive plants and encroachment of native woody plants that shade out the heartleaf.

How was the decision made to recommend delisting?
The Service brought together a team of biologists, which compiled and examined all known data and research regarding the plant. The outcome was a peer-reviewed summary of its historic and current status, as well as projections of population stability and future trends. This Species Status Assessment formed foundation for the Service's decision not to place these animals on the federal threatened and endangered species list.

Why propose delisting?
When the plant was put on the endangered species list in 1989, there were only 24 known populations, distributed across eight counties. Today, there are at least 119 known populations of dwarf-flowered heartleaf, scattered across 10 North Carolina and two South Carolina counties. Of those 119 populations, 28 have more than 1,000 plants, and several are found on protected sites.

In looking at the plant's future viability, the biologists modeled three scenarios, each reflecting a different level of conservation effort and habitat loss from development. Even in the high-development scenario, it's predicted 56 of these populations would have moderate or better viability, with 27 of those having very high viability.

Who contributed to its recovery?
Key to the heartleaf's recovery has efforts by a wide variety of organizations to conserve places where the plant grows, including:

- Foothills Land Conservancy
- Catawba Lands Conservancy
- The Nature Conservancy
- National Park Service
- Broad River Greenway
- North Carolina Department of Transportation
- Duke Energy
- Private landowners
- State of North Carolina

The world's largest population is currently conserved by private individuals, and the most significant contribution to the plant's conservation came from the N.C. Department of Transportation. Over the years, the NCDOT has protected sites to address impacts to the plants from highway projects.

How do I comment on the proposed delisting?

1) Electronically:

Go to the federal eRulemaking Portal at *http://www.regulations.gov*. In the Search box, enter **<insert Federal Register notice info>**, 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 Rules link to locate this document. You may submit a comment by clicking on "Comment Now!" or

(2) Submit hard copies by U.S. mail or hand-delivery to:

Public Comments Processing
Attn: **<insert Federal Register notice info>**
U.S. Fish & Wildlife Headquarters, MS: BPHC
5275 Leesburg Pike
Falls Church, VA 22041-3803

The Service will accept and consider comments and information that is received or are postmarked on or before **<insert date>**. The agency must receive comments submitted electronically using the federal eRulemaking Portal by 11:59 p.m. Eastern Time on the closing date.

Please send your comments **only** by the methods described above. Verbal comments left on phone voicemail or comments sent to other postal or email addresses will not be accepted. The Service will post all information received on http://www.regulations.gov. This generally means that the Service will post any personal information you provide.

Where can I learn more about the proposed rule to delist the dwarf-flowered heartleaf?
Information is available online at <insert url> or you may contact the U.S. Fish and Wildlife Service's Asheville North Carolina Field Office at:

Janet Mizzi, Field Supervisor
Asheville Ecological Services Field Office
160 Zillicoa St.
Asheville, NC 28801
Phone: 828/258-3939

If you use a telecommunications device for the deaf (TDD), call the Federal Information Relay Service (FIRS) at 800-877-8339.

Frequently Asked Questions

Where does it live?
Dwarf-flowered heartleaf is known from Greenville, Spartanburg, and Cherokee counties, South Carolina; and Polk, Rutherford, Cleveland, Gaston, Lincoln, Burke, Catawba, Caldwell, Alexander, and Iredell counties, North Carolina. Thirteen counties total, three in South Carolina, ten in North Carolina.

Commented [1]: Can we add a sentence about the type of habitat it is found in.

What threats has the plant faced?
Dwarf-flowered heartleaf grows in rapidly growing urban areas, including Charlotte, Greenville/Spartanburg, and Hickory. As a result, habitat loss due to development has been the single largest threat to the plant. Other threats include invasive plants and encroachment of native woody plants that shade out the heartleaf.

Why propose delisting?
When the plant was put on the endangered species list in 1989, there were only 24 known populations, distributed across eight counties. Today, there are at least 119 known 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, and several are found on protected conservation lands.

Deleted: sites

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Deleted: has

Deleted: places where the plant grows

- Foothills Land Conservancy
- Catawba Lands Conservancy
- The Nature Conservancy
- National Park Service
- Broad River Greenway
- North Carolina Department of Transportation
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- State of North Carolina

The world's largest population is currently conserved by private individuals, and the most significant contribution to the plant's conservation came from the N.C. Department of Transportation. **How was the decision made to recommend delisting?**
The Service brought together a team of biologists, which compiled and examined all known data and research regarding the plant. The outcome was a peer-reviewed summary of its historic and current status, as well as projections of population stability and future trends. This Species Status Assessment formed the foundation for the Service's decision to propose removing this plant from the federal threatened and endangered species list.

Deleted: Over the years, the NCDOT has protected sites to address impacts to the plants from highway projects.¶
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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

NC Natural Heritage Program *Hexastylis naniflora* Flex Fund
Quarterly report
Submitted by NC Natural Heritage Program to the US Fish and Wildlife Service
March 26, 2012

Monitoring and threat assessment protocols:

James Padgett made some preliminary site visits in North and South Carolina in mid-February and early March 2012 to check on status of flowering of the populations. One site (Peters Creek Preserve), had just begun flowering in South Carolina in mid-February. In North Carolina, sites had just begun flowering in early to mid-March. Plants should retain their flowers through seed development that generally last through late May.

A site visit/meeting was held on March 15, 2012 with NCDOT and USFWS at the Broad River Greenway in Cleveland County, North Carolina to coordinate monitoring protocols that have been established and utilized by NCDOT.

We have initiated discussions for developing a standardized assessment of trends and threats, using categorical rankings and will continue to work with USFWS and NCDOT through the growing season to further develop this.

Current field schedule and difficulties associate with landowner contacts or other access issues:

James will begin collecting monitoring data in late March to early April, and will complete monitoring efforts for this year by late May. Laura Gadd and possibly Misty Buchanan will assist 3-4 days this season with delineating some of the larger populations and setting up monitoring plots.

This agreement includes 15 sites to be monitored by NC NHP. Letters were sent out to all landowners in early 2012, with the exception of the South Carolina landowners associated with the South Pacolet River and Tributaries site. There was great difficulty in determining the landowners for this site because we had limited access to parcel data and the GIS data we received from SC NHP had very low accuracy in the mapped records. Most of these Element Occurrences (EOs) occur on private lands. We were not able to get more specific landowner information from South Carolina contacts that are more familiar with the sites. However, after speaking with Jackie Wagner from Appalachian State University at our meeting on March 15, she was able to gain access to some of these sites by knocking on doors, since she experienced the same difficulties. Jackie is going to share with us which sites she was able to get access to and the location of those sites for us to include in our study. We may exchange some of the previously selected EOs with ones that we can gain access to for this site.

In South Carolina, we have received permission to access Blalock Reservoir, Peters Creek Preserve, and Cowpens National Battlefield. In North Carolina, we have heard back from 21 landowners, all but 4 have granted access. The Lincoln County Manager, who owns a significant portion of the Lincoln County Airport and Leepers Creek site, is one of the landowners that have denied access to their property. There are 100 landowners that have not responded to our letter and I have begun making phone calls to the landowners with the largest tracts that contain *Hexastylis naniflora*.

Update on most recent site data obtained from SC.

We were able to obtain GIS data for the *Hexastylis naniflora* occurrences in South Carolina, however, the records are not mapped very accurately. We recently received a map from the chief ranger at Cowpens National Battlefield of the populations more accurately mapped, which will be helpful.

Issues in meeting project objectives and proposed solutions.

The biggest issues and concerns to date with the project have been gaining landowner access for all properties proposed for study. It may be necessary for James to knock on a few doors at some locations where we have not been able to get in contact with the landowners. In some cases, obtaining landowner permission by some owners will not be critical because the mapped population may only touch a very small portion of the parcel.

***Hexastylis naniflora* Performance Schedule**:

Schedule is based on the original grant award for two field seasons (2012-2013). Should additional monies be granted for this project, we will extend the survey into 2014.

Activity	Timeline	Agency/Person responsible
Initial coordination meeting/conference call	September, 2011	NHP, DOT, USFWS, ASU
Final selection of Hexastylis naniflora sites for inclusion in study (via conference call)	November 2011	NHP & USFWS
Make landowner contacts, send letters and complete permit applications where applicable.	Winter 2011-2012	NHP (Gadd)
Field coordination meeting with NCDOT and USFWS to establish and standardize monitoring protocols for the season	March 15, 2012	NHP-Coordinator, with NCDOT, USFWS, ASU
Quarterly report due	March 2012	NHP (Gadd)
First season field work: delineate population areas, set up monitoring plots, and determine categorical rankings for threat assessment.	March-May, 2012	NHP (Padgett-primary, Gadd)
Meeting or conference call with NCDOT, USFWS, ASU to report on field season and any inconsistencies or problems.	June 2012	NHP, USFWS, NCDOT, ASU
Quarterly report due	June 2012	NHP (Gadd)
Compiling, entering and reviewing field data	Summer-Fall 2012	NHP (Padgett-primary, Gadd)
Quarterly report due	September 2012	NHP (Gadd)
Quarterly report due	December 2012	NHP (Gadd)
Quarterly report due	March 2013	NHP (Gadd)
Second season field work: check population areas, monitor plots, threat assessment	March-May, 2013	NHP (Padgett-primary, Gadd)
Quarterly report due	June 2013	NHP (Gadd)
Compiling, entering and reviewing field data	Summer-Fall 2012	NHP (Padgett-primary, Gadd)
Quarterly report due	September 2013	NHP (Gadd)
Final report due	December 2013	NHP (Padgett, Gadd)





NC Natural Heritage Program *Hexastylis naniflora* Flex Fund

Annual report
Submitted by NC Natural Heritage Program
to the US Fish and Wildlife Service – Asheville Office
October 12, 2012

Update on monitoring and threat assessment protocols:

Monitoring Methodology:

In the spring and summer of 2012, site visits to *Hexastylis naniflora* sites were conducted by North Carolina Natural Heritage Program (NHP) biologist James Padgett, with assistance from Kimberly Israel and Laura Gadd. Site visits included all or part of 13 out of the 15 populations recommended for survey by the United States Fish and Wildlife Service (USFWS). All populations and tracts where landowner permission was granted were included in the surveys. Table 1 shows details regarding landowner access and summary of work for each site for 2012. This September, we were able to reach the managers of the Catawba County Wildlife Club (EO 243) and they granted permission to conduct surveys. However, because permission was granted after the optimal survey season for this species, we will include this site in the survey for the next two years of data collection.

The spring of 2012 was spent continuing to reach out to landowners by knocking on doors and making phone calls when initial letters were unanswered last winter. In late spring and early summer, where access was granted, *Hexastylis naniflora* populations were delineated with GPS and mapped. Following the delineation of each *H. naniflora* population, James randomly set up monitoring plots in the mapped areas to sample approximately 10% of the population, following the North Carolina Department of Transportation (DOT) monitoring protocol. Monitoring plots were either 200'x50' or 100'x25' in size, depending on the size of the population. This methodology is consistent with DOT monitoring methodology, as determined during the field coordination meeting on March 15, 2012. All plants were counted in each plot, and that number was extrapolated to determine an estimate of how many plants occur at each site, based on the entire size of the delineated population. In addition to the DOT protocol, given that some plants may have been overlooked within the plots during the plant counts, extrapolations with five percent margin of error above and below the extrapolated estimate were also calculated to account for any plants that may have been overlooked or missed.

Monitoring Results:

Table 2 shows the results of 2012 field surveys, including the acreage of the populations delineated, the numbers of individuals counted in each plot, and the extrapolated estimate of number of individuals in the entire population based on the plot counts.

We were not able to access the entire population at Broad River/Floyd's Branch site and Island Creek Lovelady site because we did not gain landowner permission for all the tracts. Although most of the site was visited, we were unable to visit every location at the Cliffside Steam Station on Duke Energy Property this year, because of restrictions with needing a land manager escort at all times on site. However, we will likely be able to access the entire population in 2013. At these three sites, however, NHP had detailed population data from recent surveys for areas that we could not include in this year's surveys. The Island Creek Bluff/Love Lady Tracts had been surveyed and delineated by James Padgett

and other NHP staff in 2005. The other two sites, Cliffside Steam Station and Broad River/Floyds Creek have recently been mapped by a contract biologist in 2011 and by DOT biologists in 2005, respectively.

The supplemental acreage from recent surveys in these three sites listed above substantially increased the size of the population and extrapolated numbers of *Hexastylis naniflora* individuals. We believe this additional data more accurately portrays the actual size of the population. The accuracy of the mapping at these three sites is likely high, but to account for some uncertainty and to show what data was collected in 2012 by NHP, we present the additional data in two data sets. Table 2 shows the total population size and extrapolated numbers of individuals for data collected in 2012 and data provided by partners. Table 3 shows only the population size estimates for population sampled by NHP at Cliffside Steam Station, Broad River, Floyds Branch, Long Branch, and Island Creek Bluff/Lovelady Site in 2012.

Maps of each site follow Table 3, showing the entire delineated area for each population.

Table 1: Summary of *Hexastylis naniflora* populations surveyed by NHP in 2012.

Site name	County	NHP Element Occurrence #	Sub EO(s) # (if applicable)	Landowner permission obtained	Comment
North Carolina Sites					
Island Creek Bluff/ Love Lady Site	Burke	029	N/A	Mostly	This site had been previously surveyed in 2005, but in 2012 we did not gain access to the entire population. In 2012, NHP mapped additional 18 acres of previously unknown plants.
South Fork Catawba River: Jacob Fork, Camp Creek	Catawba	158	N/A	Yes	Mapped and all of the plants were counted (complete census).
Catawba Wildlife Club	Catawba	243	012, 242, 269, 270	Yes	Landowner permission was obtained in September 2012, after optimal survey season. This site will be included in 2013-2014 surveys.
Cliffside Steam Station	Cleveland/ Rutherford	276	N/A	Yes	The entire population was not remapped this year due to limited access to the entire Duke Energy property. However, we do have supplement population data from previous years collected by other biologists. See note in monitoring results section and Table 2 and 3.
Rhyne Preserve	Lincoln	262	131, 260	Yes	This site was added to replace the Lincoln Co. Airport site, where permission to survey was denied.
Mills Creek Forest and Seep	Polk	23	N/A	Yes	Remapped and sampled entire population.
Broad River: New Hope Springhead Swamp	Polk	125	N/A	Yes	Remapped and sampled entire population.

Site name	County	NHP Element Occurrence #	Sub EO(s) # (if applicable)	Landowner permission obtained	Comment
Second Broad River (Forest City Industrial Complex)	Rutherford	154	N/A	Yes	Remapped and sampled entire population.
Broad River: Henson's Creek Ravine, Brice Rare Plant Site, and Sandy Mush Outcrop	Rutherford	099	10, 37, 55, 75, 76, 79, 90, 121, 181	Mostly	Where landowners have granted permission, we remapped and sampled the population.
Broad River: Cleghorn Creek tributary/US221	Rutherford	176	167-170	Yes	Mapped and sampled all but one of the sites. At the last site, maps provided by DOT, 2006.
Broad River: Floyds Creek, Long Branch	Rutherford	177	16, 107, 122, 163-166	Mostly	Mapped and sampled most of the population. Not all tracts at this site have been visited yet.
South Carolina Sites					
Cowpens Battlefield	Cherokee	016, 017, 018	N/A	Yes	Remapped and sampled entire population.
South Pacolet River and Tributaries	Greenville/ Spartanburg	002, 004, 024, 032, 033, 036, 038, 039, 040, 041	N/A	No	We do not anticipate getting landowner permission to visit this population. See explanation under SC data heading.
Peters Creek Heritage Preserve/Mineral Springs Creek	Spartanburg	011, 014, 026-028, 047, 048, 057	N/A	Yes	Remapped and sampled entire population.
Blalock Reservoir	Spartanburg	007, 029	N/A	Yes	Obtained detailed maps of population locations from Reservoir officials (Spring 2012). NHP staff revisited and sampled the population.

Table 2: 2012 *Hexastylis naniflora* population size estimates

Site Name	NHP EO Number	Sub EO(s) # (if Applicable)	Plot Marker	Acres of *Hexastylis naniflora* Mapped By NHP	Acres Previously Reported By Partners	TOTAL population acreage including supplemental data from partners	Sample Plot Size(s) (Acres)	Actual Plant Count in plots (2012)	Extrapolated Total Number Of Plants (Estimate)[1]	5% Margin Of Error below extrapolated number of plants (number Of plants)[1]	5% Margin Of Error above extrapolated number of plants (number Of plants)[1]
North Carolina Sites											
Island Creek Bluff/Love Lady Site	029	N/A	Painted steel peg	18	47	**65**	1.8	1,015	**36,652**	34,819	38,485
South Fork Catawba River: Jacob Fork, Camp Creek	158	N/A	None/ Complete census	0.2	NA	**0.2**	0.2	256	**256**	243	268
Cliffside Steam Station	276	N/A	Painted steel peg	10.22	41.78	**52**	1.02	1430	**17,786**	16,897	18,675
Rhyne Preserve	262	131, 260	Painted steel peg	19.31	NA	**19.31**	1.5	1378	**17,739**	16,852	18,626
Mills Creek Forest and Seep	023	N/A	Metal tags	1.17	NA	**1.17**	0.14	208	**1,738**	1,651	1,825
Broad River: New Hope Springhead Swamp	125	N/A	Painted steel peg	4	NA	**4**	0.4	950	**9,500**	9,690	9,785
New Hope Springhead Swamp	125	N/A	Painted steel peg	4	NA	**4**	0.4	950	**9,500**	9,025	9,975

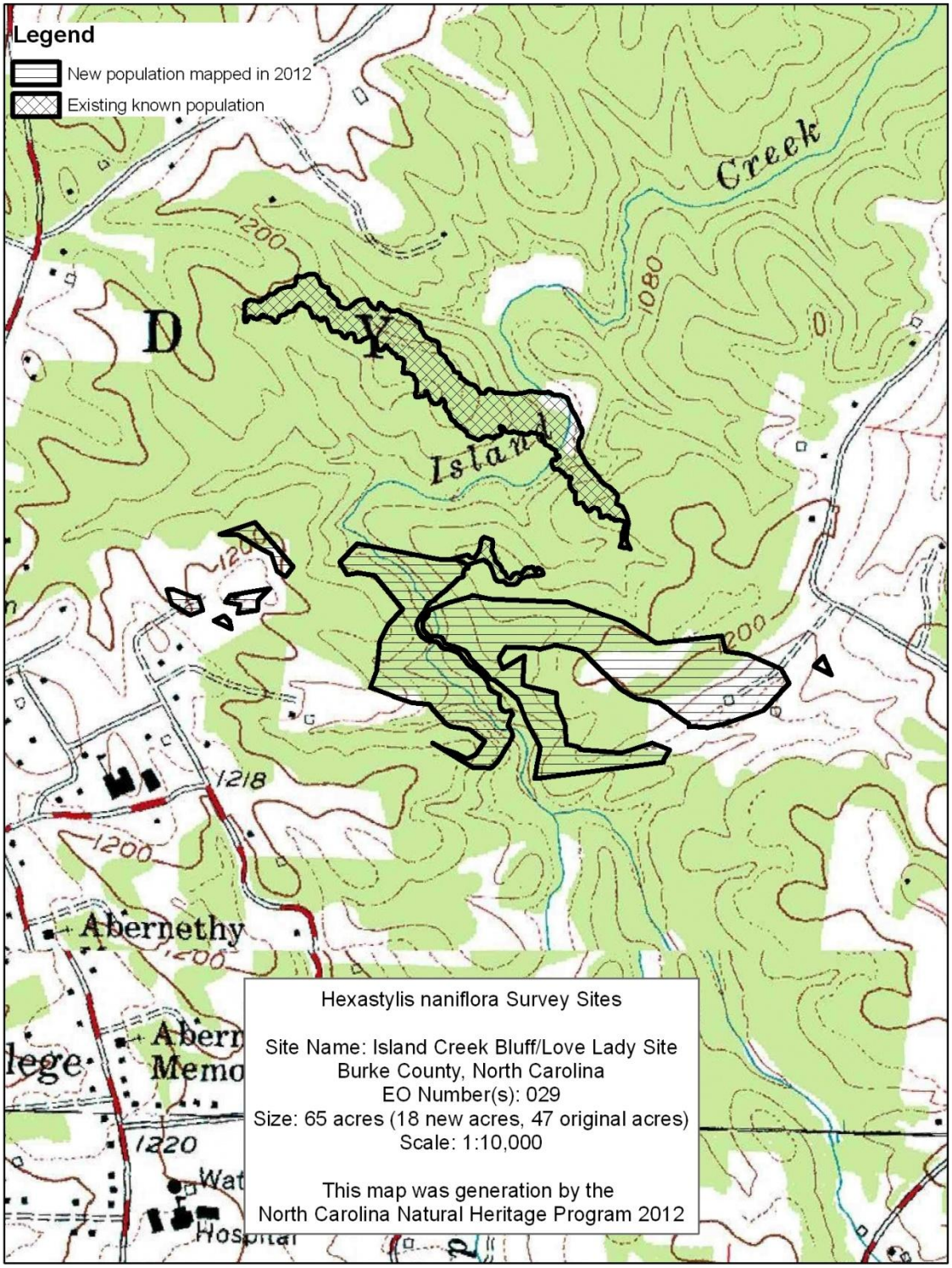
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Second Broad River (Forest City Industrial Complex)	154	N/A	Painted steel peg	5.3	NA	**5.3**	0.53	315	**3,150**	2,992	3,307
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop	099	10, 37, 55, 75, 76, 79, 90, 121, 181	Painted steel peg	24.61	NA	**24.61**	2.29	2551	**27,415**	26,044	28,785
Broad River: Cleghorn Creek, US 221	176	167-170	Painted steel peg	6.84	NA	**6.84**	0.68	638	**6,418**	6,097	6,739
Broad River: Floyds Creek, Long Branch	177	16, 107, 122, 163-166	Painted steel peg	2.35	2.86	**5.21**	0.24	204	**4,428**	4,206	4,649
South Carolina Sites											
Cowpens National Battlefield	016, 017, 018	N/A	metal tags	6.05	NA	**6.05**	0.69[2]	459	**4,024**	3,822	4,225
Peters Creek Preserve	011, 014, 026-028, 047, 048, 057	N/A	Painted steel peg	8.98	NA	**8.98**	0.91	432	**4,263**	4,049	4,476
Blalock Reservoir	007, 029	N/A	Complete survey using survey markers	7.59	NA	**7.59**	0.76	404	**4,034**	3,832	4,235

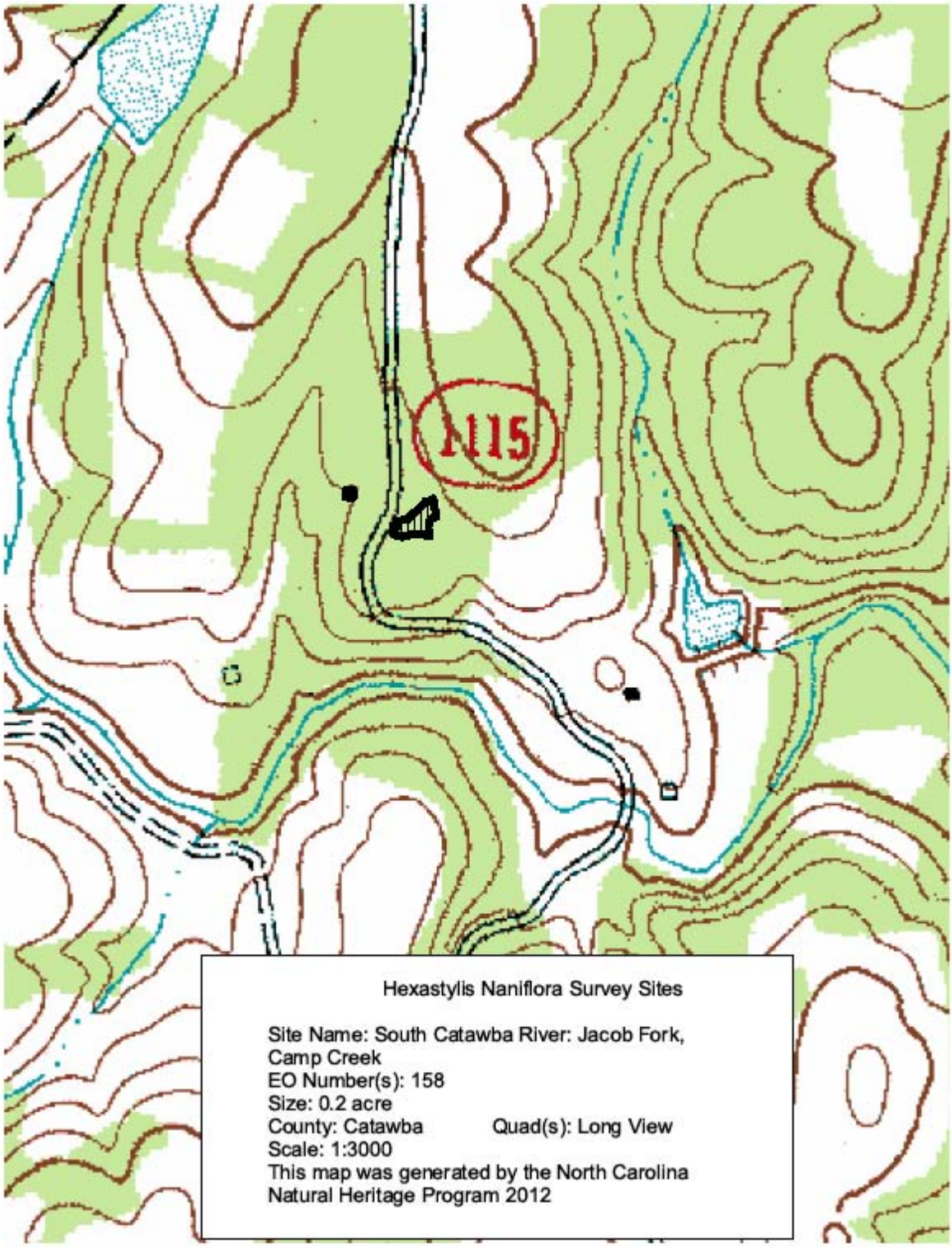
Site Name	NHP EO Number	Sub EO(s) # (if Applicable)	Plot Marker	Acres of *Hexastylis naniflora* Mapped By NHP	Acres Previously Reported By Partners	TOTAL population acreage including supplemental data from partners	Sample Plot Size(s) (Acres)	Actual Plant Count in plots (2012)	Extrapolated Total Number Of Plants (Estimate)[1]	5% Margin Of Error <u>below</u> extrapolated number of plants (number Of plants)[1]	5% Margin Of Error <u>above</u> extrapolated number of plants (number Of plants)[1]
TOTAL for all sites				**119**	**91.64**	**210**	**11.56**	**11,190**	**146,903**	**140,219**	**154,055**

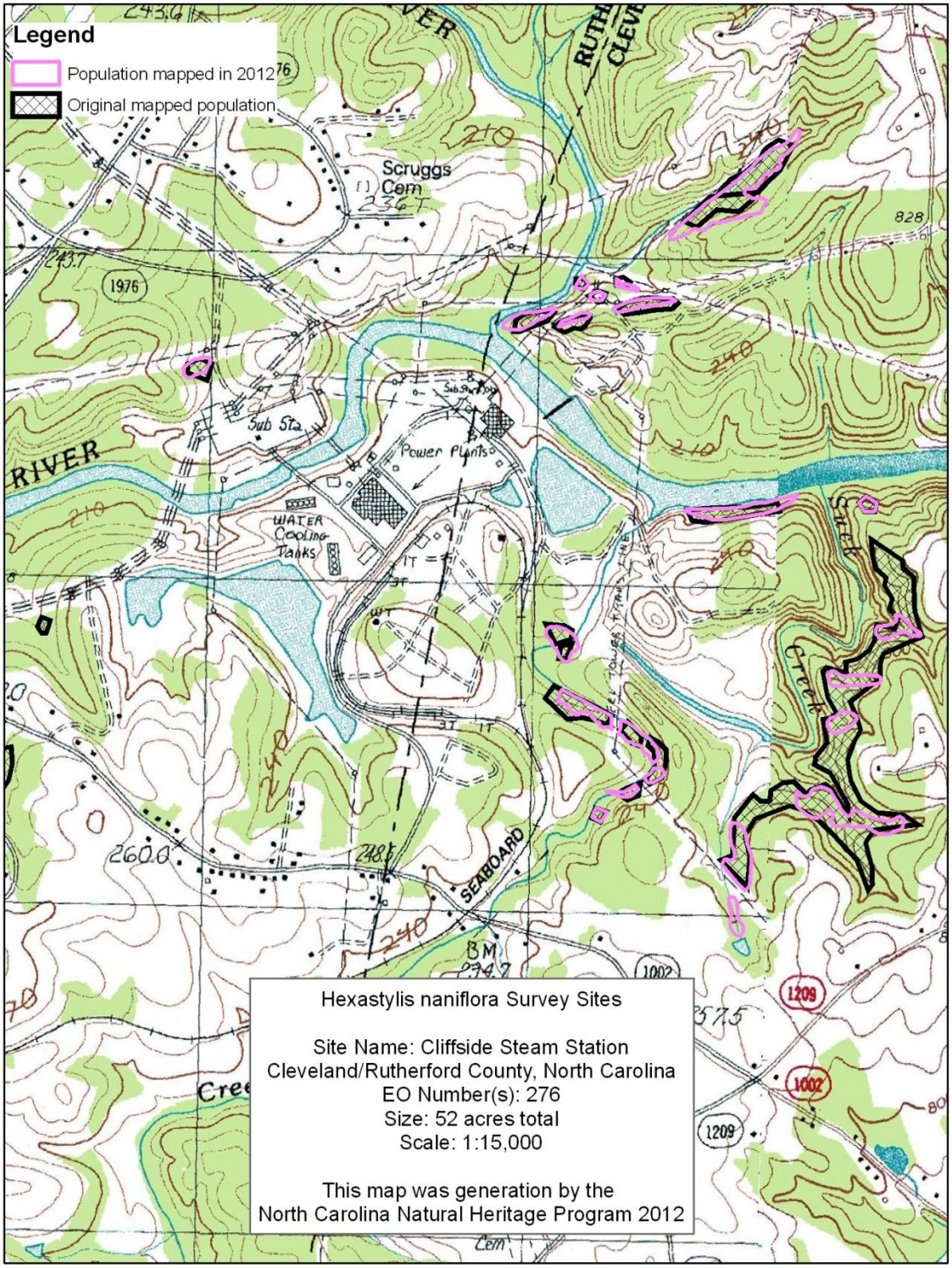
[1]Extrapolated total number of plants and 5% margins of error were calculated based on the total acreage from population delineated in 2012 plus additional population data provided by partners for Cliffside Steam Station, Broad River, Floyds Branch, Long Branch, and Island Creek Bluff/Lovelady Sites.

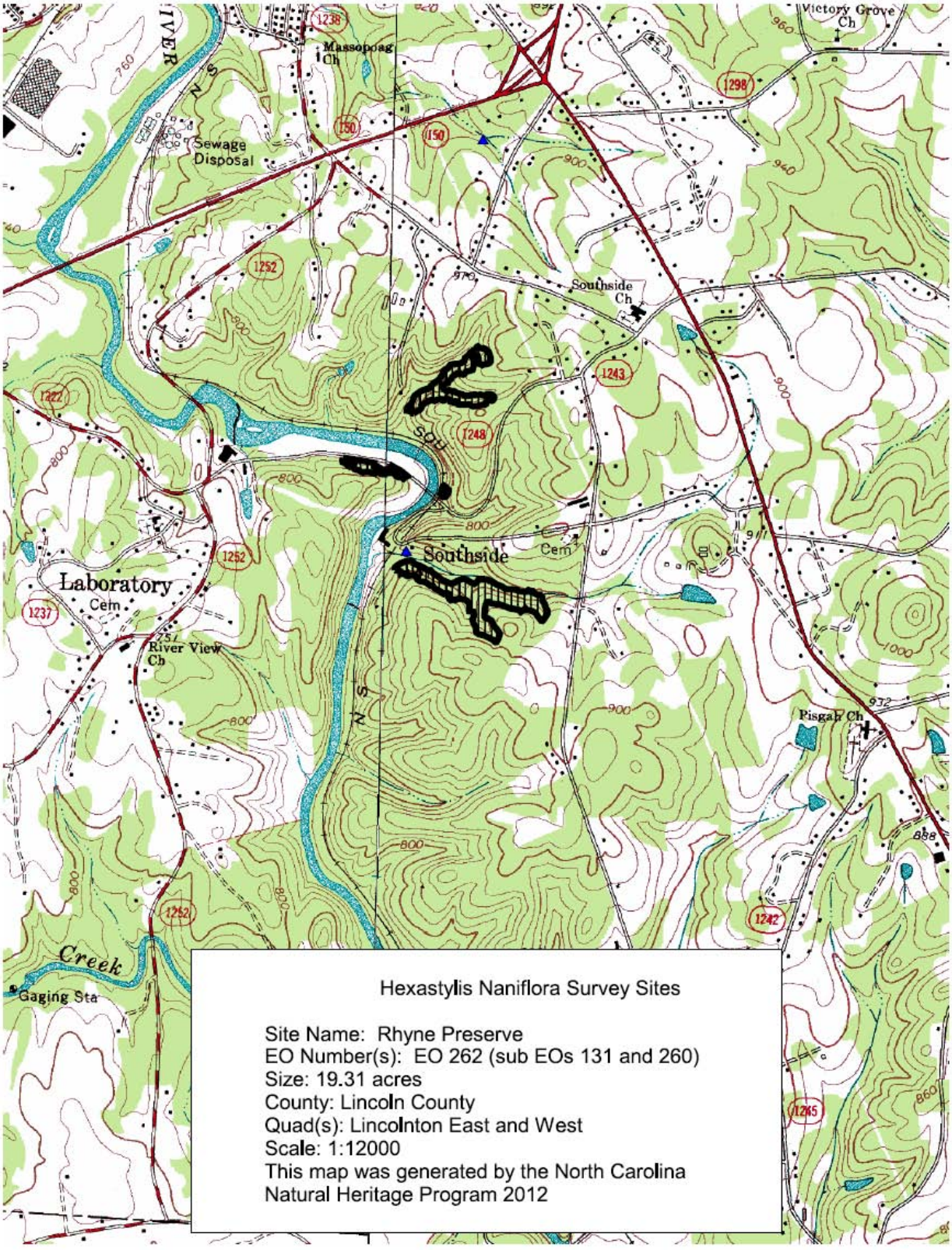
Table 3: 2012 *Hexastylis naniflora* population size estimates for population sampled by NHP at Cliffside Steam Station; Broad River, Floyds Branch, Long Branch; and Island Creek Bluff/Lovelady Site.

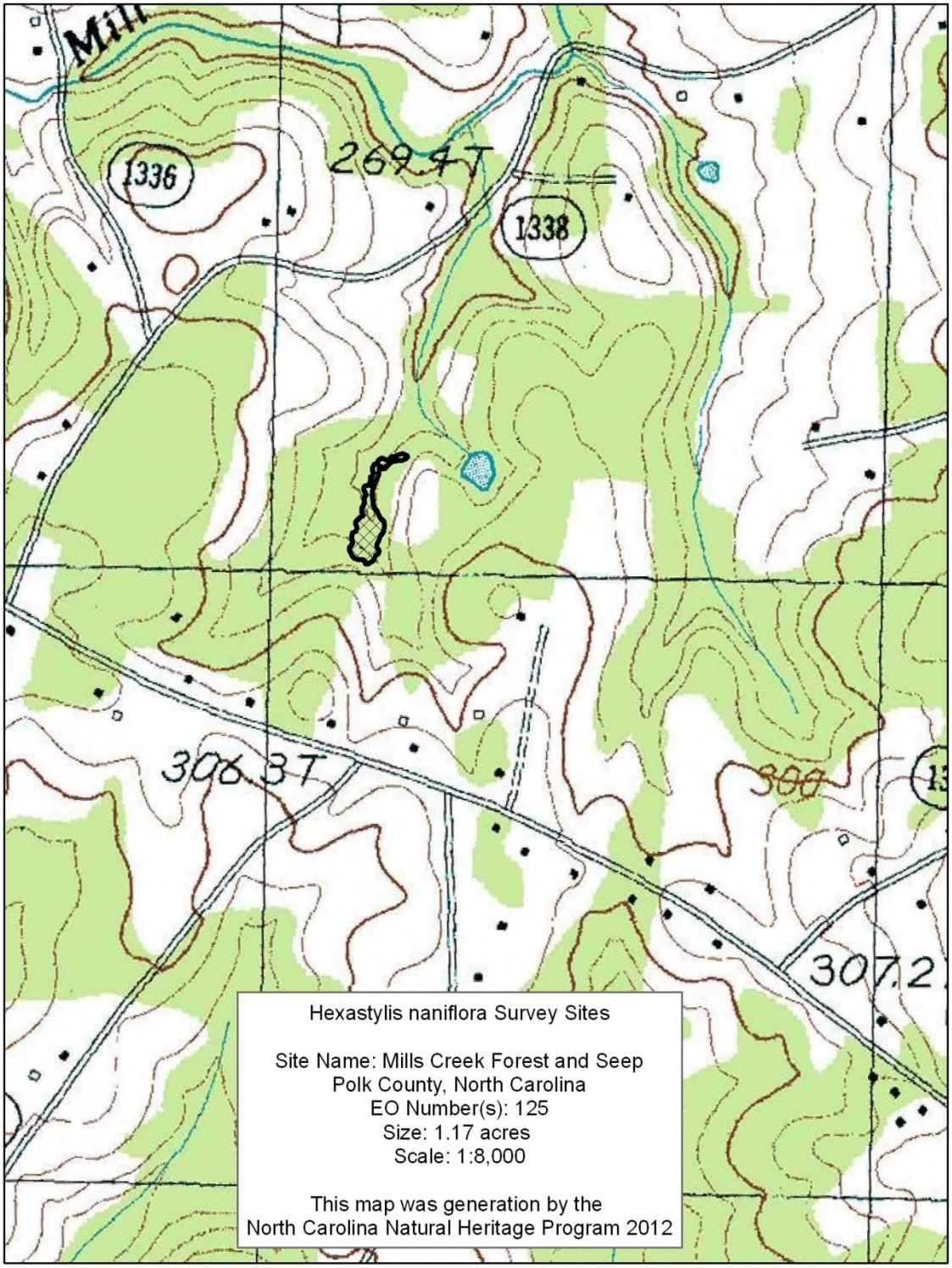
Site Name	NHP EO Number	Sub EO(s) # (if Applicable)	Acres of *Hexastylis naniflora* Mapped By NHP	Actual Plant Count in plots (2012)	Extrapolated Total Number Of Plants (Estimate)	-5% Margin Of Error <u>below</u> extrapolated number of plants (number Of plants)	+5% Margin Of Error <u>above</u> extrapolated number of plants (number Of plants)
Cliffside Steam Station	EO 276	NA	10.22	1430	14,338	13,621	15,055
Broad River, Floyds Creek, Long Branch	EO 177 (various sub EOs)	16, 107, 122, 163-166	2.35	204	1,998	1,898	2,098
Island creek Bluff/Love Lady Site	EO 29	NA	18	1015	10,150	9,643	10,658


Legend
New population mapped in 2012
Existing known population
Creek
1200
1080
D
Island
1218
1200
Abernethy
1200
1220
Hexastylis naniflora Survey Sites
Site Name: Island Creek Bluff/Love Lady Site
Burke County, North Carolina
EO Number(s): 029
Size: 65 acres (18 new acres, 47 original acres)
Scale: 1:10,000
This map was generation by the
North Carolina Natural Heritage Program 2012

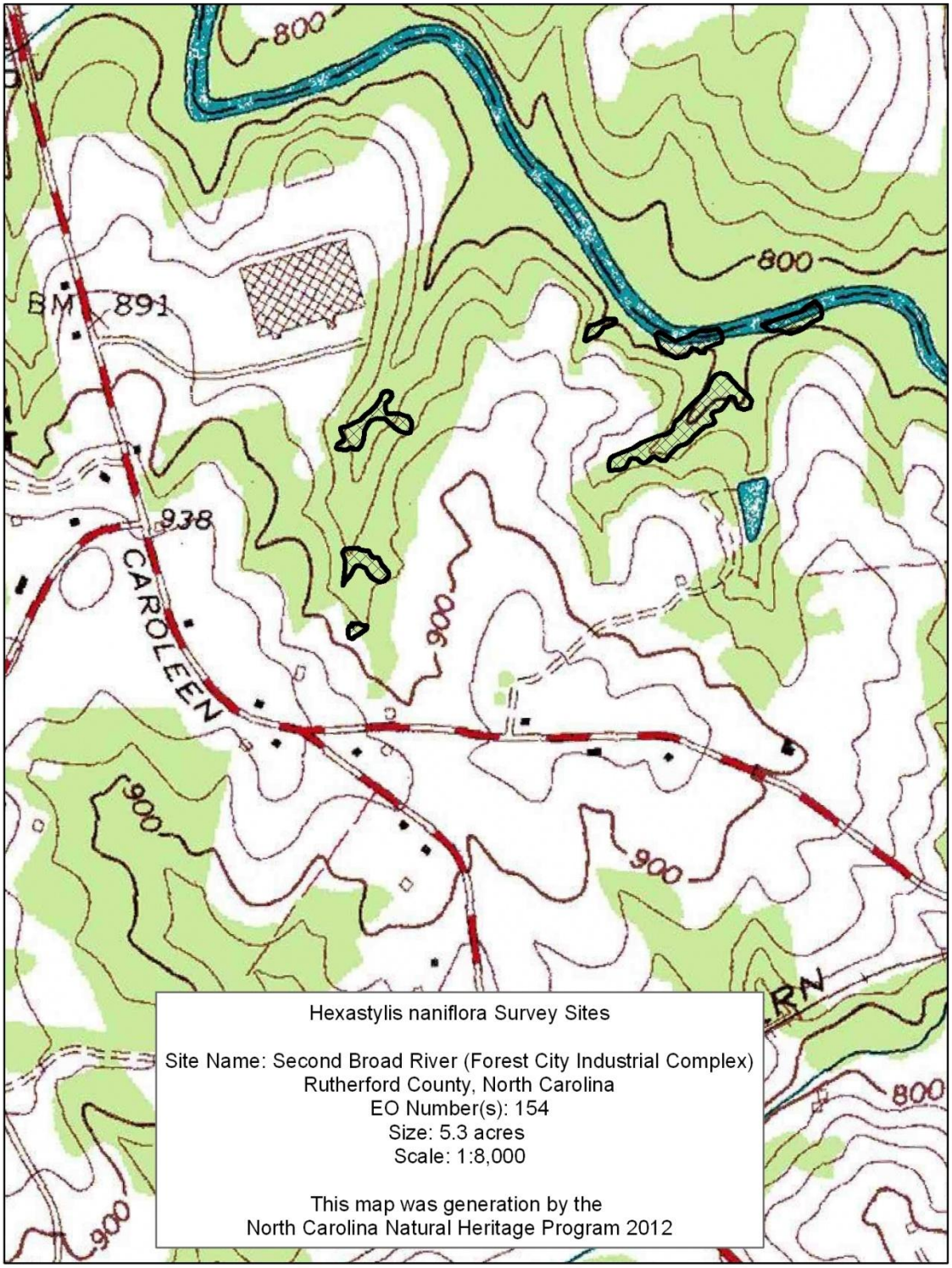

N115
Hexastylis Naniflora Survey Sites
Site Name: South Catawba River: Jacob Fork, Camp Creek
EO Number(s): 158
Size: 0.2 acre
County: Catawba
Quad(s): Long View
Scale: 1:3000
This map was generated by the North Carolina Natural Heritage Program 2012

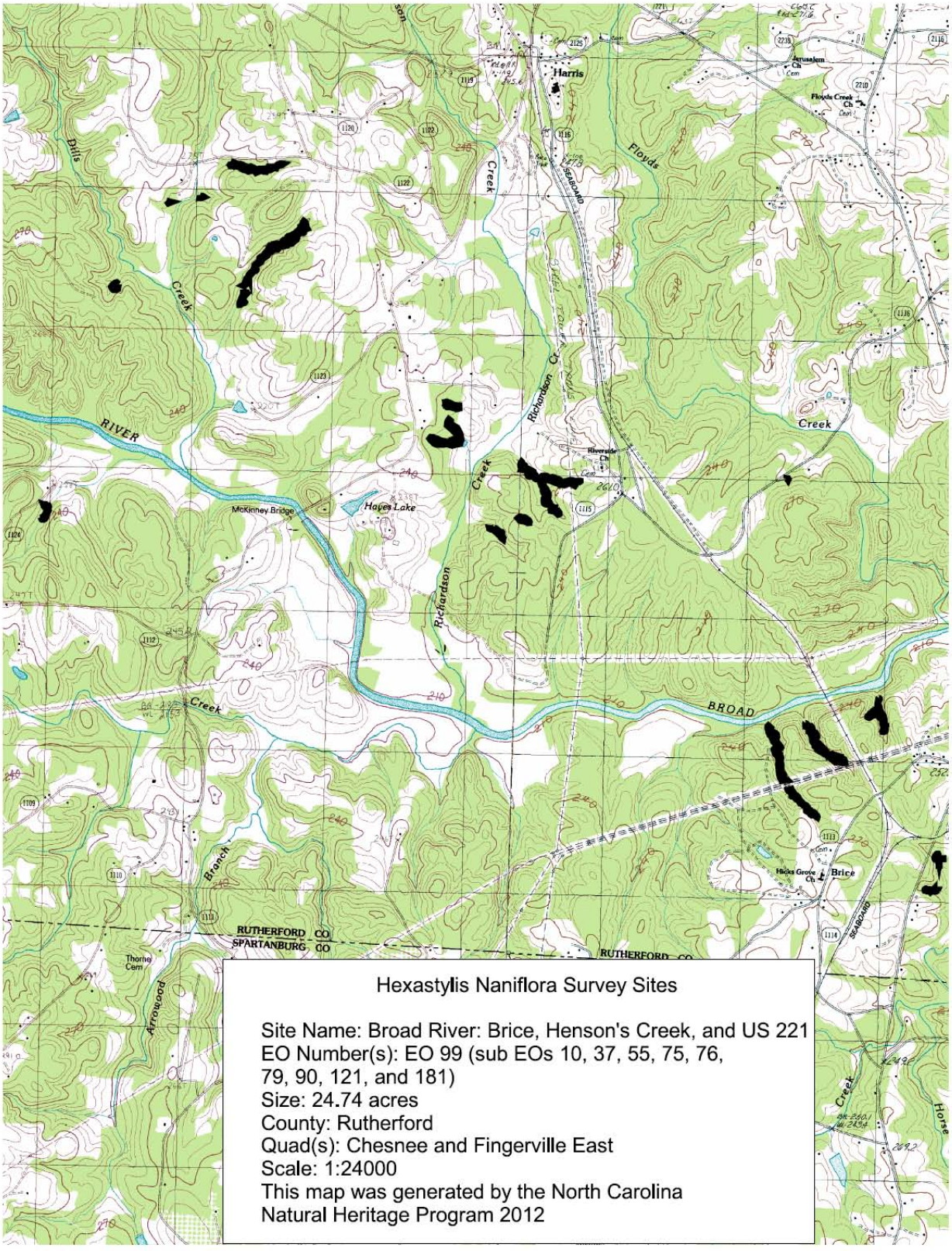

Legend
Population mapped in 2012
Original mapped population
Scruggs Cem
Sub Sta
Power Plants
WATER Cooling Towers
RIVER
Creek
SEABOARD
Hexastylis naniflora Survey Sites
Site Name: Cliffside Steam Station
Cleveland/Rutherford County, North Carolina
EO Number(s): 276
Size: 52 acres total
Scale: 1:15,000
This map was generation by the
North Carolina Natural Heritage Program 2012


Victory Grove Ch
Massapoag Ch
Sewage Disposal
Southside Ch
Southside
Cem
Laboratory
Cem
River View Ch
Pisgah Ch
Creek
Gaging Sta
1238
1298
1252
1243
1222
1248
1237
1242
1245
150
800
900
1000
Hexastylis Naniflora Survey Sites
Site Name: Rhyne Preserve
EO Number(s): EO 262 (sub EOs 131 and 260)
Size: 19.31 acres
County: Lincoln County
Quad(s): Lincolnton East and West
Scale: 1:12000
This map was generated by the North Carolina Natural Heritage Program 2012


Mill
1336
269.4T
1338
306.3T
307.2
Hexastylis naniflora Survey Sites
Site Name: Mills Creek Forest and Seep
Polk County, North Carolina
EO Number(s): 125
Size: 1.17 acres
Scale: 1:8,000
This map was generation by the
North Carolina Natural Heritage Program 2012

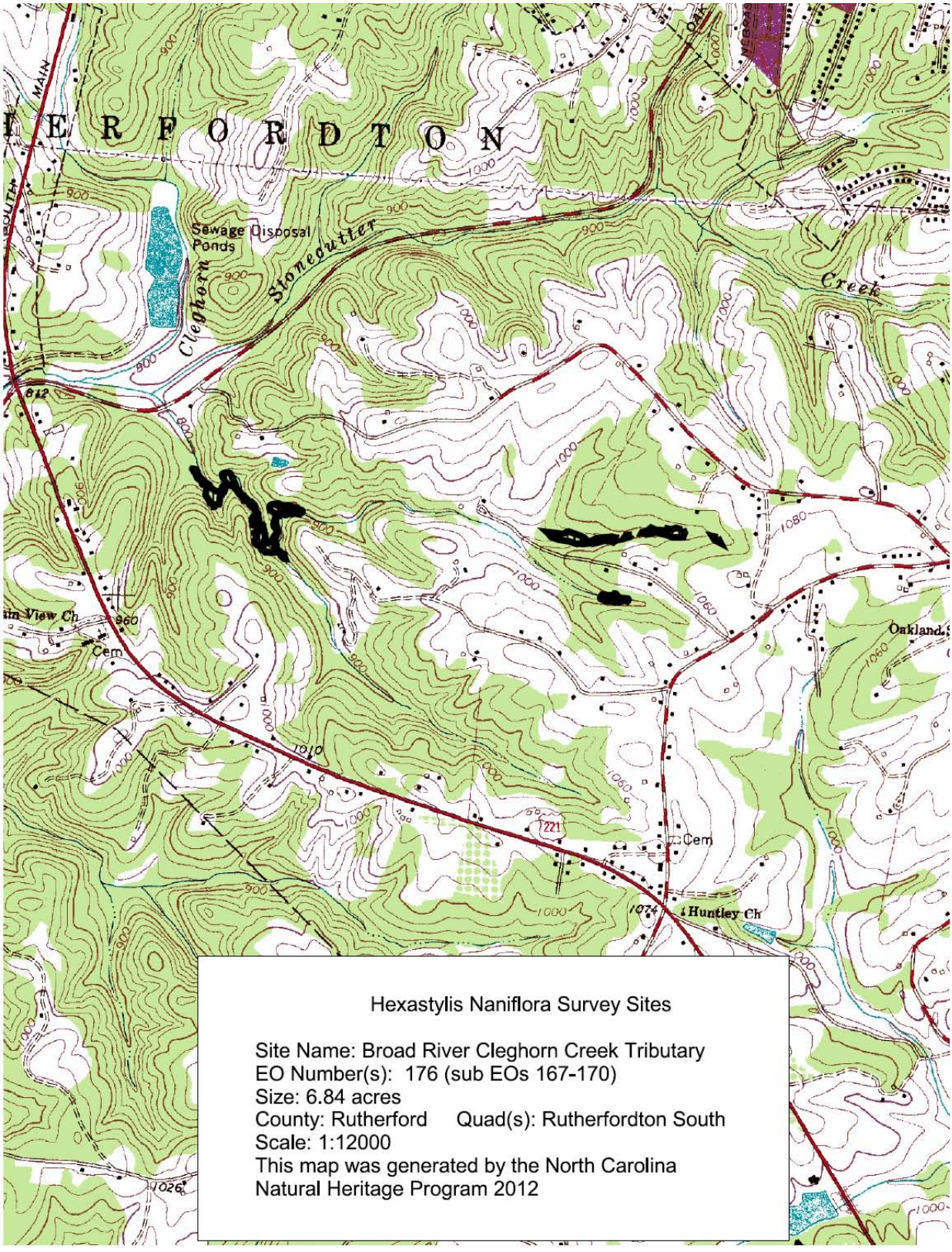

302 T
1357
291.8
1356
300
Cem
New Hope
Ch
307 T
1101
Cems
Hexastylis Naniflora Survey Sites
Site Name: Broad River; New Hope Springhead Swamp
EO Number(s): 125
Size: 3.97 acres
County: Polk
Quad(s): Fingerville East
Scale: 1:6000
This map was generated by the North Carolina
Natural Heritage Program 2012

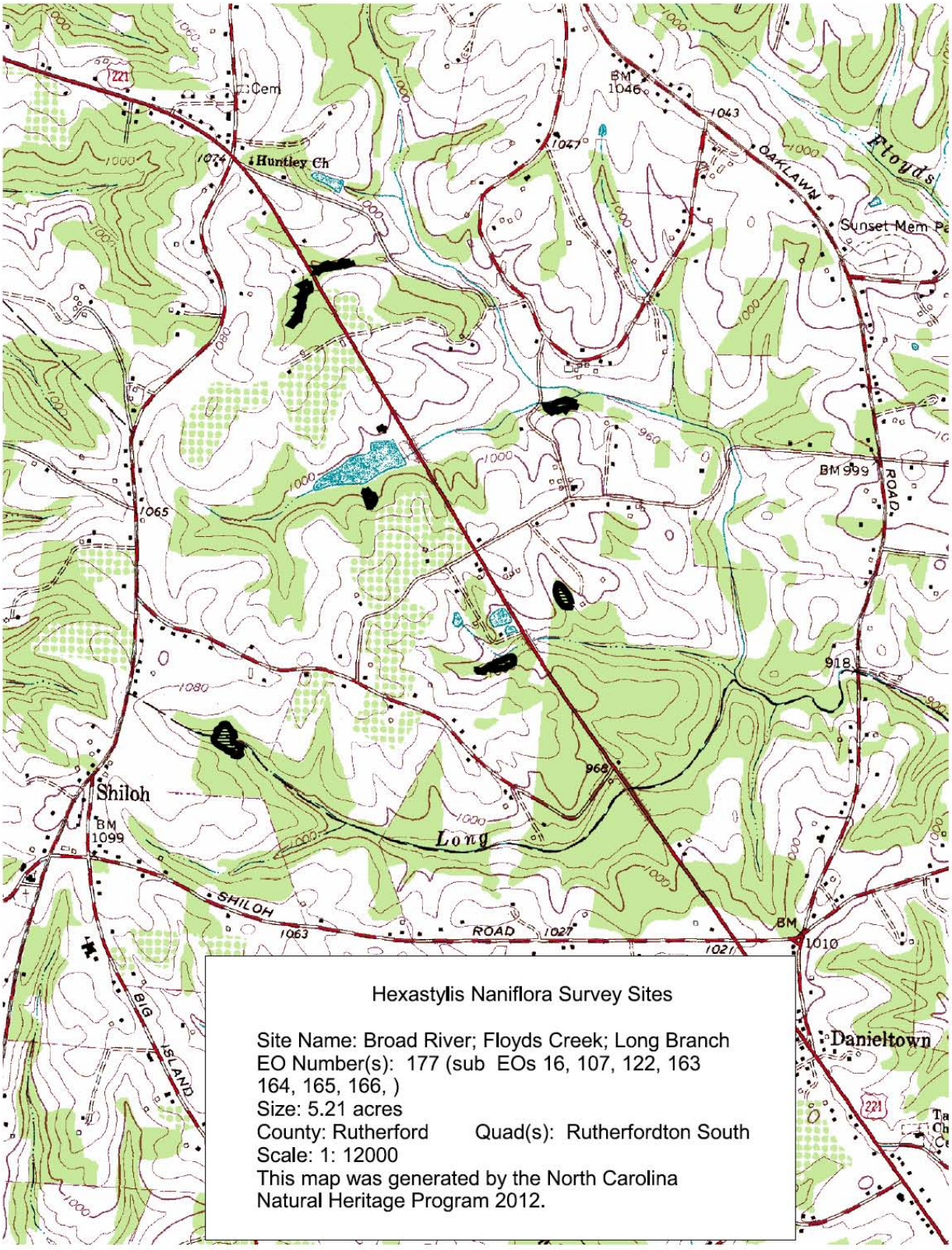

800
800
BM 891
938
CAROLEEN
900
900
900
800
900
Hexastylis naniflora Survey Sites
Site Name: Second Broad River (Forest City Industrial Complex)
Rutherford County, North Carolina
EO Number(s): 154
Size: 5.3 acres
Scale: 1:8,000
This map was generation by the
North Carolina Natural Heritage Program 2012



Hexastylis Naniflora Survey Sites

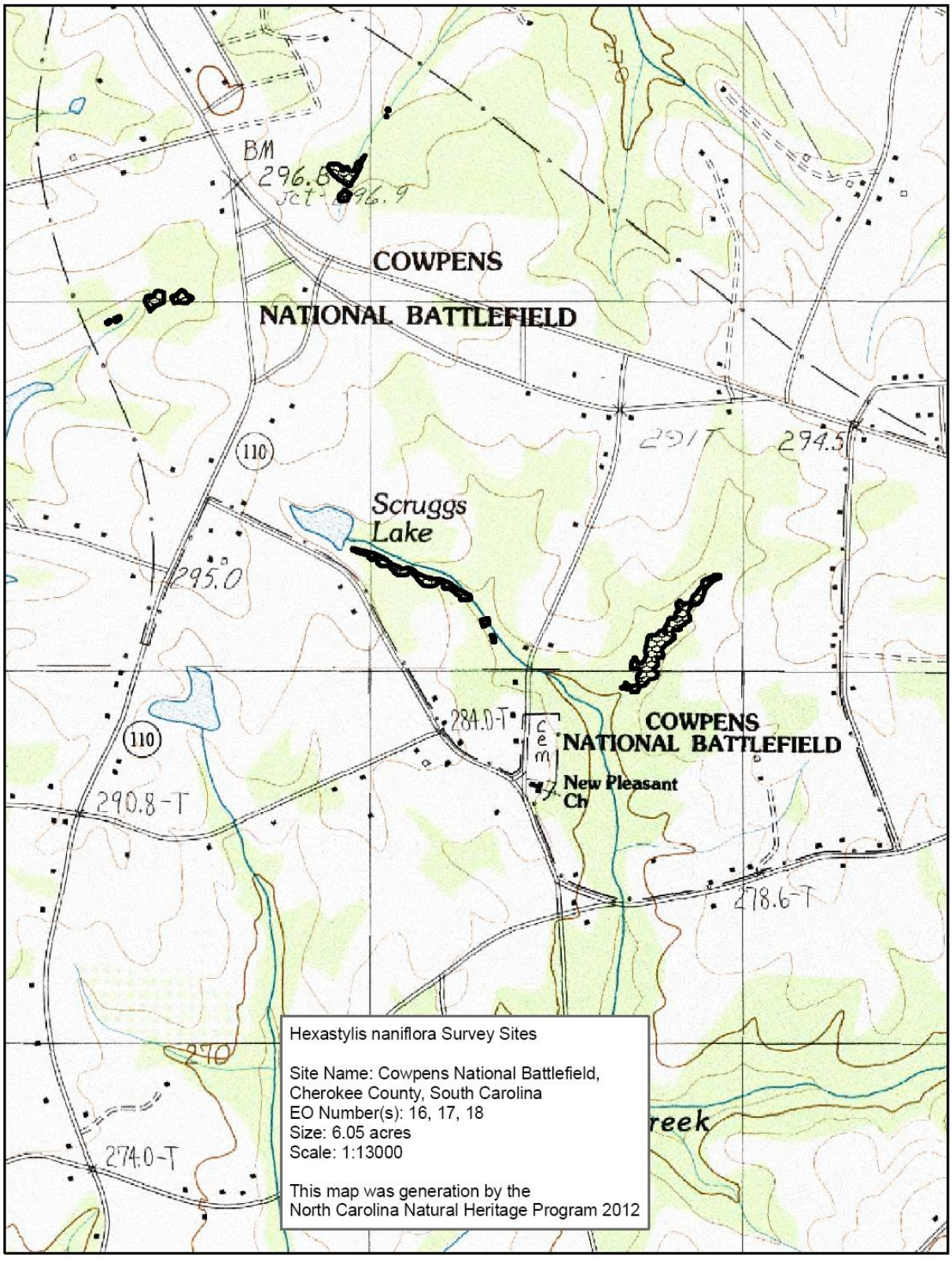
Site Name: Broad River: Brice, Henson's Creek, and US 221
EO Number(s): EO 99 (sub EOs 10, 37, 55, 75, 76, 79, 90, 121, and 181)
Size: 24.74 acres
County: Rutherford
Quad(s): Chesnee and Fingerville East
Scale: 1:24000
This map was generated by the North Carolina Natural Heritage Program 2012

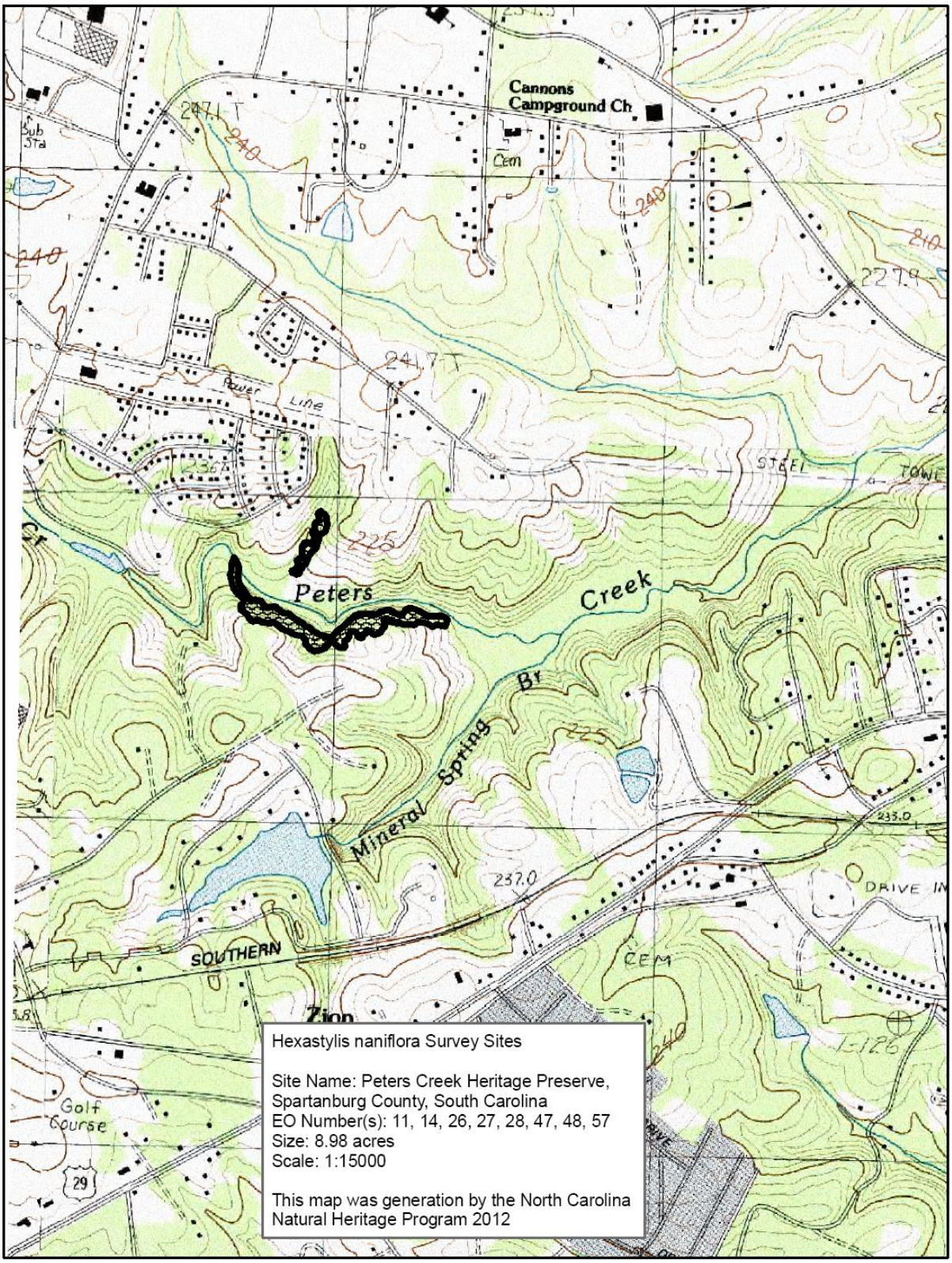

Sewage Disposal Ponds
Cleghorn Stonecutter Creek
Cem
Cem
Huntley Ch
Oakland
Hexastylis Naniflora Survey Sites
Site Name: Broad River Cleghorn Creek Tributary
EO Number(s): 176 (sub EOs 167-170)
Size: 6.84 acres
County: Rutherford Quad(s): Rutherfordton South
Scale: 1:12000
This map was generated by the North Carolina
Natural Heritage Program 2012

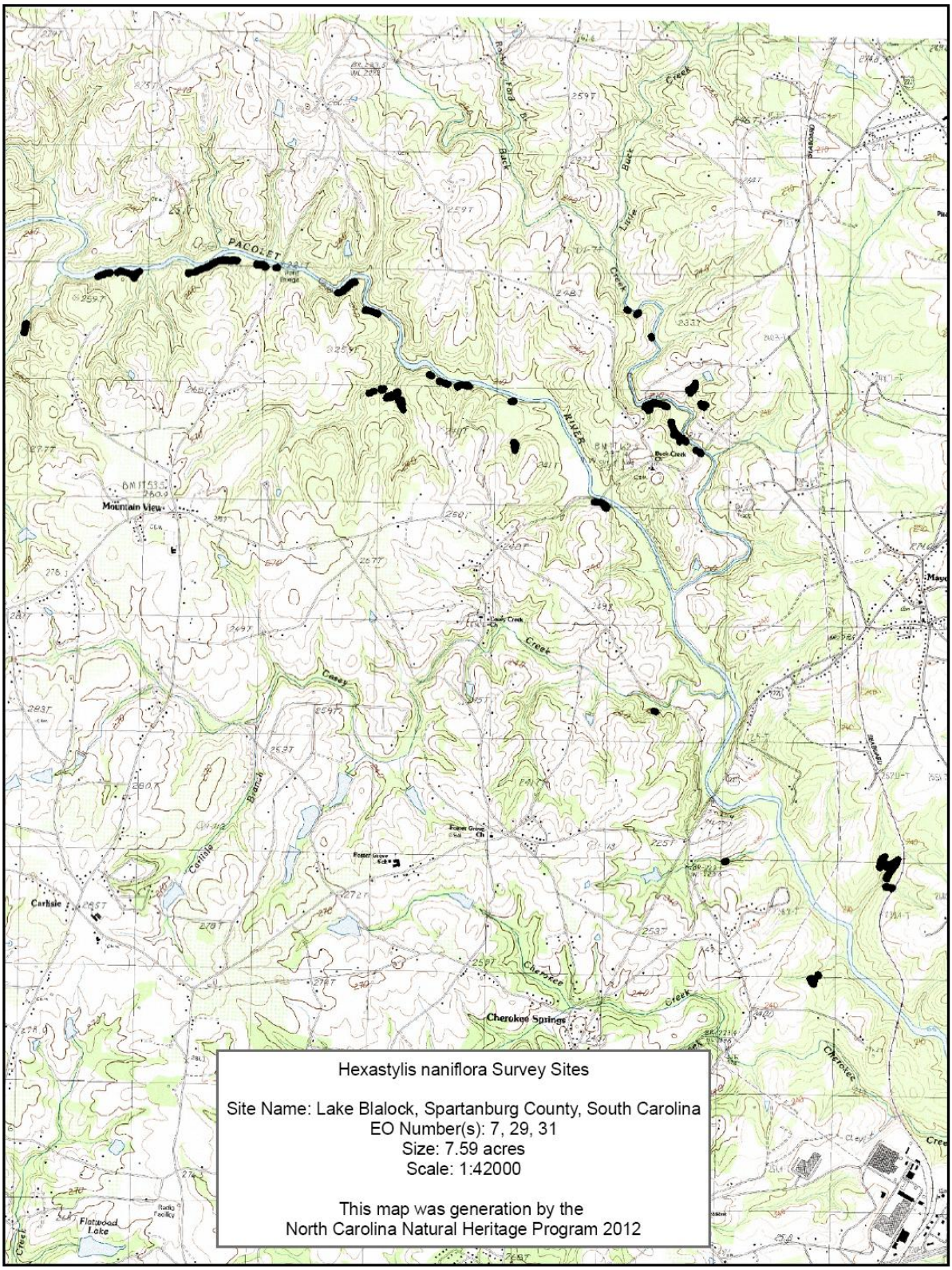


Hexastylis Naniflora Survey Sites

Site Name: Broad River; Floyds Creek; Long Branch
EO Number(s): 177 (sub EOs 16, 107, 122, 163
164, 165, 166,)
Size: 5.21 acres
County: Rutherford Quad(s): Rutherfordton South
Scale: 1: 12000
This map was generated by the North Carolina
Natural Heritage Program 2012.


COWPENS
NATIONAL BATTLEFIELD
Scruggs
Lake
COWPENS
NATIONAL BATTLEFIELD
New Pleasant
Ch
cem
110
110
BM
296.8
Jct
296.9
291T
294.5
295.0
284.0-T
290.8-T
278.6-T
274.0-T
290
Hexastylis naniflora Survey Sites
Site Name: Cowpens National Battlefield,
Cherokee County, South Carolina
EO Number(s): 16, 17, 18
Size: 6.05 acres
Scale: 1:13000
This map was generation by the
North Carolina Natural Heritage Program 2012


Cannons
Campground Ch
Cem
Power Line
STEEL
Peters
Creek
Mineral Spring Br
SOUTHERN
Zion
CEM
Golf
Course
29
DRIVE IN
Hexastylis naniflora Survey Sites
Site Name: Peters Creek Heritage Preserve, Spartanburg County, South Carolina
EO Number(s): 11, 14, 26, 27, 28, 47, 48, 57
Size: 8.98 acres
Scale: 1:15000
This map was generation by the North Carolina Natural Heritage Program 2012



Hexastylis naniflora Survey Sites

Site Name: Lake Blalock, Spartanburg County, South Carolina
EO Number(s): 7, 29, 31
Size: 7.59 acres
Scale: 1:42000

This map was generation by the
North Carolina Natural Heritage Program 2012

Threat and trend assessment protocols:

NHP initiated discussions with USFWS and DOT in March 2012 to develop a standardized assessment of trends and threats, using categorical rankings. NHP organized a conference call with biologists from DOT, USFWS, and Appalachian State University on June 25, 2012 to confirm using the threat assessment protocol that was developed by the North Carolina Plant Conservation Program (PCP) Scientific Committee and applied to all tracked plant species in 2008-2010. During the conference call, all parties agreed to use the protocol that was established by PCP. The threat assessment for *Hexastylis naniflora* sites visited in 2012 is shown in Table 3. The methodology and definitions for the threat assessment protocol are described in Appendix A.

Threats observed in 2012 included development, incompatible forestry practices, agriculture use, trampling, invasive exotic species, sedimentation, erosion, and road construction. For each site, up to three threats were identified and the severity, scope and immediacy were ranked to create an overall threat rank (see Table 4). The highest ranked threat for each population or subpopulation overrides other threats and used for the overall threat rank.

Trends for each site have not yet been assessed at this time, but will be assessed after we collect data from more than one year.

Table 4: Threat assessment for *Hexastylis naniflora* sites visited in 2012

Site Name	NHP EO #	NHP sub EO # (if applicable)	Threat 1	Threat 1 Severity	Threat 1 Scope	Threat 1 Immediacy	Overall Threat 1 rank	Threat 2	Threat 2 Severity	Threat 2 Scope	Threat 2 Immediacy	Overall threat 2 rank	Threat 3	Threat 3 Severity	Threat 3 Scope	Threat 3 Immediacy	Overall threat 3 rank	Overall Threat Assessment (all threats)
North Carolina Sites																		
Island Creek Bluffs/ Love Lady Site	29	NA	Incompatible Forestry Practices	low	high	low?	F											F
South Fork Catawba River: Jacobs Fork; Camp Creek	158	NA	Incompatible Forestry Practices	mod.	high	high	A	Erosion	mod.	high	high	A						A
Cliffside Steam Station	276		Invasive Exotic Species	low	mod.	low	F	Development	mod.	mod.	mod.	B						B
Rhyne Preserve	262	131	Invasive Exotic Species	mod.	mod.	mod.	B											B
		260	Invasive Exotic Species	low	low	low	G	Incompatible Forestry Practices (in areas not within the preserve)	mod.	low	mod.?	B						B
Mills Creek Forest and Seep	23	NA	Agricultural - Cattle	low	low	mod.	G	Incompatible Forestry Practices	low	low	low	G						G
Broad River: New Hope Springhead Swamp	125	NA	Invasive Exotic Species	low	low	low	G	Development	low	high	low	F	Incompatible Forestry Practices/ Clearing	low	mod.	mod.	E	F
Second Broad River (Forest City Industrial Complex)	154	NA	Development	high	high	high	A	Invasive Exotic Species	mod.	mod.	mod.	B	Sedimentation	mod.	high	high	A	A
Broad River: Henson's Creek Ravine, Brice Rare Plant Site, and Sandy Mush Outcrop	099	10	Incompatible Forestry Practices	high	mod.	high	B	Agricultural Use	mod.	high	low	C	Invasive Exotic Species	mod.	low	high	E	B
		37	Agricultural Use	mod.	high	high	A	Incompatible Forestry Practices	low	high	low	F						
		55	Agricultural Use	low	mod.	low	F	Incompatible Forestry Practices*	mod.	mod.	mod./high	B	Invasive Exotic Species	low	mod.	high	F	
		62	Incompatible	mod.	mod.	low	D											D

			Forestry Practices															
		75	Habitat Degradation/Sedimentation	high	high	high	A	Industrial Development	high	mod.	high	B	Invasive Exotic Species	low	mod.	mod.	F	A
		76	Road Construction	mod.	low	high	E	Invasive Exotic Species	mod.	low	high	E						E
		79	Incompatible Forestry Practices	mod.	mod.	high	B											B
		121	Incompatible Forestry Practices	low	mod.	mod.	F											F
		181	Incompatible Forestry Practices	low	mod.	mod.	F	Erosion	high	low	high	E						E
Broad River: Cleghorn Creek tributary/US221	176	167	Incompatible Forestry Practices	low	high	low	F	Invasive Exotic Species	low	mod.	low	E						D
		168	Incompatible Forestry Practices	low	high	mod.	F	Development	low	high	mod.	F						F
		169	Extirpated?	high	high	high	A (failed to find)											A
		170	Incompatible Forestry Practices	mod.	high	mod.	A	Invasive Exotic Species	low	low	high	G	Development	mod.	mod.	mod.	B	A
Broad River: Floyds Creek, Long Branch	177	16	Extirpated?	high	high	high	A											A
		163	Incompatible Forestry Practices	mod.	mod.	high	B *	Development	mod.	low	high	E						B
		164	Incompatible Forestry Practices	mod.	mod.	mod.	B	Development *	low	high	low	F						F
		165	Incompatible Forestry Practices	low	low	low	G	Development	low	high	mod.	F						F
		166	Not assessed															
		107	Incompatible Forestry Practices	low	mod.	mod.	F	Development	low	mod.	mod.	F						F
		122	Incompatible Forestry Practices	low	mod.	mod.	F	Development	low	mod.	mod.	F	Erosion/ Sedimentation	mod.	high	mod.	A	A
South Carolina Sites																		
Cowpens National Battlefield	016, 017, 018	NA	Trampling	mod.	mod.	high	B	Invasive Exotic Species	low	low	low	G						B
Peters Creek Preserve	011, 014, 026-028, 047, 048,	NA	Trampling	low	low	mod.	G	Invasive Exotic Species	low	mod.	low	F						F

	057																	
Blalock Reservoir	007, 029	NA	Development	mod.	low	high	E	Invasive Exotic Species	low	mod.	mod.	F						E

*__NOTES on threats for specific sites__:

Broad River: Floyds Creek, Long Branch; EO 177.163: The effects of timber harvest are unclear as there seems to be a population increase after the surrounding areas were clear cut.

Broad River: Floyds Creek: Long Branch; EO 177.164: This site is for sale and given its location along both US 221 and US 74, it is a likely site for development.

Broad River: Henson's Creek; Brice; etc. EO 99.55: Population density is high over a small area; possibly a short-term increase due to opening of canopy from adjacent timber harvest.

Current field schedule and access issues:

The field schedule has not changed since submission in previous quarterly reports. We have not been able to gain access to every site, however, we recently were granted permission from the Catawba Wildlife Club for inclusion of that population for the 2013 and 2014 surveys (see summary in Table 1).

Update on most recent site data obtained from SC.

As previously stated in the June2012 quarterly report, we do not anticipate getting access to the South Pacolet River and Tributaries (Element Occurrences 002, 004, 024, 032, 033, 036, 038, 039, 040, and 041) because locations for these populations obtained from SCNHP had very low accuracy, making it extremely difficult to identify who the landowners were or where the populations were. We were unable to track down any additional information for this site, despite several attempts to contact previous surveyors in SC.

Issues in meeting project objectives and proposed solutions.

No new issues identified at this time.

Appendix A: **Explanation of threat and trend assessment protocol, as developed by the NC Plant Conservation Program Scientific Committee (2008)**

This methodology was originally developed for plant species in the State of North Carolina for the purpose of assessing the rarest and most imperiled plant species. This protocol was used for individual populations of *Hexastylis naniflora*, for the purpose of developing a standardized assessment of threats and trends, as described in the scope of work for this Flex Fund grant.

Definitions:

Short-term Trend = historical trend for approximately 10 years or 3 generations. The short term trend category is separated into the following ranking system:

A – Severely declining (Decline of >70% in population, range, area occupied, and/or number or condition of occurrences)
B – Very rapidly declining (decline of 50-70%)
C – Rapidly declining (decline of 30-50%)
D – Declining (decline of 10-30%)
E – Stable (unchanged or remaining within +/- fluctuation)
F – Increasing (increase in population of >10%)
U – Unknown
Null – Criterion not assessed

The Short-term Trend will be analyzed for these populations over the three years of collecting data and by using monitoring data in the NHP database over the past 10+ years.

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species are assigned a ranking value based on their severity, scope and immediacy. The following chart explains threat value based on it's assessment.

Each threat is assigned a ranking for its Severity, Scope, and Immediacy, as described below:

Threat Severity

High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long–term recovery (>100yr).

Moderate: Major reduction of species population or long–term degradation or reduction of habitat in area affected, requiring 50–100 yr for recovery.

Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.

Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yr) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations are generally considered Insignificant as defined here.

Scope

High: >60% of total population, occurrences, or area affected
Moderate: 20–60% of total population, occurrences, or area affected
Low: 5–20% of total population, occurrences, or area affected
Insignificant: <5% of total population or area affected

Immediacy

High: Threat is operational (happening now) or imminent (within a year).
Moderate: Threat is likely to be operational within 2–5 yr.
Low: Threat is likely to be operational within 5–20 yr.
Insignificant: Threat not likely to be operational within 20 yr.

The assigned ranks for the Severity, Scope, and Immediacy for each threat is put into the matrix below to determine an overall value for each threat to an individual population.

Threat severity	Threat Scope	Threat Immediacy	Value	Threat Description
High	High	High	A	Moderate to severe, imminent threat for most (>60% of population, occurrences, or area
High	High	Moderate		
Moderate	High	High		
Moderate	High	Moderate		
High	Moderate	High	B	Moderate to severe, imminent threat for a significant proportion (20-60%) of population, occurrences or area
High	Moderate	Moderate		
Moderate	Moderate	High		
Moderate	Moderate	Moderate		
High	High	Low	C	Moderate to severe, non-imminent threat for most of population, occurrences or area
Moderate	High	Low		
High	Moderate	Low	D	Moderate to severe, non-imminent threat for a significant proportion of population, occurrences or area
Moderate	Moderate	Low		
High	Low	High	E	Moderate to severe threat for small proportion of population, occurrences, or area
High	Low	Moderate		
High	Low	Low		
Moderate	Low	High		

Moderate	Low	Moderate		
Moderate	Low	Low		
Low	High	High	F	Low severity threat for most or significant proportion of population, occurrences, or area
Low	High	Moderate		
Low	High	Low		
Low	Moderate	High		
Low	Moderate	Moderate		
Low	Moderate	Low		
Low	Low	High	G	Low severity threat for a small proportion of population, occurrences, or area
Low	Low	Moderate		
Low	Low	Low		

U.S. FISH AND WILDLIFE SERVICE

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

April 2019

Commented [RRN1]: Suggested changes were made on 04.08.19.

Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)

April 2019

DRAFT

Recommended Citation:

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Acknowledgements

The Draft Post-Delisting Monitoring Plan (Plan) for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) was prepared by the US Fish and Wildlife Service (Service) with participation from Rebekah Reid, Asheville Ecological Services Field Office, and Drew Becker, Southeast Regional Office. The Service acknowledges partners outside our agency who provided input during development of this draft Plan, including the North Carolina Natural Heritage Program and the North Carolina Department of Transportation.

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Table of Contents

II. Summary of Species Status at Delisting 1
A. Demographic Parameters 1
B. Discussion of Populations 2
III. Public Review and Comment 3
IV. Monitoring Methods and Locations 4
IV. Definition of Response Triggers for Potential Monitoring Outcomes 5
A. Category I 5
B. Category II 6
C. Category III 6
V. Data Compilation and Reporting Procedures 6
VI. Estimated Funding Requirements and Sources 7
VII. PDM Implementation Schedule 7
VIII. Literature Cited 8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

DRAFT

I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2015), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June. They are small,

inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989). The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).

B. Discussion of Populations

When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2010).

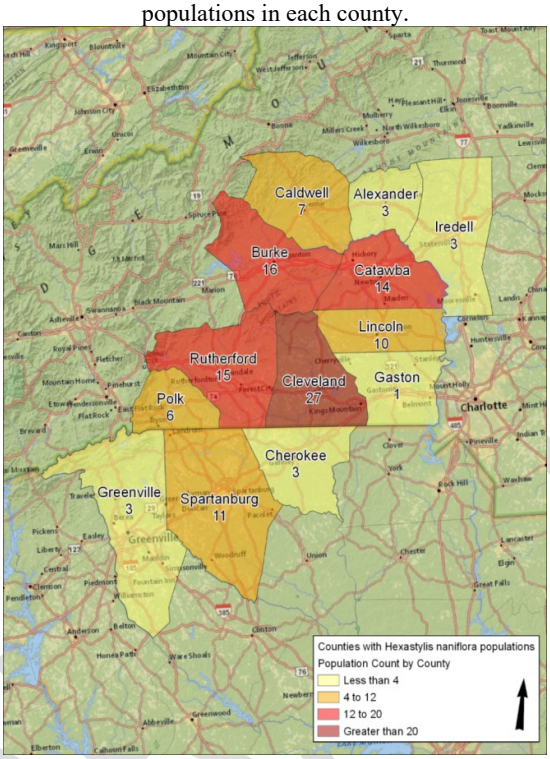
Since listing, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to NCNHP Element Occurrence (EO) records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This generated considerable discrepancies among sources with respect to abundance and distribution of the species, to the extent that data are usually not comparable from one source to the next (Service 2010).

NatureServe and its member Natural Heritage Programs (NHP) 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 into meaningful units of conservation interest that may approximate biological populations (NatureServe 2004). The Service does not maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards the NHP databases as the best repository for this information.

As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).

DRAFT

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.



The listing rule placed emphasis on populations containing more than 1,000 rosettes. This threshold has been used in subsequent reports to call attention to particularly large populations. Populations with greater than 1,000 rosettes increased from three in 1989 to 26 in 2016 (Robinson 2016). This is approximately 23% of the total known populations and many contain well over 1,000 rosettes. Twenty-five of the largest known populations have been monitored for at least 5 years by NCNHP (13 populations) and NCDOT (12 populations).

III. Public Review and Comment

The Service will announce the availability of the draft Plan for public review and comment in the publication of the proposed rule to delist dwarf-flowered heartleaf. At conclusion of the comment period, the Service will review each comment and prepare responses to substantive comments.

IV. Monitoring Methods and Locations

The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). A second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants occurring at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data were used to determine the size of the entire population. The supplemental acreage from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals, when every tract could not be visited. The estimated extrapolated size of each population for each year was determined with the following formula:

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$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

The PDM will be a continuation of the monitoring described above and occur within at least 13 previously monitored populations (Appendix A).

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The following practices will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked (unless population is small enough for a complete census).
- A field data sheet, developed prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
- Threats will be assessed at each location using NCPCP guidelines (Appendix B).
- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 13 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6-7 sites are monitored each year for six years (three complete monitoring cycles).

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After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

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This would be true if:

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2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

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PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

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PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

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Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be

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negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

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1-6	5	3	
7-13	6	3	Cycle 1-3 Final Report (end of year)

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Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:
Blalock Reservoir (SC EO 007, 031)
Broad River: Cleghorn Creek, US 221 (EO 176)
Broad River: Floyds Creek, Long Branch (EO 177)
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop (EO 099)
Cliffside Steam Station (EO 276)
Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Love Lady Site (EO 029)
Mills Creek Forest and Seep (EO 023)
New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
Rhyne Preserve (EO 302)
Second Broad River (Forest City Industrial Complex) (EO 154)
South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)

NCDOT Sites:
Broad River Greenway (EO 049-051, 073-074, 149, 233, 238-241)
Buffalo Shoals Creek (EO 275)
Catawba County (EO 158, 162)
Extension of 15th Avenue (EO 031)
Gunpowder Creek (EO 077)
Little Gunpowder Creek (EO 044)
Longview (EO 032)
Micol Creek (EO 159)
Murray's Mill (EO 184)
Shelby Bypass Site 7 (EO 191)
Tate Boulevard Extension (EO 030)
Tate Conservation Area (EO 106, 286)

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Appendix B – Threats Assessment Guidance

This methodology was originally developed by the NC Plant Conservation Program (NCPCP) Scientific Committee in 2008 to assess the rarest and most imperiled plant species. This protocol was applied to individual populations of *Hexastylis naniflora*, during baseline monitoring, to develop a standardized assessment of threats and trends.

Deleted: for the purpose of assessing

Deleted: for the purpose of developing

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species. Each threat is assigned a ranking for its severity, scope, and immediacy, as described below:

Threat Severity

- High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long-term recovery (>100 yr.).
- Moderate: Major reduction of species population or long-term degradation or reduction of habitat in area affected, requiring 50–100 yr. for recovery.
- Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.
- Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yrs.) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations is generally considered Insignificant as defined here.

Scope

- High: >60% of total population, occurrences, or area affected.
- Moderate: 20–60% of total population, occurrences, or area affected.
- Low: 5–20% of total population, occurrences, or area affected.
- Insignificant: <5% of total population or area affected.

Immediacy

- High: Threat is operational (happening now) or imminent (within a year).
- Moderate: Threat is likely to be operational within 2–5 yr.
- Low: Threat is likely to be operational within 5–20 yr.
- Insignificant: Threat not likely to be operational within 20 yr.

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U.S. FISH AND WILDLIFE SERVICE

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

April 2019

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Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)

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Acknowledgements

The Draft Post-Delisting Monitoring Plan (Plan) for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) was prepared by the US Fish and Wildlife Service (Service) with participation from Rebekah Reid, Asheville Ecological Services Field Office, and Drew Becker, Southeast Regional Office. The Service acknowledges partners outside our agency who provided input during development of this draft Plan, including the North Carolina Natural Heritage Program and the North Carolina Department of Transportation.

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Table of Contents

II. Summary of Species Status at Delisting 1
A. Demographic Parameters 1
B. Discussion of Populations 2
III. Public Review and Comment 3
IV. Monitoring Methods and Locations 4
IV. Definition of Response Triggers for Potential Monitoring Outcomes 5
A. Category I 5
B. Category II 6
C. Category III 6
V. Data Compilation and Reporting Procedures 6
VI. Estimated Funding Requirements and Sources 7
VII. PDM Implementation Schedule 7
VIII. Literature Cited 8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

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I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2015), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June. They are small,

inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989). The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).

B. Discussion of Populations

When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2010).

Since listing, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to NCNHP Element Occurrence (EO) records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This generated considerable discrepancies among sources with respect to abundance and distribution of the species, to the extent that data are usually not comparable from one source to the next (Service 2010).

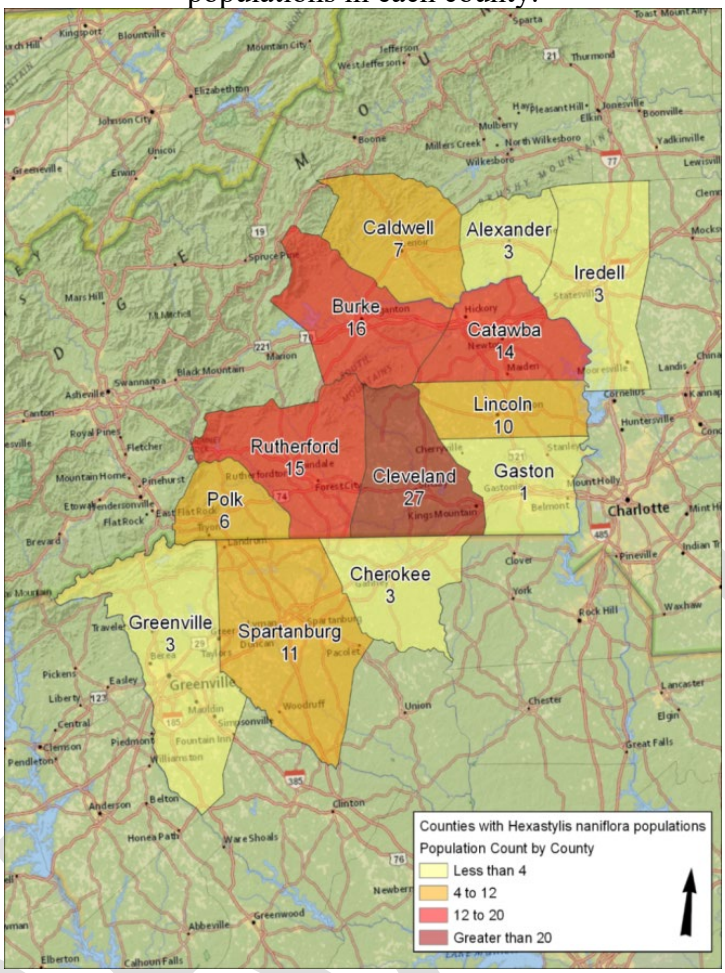
NatureServe and its member Natural Heritage Programs (NHP) have devised mapping standards to balance the need for fine-scale, highly site-specific EO records (required for monitoring and management) with the need to aggregate these records into meaningful units of conservation interest that may approximate biological populations (NatureServe 2004). The Service does not maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards the NHP databases as the best repository for this information.

As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).

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Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.



The listing rule placed emphasis on populations containing more than 1,000 rosettes. This threshold has been used in subsequent reports to call attention to particularly large populations. Populations with greater than 1,000 rosettes increased from three in 1989 to 26 in 2016 (Robinson 2016). This is approximately 23% of the total known populations and many contain well over 1,000 rosettes. Twenty-five of the largest known populations have been monitored for at least 5 years by NCNHP (13 populations) and NCDOT (12 populations).

III. Public Review and Comment

The Service will announce the availability of the draft Plan for public review and comment in the publication of the proposed rule to delist dwarf-flowered heartleaf. At conclusion of the comment period, the Service will review each comment and prepare responses to substantive comments.

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IV. Monitoring Methods and Locations

The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). A second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

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7-13	6	3	Cycle 1-3 Final Report (end of year)

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Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:
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Jon Comments 4/12

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Comments addressed 5/30/19 - RNR

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

April 2019

Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)

April 2019

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Recommended Citation:

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Acknowledgements

The Draft Post-Delisting Monitoring Plan (Plan) for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) was prepared by the US Fish and Wildlife Service (Service) with participation from Rebekah Reid, Asheville Ecological Services Field Office, and Drew Becker, Southeast Regional Office. The Service acknowledges partners outside our agency who provided input during development of this draft Plan, including the North Carolina Natural Heritage Program and the North Carolina Department of Transportation.

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Table of Contents

II.	Summary of Species Status at Delisting	1
	A. Demographic Parameters	1
	B. Discussion of Populations	2
III.	Public Review and Comment	3
IV.	Monitoring Methods and Locations	4
IV.	Definition of Response Triggers for Potential Monitoring Outcomes	5
	A. Category I	5
	B. Category II	6
	C. Category III	6
V.	Data Compilation and Reporting Procedures	6
VI.	Estimated Funding Requirements and Sources	7
VII.	PDM Implementation Schedule	7
VIII.	Literature Cited	8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

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I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq.*). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2015), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June.

They are small, inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989). The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).

B. Discussion of Populations

When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2010).

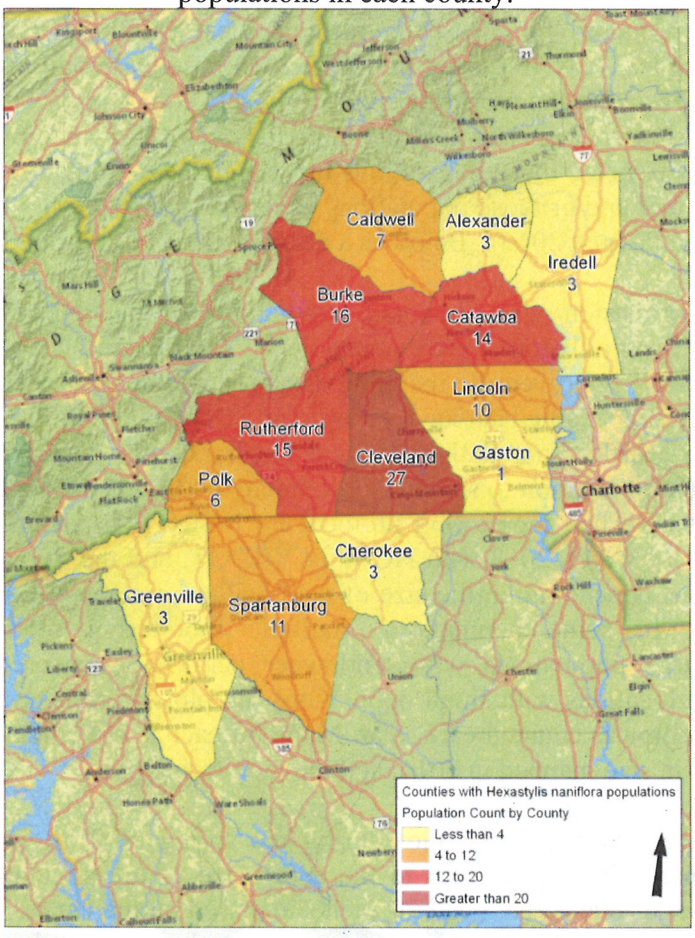
Since listing, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to NCNHP Element Occurrence (EO) records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This generated considerable discrepancies among sources with respect to abundance and distribution of the species, to the extent that data are usually not comparable from one source to the next (Service 2010).

NatureServe and its member Natural Heritage Programs (NHP) 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 into meaningful units of conservation interest that may approximate biological populations (NatureServe 2004). The Service does not maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards the NHP databases as the best repository for this information.

As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).

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Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.



The listing rule placed emphasis on populations containing more than 1,000 rosettes. This threshold has been used in subsequent reports to call attention to particularly large populations. Populations with greater than 1,000 rosettes increased from three in 1989 to 26 in 2016 (Robinson 2016). This is approximately 23% of the total known populations and many contain well over 1,000 rosettes. Twenty-five of the largest known populations have been monitored for at least 5 years by NCNHP (13 populations) and NCDOT (12 populations).

III. Public Review and Comment

The Service will announce the availability of the draft Plan for public review and comment in the publication of the proposed rule to delist dwarf-flowered heartleaf. At conclusion of the comment period, the Service will review each comment and prepare responses to substantive comments.

IV. Monitoring Methods and Locations

The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). A second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants that occur at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data to determine the size of the entire population was used. The supplemental acreage from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals when every tract could not be visited. The estimated extrapolated size of each population for each year was determined with the following formula:

I really do not understand what supplemental acreage is?

$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

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The PDM will be a continuation of the monitoring described above and occur within at least 13 previously monitored populations (Appendix A).

A. Procedures to Assure Consistency

The following practices will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked (unless population is small enough for a complete census).
- A field data sheet, developed prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
- Threats will be assessed at each location using NCPCP guidelines (Appendix B).
- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 13 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6-7 sites are monitored each year for six years (three complete monitoring cycles).

IV. Definition of Response Triggers for Potential Monitoring Outcomes

Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios.

After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

A. Category I

PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections.
This would be true if: (#'s of individuals or #'s of pops?

1) Population numbers are within the standard deviation of the mean or above, and

Total #'s, or any 1 pop'n?

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2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

B. Category II

PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, all actions from Category II will be implemented. Additionally, the Service will initiate a formal status review and determine whether a proposal for relisting is appropriate.

V. Data Compilation and Reporting Procedures

Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be

negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

If response triggers in Section IV are met or exceeded, the Service will consult with NCNHP, NCDOT, and other partners to determine whether to conclude the PDM process or pursue management actions. The determination will also include, if necessary, an evaluation of the threats to dwarf-flowered heartleaf using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state and tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of dwarf-flowered heartleaf following removal from protections of the Act. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this draft Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

As staff resources and funding allow, the primary entities conducting the PDM and preparing reports will be NCNHP and/or NCDOT. Based on a funding estimate received from NCNHP, monitoring 6-7 sites each year would require approximately $6,100 in funding. A complete monitoring cycle of two years would require approximately $12,200 and the entire six years of monitoring (three monitoring cycles) would require approximately $36,600. The NCNHP funding estimates do not apply to NCDOT and NCDOT is unable to provide an estimate for monitoring additional sites at this time. The Service will provide assistance as needed and as resources permit.

VII. PDM Implementation Schedule

A schedule will be developed in coordination with NCNHP and/or NCDOT in order to ensure that it is feasible to accomplish PDM activities at all sites scheduled for a given year. An example schedule is shown below:

Sites	Year	Monitoring Cycle	Reporting
1-6	1	1	
7-13	2	1	Cycle 1 (end of year)
1-6	3	2	
7-13	4	2	Cycle 2 (end of year)
1-6	5	3	
7-13	6	3	Cycle 1-3 Final Report (end of year)

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Draft Post-Delisting Monitoring Plan

Commented [RRN1]: Comments addressed 5/30/19

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

April 2019

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Table of Contents

II. Summary of Species Status at Delisting 1
A. Demographic Parameters 1
B. Discussion of Populations 2
III. Public Review and Comment 3
IV. Monitoring Methods and Locations 4
IV. Definition of Response Triggers for Potential Monitoring Outcomes 5
A. Category I 5
B. Category II 6
C. Category III 6
V. Data Compilation and Reporting Procedures 6
VI. Estimated Funding Requirements and Sources 7
VII. PDM Implementation Schedule 7
VIII. Literature Cited 8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

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I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2015), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June. They are small,

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B. Discussion of Populations

When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2010).

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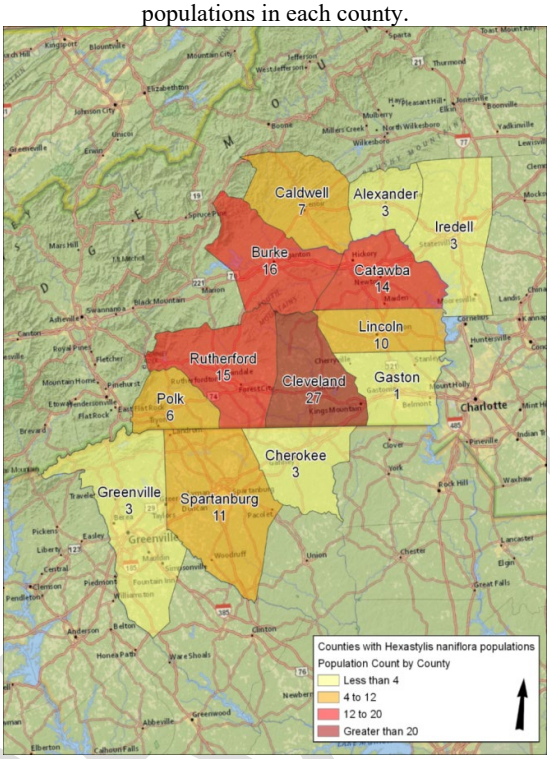
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The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). The second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps provided for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

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Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants occurring at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data were used to determine the size of the entire population. The supplemental acreage from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals, when every tract could not be visited. The estimated extrapolated size of each population for each year was determined with the following formula:

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$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

The PDM will be a continuation of the monitoring described above and occur within at least 13 previously monitored populations (Appendix A).

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A. Procedures to Assure Consistency

The following practices will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked (unless population is small enough for a complete census).
- A field data sheet, developed prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
- Threats will be assessed at each location using NCPCP guidelines (Appendix B).
- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 13 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6-7 sites are monitored each year for six years (each site receives three complete monitoring cycles).

IV. Definition of Response Triggers for Potential Monitoring Outcomes

Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios.

After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

A. Category I

PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections.
This would be true if:

1) Population numbers are within the standard deviation of the mean or above, and

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2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

B. Category II

PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, all actions from Category II will be implemented. Additionally, the Service will initiate a formal status review and determine whether a proposal for relisting is appropriate.

V. Data Compilation and Reporting Procedures

Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be

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negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

If response triggers in Section IV are met or exceeded, the Service will consult with NCNHP, NCDOT, and other partners to determine whether to conclude the PDM process or pursue management actions. The determination will also include, if necessary, an evaluation of the threats to dwarf-flowered heartleaf using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state and tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of dwarf-flowered heartleaf following removal from protections of the Act. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this draft Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

As staff resources and funding allow, the primary entities conducting the PDM and preparing reports will be NCNHP and/or NCDOT. Based on a funding estimate received from NCNHP, monitoring 6-7 sites each year would require approximately $6,100 in funding. A complete monitoring cycle of two years would require approximately $12,200 and the entire six years of monitoring (three monitoring cycles) would require approximately $36,600. The NCNHP funding estimates do not apply to NCDOT and NCDOT is unable to provide an estimate for monitoring additional sites at this time. The Service will provide assistance as needed and as resources permit.

VII. PDM Implementation Schedule

A schedule will be developed in coordination with NCNHP and/or NCDOT in order to ensure that it is feasible to accomplish PDM activities at all sites scheduled for a given year. An example schedule is shown below:

Sites	Year	Monitoring Cycle	Reporting
1-6	1	1	
7-13	2	1	Cycle 1 (end of year)
1-6	3	2	
7-13	4	2	Cycle 2 (end of year)
1-6	5	3	
7-13	6	3	Cycle 1-3 Final Report (end of year)

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Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:
Blalock Reservoir (SC EO 007, 031)
Broad River: Cleghorn Creek, US 221 (EO 176)
Broad River: Floyds Creek, Long Branch (EO 177)
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop (EO 099)
Cliffside Steam Station (EO 276)
Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Love Lady Site (EO 029)
Mills Creek Forest and Seep (EO 023)
New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
Rhyne Preserve (EO 302)
Second Broad River (Forest City Industrial Complex) (EO 154)
South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)

NCDOT Sites:
Broad River Greenway (EO 049-051, 073-074, 149, 233, 238-241)
Buffalo Shoals Creek (EO 275)
Catawba County (EO 158, 162)
Extension of 15th Avenue (EO 031)
Gunpowder Creek (EO 077)
Little Gunpowder Creek (EO 044)
Longview (EO 032)
Micol Creek (EO 159)
Murray's Mill (EO 184)
Shelby Bypass Site 7 (EO 191)
Tate Boulevard Extension (EO 030)
Tate Conservation Area (EO 106, 286)

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Appendix B – Threats Assessment Guidance

This methodology was originally developed by the NC Plant Conservation Program (NCPCP) Scientific Committee in 2008 to assess the rarest and most imperiled plant species. This protocol was applied to individual populations of *Hexastylis naniflora*, during baseline monitoring, to develop a standardized assessment of threats and trends.

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species. Each threat is assigned a ranking for its severity, scope, and immediacy, as described below:

Threat Severity

- High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long-term recovery (>100 yr.).
- Moderate: Major reduction of species population or long-term degradation or reduction of habitat in area affected, requiring 50–100 yr. for recovery.
- Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.
- Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yrs.) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations is generally considered Insignificant as defined here.

Scope

- High: >60% of total population, occurrences, or area affected.
- Moderate: 20–60% of total population, occurrences, or area affected.
- Low: 5–20% of total population, occurrences, or area affected.
- Insignificant: <5% of total population or area affected.

Immediacy

- High: Threat is operational (happening now) or imminent (within a year).
- Moderate: Threat is likely to be operational within 2–5 yr.
- Low: Threat is likely to be operational within 5–20 yr.
- Insignificant: Threat not likely to be operational within 20 yr.

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U.S. FISH AND WILDLIFE SERVICE

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

April 2019

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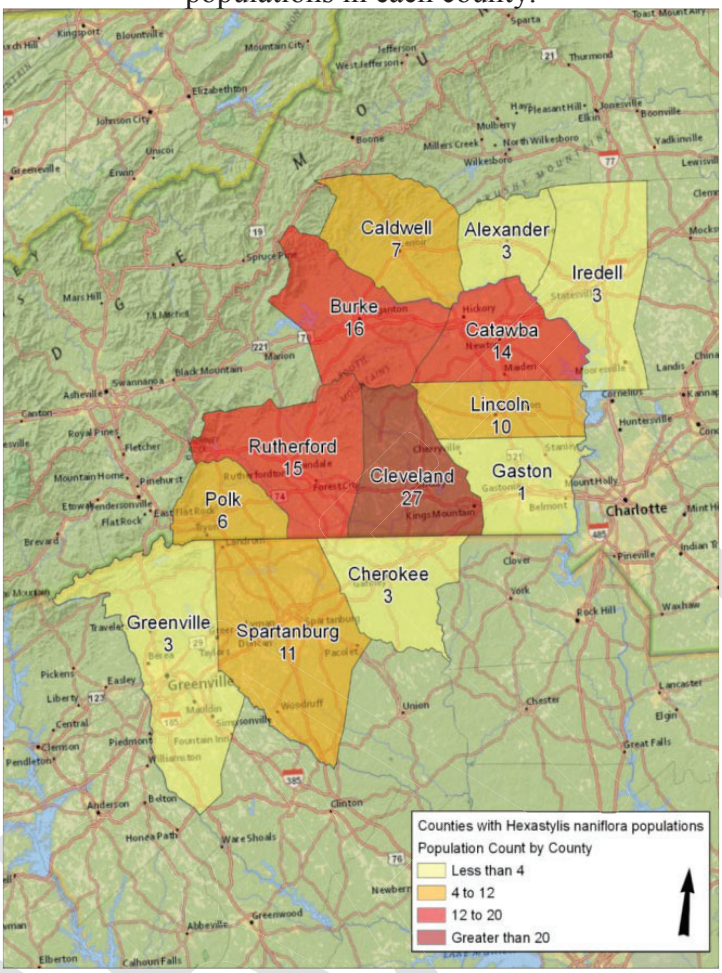
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Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants occuring at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data were used to determine the size of the entire population. The supplemental acreage from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals, when every tract could not be visited. The estimated extrapolated size of each population for each year was determined with the following formula:

$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

The PDM will be a continuation of the monitoring described above and occur within at least 13 previously monitored populations (Appendix A).

A. Procedures to Assure Consistency

The following practices will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked (unless population is small enough for a complete census).
- A field data sheet, developed prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
- Threats will be assessed at each location using NCPCP guidelines (Appendix B).
- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 13 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6-7 sites are monitored each year for six years (three complete monitoring cycles).

IV. Definition of Response Triggers for Potential Monitoring Outcomes

Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios.

After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

A. Category I

PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections.
This would be true if:

1) Population numbers are within the standard deviation of the mean or above, and

Summary of Comments on Post-delisting Monitoring Plan

Page: 9

Number: 1 Author: tpbassette Subject: Highlight Date: 5/21/2019 1:52:59 PM -06'00'

May need to talk about this term. We must hire contractors, whether they have done the work before or not. If they do not have the experience, the contractors must be trained by NCDOT.

Number: 2 Author: tpbassette Subject: Highlight Date: 5/21/2019 3:31:52 PM -06'00'

Note: Due to safety concerns, NCDOT has a couple sites in the Broad River Greenway Conservation Area that utilize permanently marked plots. Otherwise, NCDOT always enumerates via direct count using walked, straight-line transects across occupied habitat to better ensure the accuracy of the number of specimens.

Number: 3 Author: tpbassette Subject: Highlight Date: 5/21/2019 1:33:08 PM -06'00'

Is this the NCNHP Rare Plant Form? This is what we are currently requiring NCDOT staff and our contractors to complete, I have enclosed guidelines that I developed in conjunction with NCNHP on preparing the forms. These have been included in all NCDOT contracts to ensure that our contractors are completing the work in the same, consistent manner.

Number: 4 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 3:52:54 PM -06'00'

Request that NCDOT continues to generally differentiate between the plant numbers and acreage of occupied habitat that occurs or is officially protected inside NCDOT right-of-way/conservation easement and plant numbers and acreage of occupied habitat that occurs within the Element Occurrence or portion of the EO ("site"). The EO (or "site") and what NCDOT has in its ROW or conservation easement may or may not equate. This concept is derived from various Conservation Measures found in our project's Biological Opinions.

Number: 5 Author: tpbassette Subject: Highlight Date: 5/21/2019 2:24:37 PM -06'00'

What about acreage of occupied habitat? Does it get reported? NCDOT has been incorporating this information into its monitoring efforts. The threat analysis includes information pertaining to habitat.

2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

B. Category II

PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Population numbers are below the standard deviation of the mean, and

2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, all actions from Category II will be implemented. Additionally, the Service will initiate a formal status review and determine whether a proposal for relisting is appropriate.

V. Data Compilation and Reporting Procedures

Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be

Page: 10

Number: 1 Author: tpbassette Subject: Highlight Date: 5/21/2019 2:24:57 PM -06'00'
What about acreage of occupied habitat? Does it get reported? NCDOT has been incorporating this information into its monitoring efforts. The threat analysis includes information pertaining to habitat.

Number: 2 Author: tpbassette Subject: Highlight Date: 5/21/2019 2:25:35 PM -06'00'
What about acreage of occupied habitat? Does it get reported? NCDOT has been incorporating this information into its monitoring efforts. The threat analysis includes information pertaining to habitat.

Number: 3 Author: tpbassette Subject: Highlight Date: 5/21/2019 1:51:17 PM -06'00'
Is there a standardized format for this report, like the report format created by Carolyn Wells when she was with USFWS?

negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

If response triggers in Section IV are met or exceeded, the Service will consult with NCNHP, NCDOT, and other partners to determine whether to conclude the PDM process or pursue management actions. The determination will also include, if necessary, an evaluation of the threats to dwarf-flowered heartleaf using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state and tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of dwarf-flowered heartleaf following removal from protections of the Act. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this draft Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

As staff resources and funding allow, the primary entities conducting the PDM and preparing reports will be NCNHP and/or NCDOT. Based on a funding estimate received from NCNHP, monitoring 6-7 sites each year would require approximately $6,100 in funding. A complete monitoring cycle of two years would require approximately $12,200 and the entire six years of monitoring (three monitoring cycles) would require approximately $36,600. The NCNHP funding estimates do not apply to NCDOT and NCDOT is unable to provide an estimate for monitoring additional sites at this time. The Service will provide assistance as needed and as resources permit.

VII. PDM Implementation Schedule

A schedule will be developed in coordination with NCNHP and/or NCDOT in order to ensure that it is feasible to accomplish PDM activities at all sites scheduled for a given year. An example schedule is shown below:

Sites	Year	Monitoring Cycle	Reporting
1-6	1	1	
7-13	2	1	Cycle 1 (end of year)
1-6	3	2	
7-13	4	2	Cycle 2 (end of year)
1-6	5	3	
7-13	6	3	Cycle 1-3 Final Report (end of year)

Page: 11

Number: 1 Author: tpbassette Subject: Highlight Date: 5/21/2019 2:26:40 PM -06'00'
See comments in my email accompanying this.

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

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Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:
Blalock Reservoir (SC EO 007, 031)
Broad River: Cleghorn Creek, US 221 (EO 176)
Broad River: Floyds Creek, Long Branch (EO 177)
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop (EO 099)
Cliffside Steam Station (EO 276)
Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Love Lady Site (EO 029)
Mills Creek Forest and Seep (EO 023)
New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
Rhyne Preserve (EO 302)
Second Broad River (Forest City Industrial Complex) (EO 154) [1]
South Fork Catawba River: Jacob Fork, Camp Creek (EO 158)

NCDOT Sites:
Broad River Greenway (EO 049-051, 073-074, 149, 233, 238-241)
Buffalo Shoals Creek (EO 275) [2]
Catawba County (EO 158, 1[illegible])
Extension of 15th Avenue (EO 031)
Gunpowder Creek (EO 077)
Little Gunpowder Creek (EO 044) [3]
Longview (EO 032)
Micol Creek (EO 159)
Murray's Mill (EO 184) [4]
Shelby Bypass Site 7 (EO 191)
Tate Boulevard Extension (EO 030)
Tate Conservation Area (EO 106, 286) [5]
[6]

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Page: 14

Number: 1 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 1:44:22 PM -06'00'
EO 158 is listed for both NHP (Camp Creek) and NCDOT (Catawba County, though even we often refer to it as Camp Creek).

Number: 2 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 2:26:48 PM -06'00'
EO 158 is listed for both NHP (Camp Creek) and NCDOT (Catawba County, though even we often refer to it as Camp Creek).

Number: 3 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 3:27:35 PM -06'00'
Note that Little Gunpowder Creek should become a portion of EO 44, rather than the entire EO, since US 321 Widening (STIP No. U-4700) Site 43 is directly opposite Site 44 on the other side of the road.

Number: 4 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 3:29:01 PM -06'00'
Add the following: Shelby Bypass Sites 1 and 2 portion of EO 188; Shelby Bypass Sites 8, 8A, & 8B (EO 192); Shelby Bypass Sites 10, 11, 12 (EO 194); Shelby Sites 15 & 16 portion of EO 199; Shelby Site 22 (EO 209); Shelby Site 24 (EO 202); Shelby Site 25 (EO 213); Shelby Sites 28 & 29 (EO 203); and portion of Shelby Site 32 on portion of EO 208 comprising newly obtained Hoffmier & White Conservation Easements.

Side notes: Could request that all of Site 32 portion of EO 208 be included.

Only what is left with Site 28 is to be on NCDOT ROW, but Site 29 is real close by and is easy to get to.

All Shelby sites will have, or will have this year, a pre-construction baseline survey, followed with 3 rounds of post-construction monitoring.

Number: 5 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 1:17:47 PM -06'00'
Add Lovelady Road EOs 160 & 280.

Number: 6 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 3:27:06 PM -06'00'
I excluded the US 321 Widening (STIP No. U-4700 in Catawba County) Sites 32, 34, 36, & 43, portions of which are required by the USFWS Draft Biological Opinion (April 2019) of to be protected in NCDOT-owned right-of-way. There is currently no funding in place for these land acquisitions to occur, and construction of this portion of the project is currently many years out.

I have also excluded EO 308 and its recently transplanted specimens reintroduced back into the occurrence(STIP B-5391) in Alexander County, since this EO is an approximated mix of *H. naniflora* and *H. heterophylla*.

Appendix B – Threats Assessment Guidance

This methodology was originally developed by the NC Plant Conservation Program (NCPCP) Scientific Committee in 2008 to assess the rarest and most imperiled plant species. This protocol was applied to individual populations of *Hexastylis naniflora*, during baseline monitoring, to develop a standardized assessment of threats and trends.

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species. Each threat is assigned a ranking for its severity, scope, and immediacy, as described below:

Threat Severity

- High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long-term recovery (>100 yr.).
- Moderate: Major reduction of species population or long-term degradation or reduction of habitat in area affected, requiring 50–100 yr. for recovery.
- Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.
- Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yrs.) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations is generally considered Insignificant as defined here.

Scope

- High: >60% of total population, occurrences, or area affected.
- Moderate: 20–60% of total population, occurrences, or area affected.
- Low: 5–20% of total population, occurrences, or area affected.
- Insignificant: <5% of total population or area affected.

Immediacy

- High: Threat is operational (happening now) or imminent (within a year).
- Moderate: Threat is likely to be operational within 2–5 yr.
- Low: Threat is likely to be operational within 5–20 yr.
- Insignificant: Threat not likely to be operational within 20 yr.

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Page: 15

Number: 1 Author: tpbassette Subject: Highlight Date: 5/21/2019 3:29:57 PM -06'00'
Do indirect and direct threats roughly correspond to indirect and direct effects as defined under ESA Section 7 Consultation process? If they do, that would make it easier in many instances to assess from NCDOT's perspective.

Number: 2 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 2:13:04 PM -06'00'
Would "cumulative effects" as defined under ESA Section 7 be considered as a threat?

Number: 3 Author: tpbassette Subject: Sticky Note Date: 5/21/2019 3:30:19 PM -06'00'
When assessing for habitat, does this refer to occupied habitat, unoccupied habitat that adjoins the occupied habitat, or both?

U.S. FISH AND WILDLIFE SERVICE

Draft Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)



Photo courtesy of US Fish and Wildlife Service

Prepared by:

US Fish and Wildlife Service
Asheville Ecological Services Field Office
Asheville, North Carolina

June 2019

Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*)

June 2019

Recommended Citation:

US Fish and Wildlife Service. 2019. Draft Post-Delisting Monitoring Plan for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*). Asheville Ecological Services Field Office, Asheville, North Carolina. 11 pp.

Acknowledgements

The Draft Post-Delisting Monitoring Plan (Plan) for Dwarf-Flowered Heartleaf (*Hexastylis naniflora*) was prepared by the US Fish and Wildlife Service (Service) with participation from Rebekah Reid, Asheville Ecological Services Field Office, and Drew Becker, Southeast Regional Office. The Service acknowledges partners outside our agency who provided input during development of this draft Plan, including the North Carolina Natural Heritage Program and the North Carolina Department of Transportation.

Table of Contents

II. Summary of Species Status at Delisting 1
A. Demographic Parameters 1
B. Discussion of Populations 2
III. Public Review and Comment 3
IV. Monitoring Methods and Locations 4
IV. Definition of Response Triggers for Potential Monitoring Outcomes 5
A. Category I 5
B. Category II 6
C. Category III 6
V. Data Compilation and Reporting Procedures 6
VI. Estimated Funding Requirements and Sources 7
VII. PDM Implementation Schedule 7
VIII. Literature Cited 8

Figure

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.

Appendices

Appendix A. Monitoring Sites with Baseline Data

Appendix B. Threats Assessment Guidance

I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.). Section 4(g)(1) requires the US Fish and Wildlife Service (Service) to:

> *"implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary."*

The purpose of this post-delisting monitoring is to verify that 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), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

Dwarf-flowered heartleaf occurs mainly on private lands, with a few populations on public lands. NCNHP and NCDOT have monitored 25 of the largest populations for at least five years to collect baseline data (Appendix A). As staff resources and funding allow, the Service expects that cooperators who are currently monitoring and managing lands containing populations of dwarf-flowered heartleaf will continue to conduct or allow for monitoring at previously monitored populations.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2018), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

The plant has 4-5 centimeter (cm) heart-shaped leaves that are dark green, variegated, and leathery. They are supported by long thin petioles from a subsurface rhizome. Maximum plant height rarely exceeds 15cm. The jug-shaped flowers are usually beige to dark brown in color, with a calyx tube orifice 5 millimeters (mm) or less in diameter (sometimes up to 7mm) (Blomquist 1957, Gaddy 1987, Padgett 2004). Flowers appear from mid-March to early June. They are small,

inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989). The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).

B. Discussion of Populations

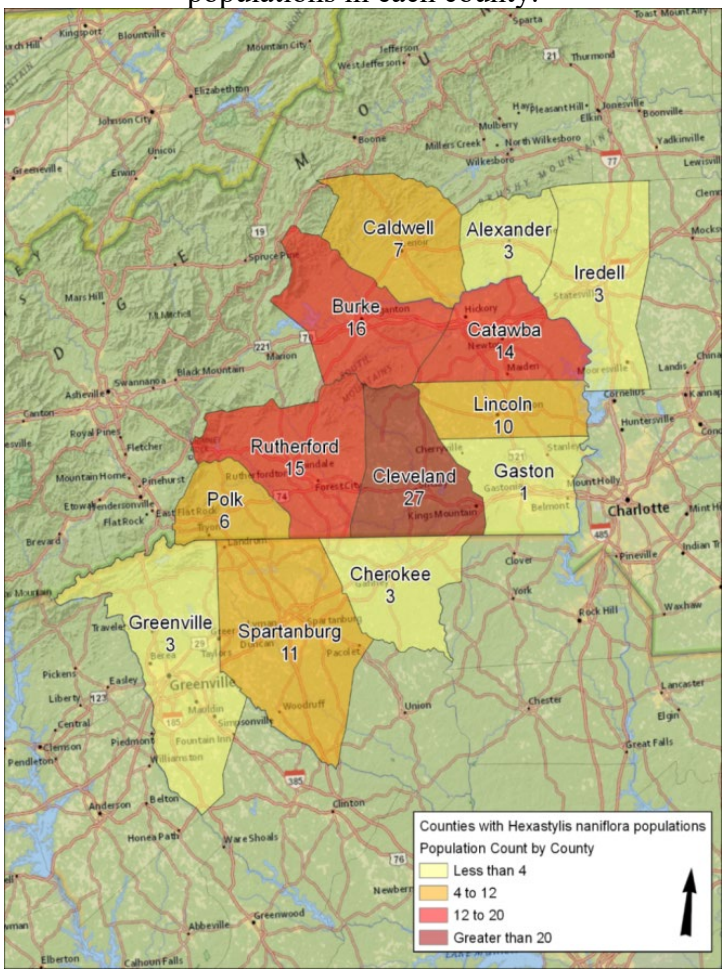
When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears that each site-specific location containing the species was counted as a separate population (Service 2011).

Since listing, many of those working with dwarf-flowered heartleaf have used the terms "sub site," "site," "location," "occurrence" (often, but not always, in reference to NCNHP Element Occurrence (EO) records), and "population" interchangeably, while others have aggregated sites into populations according to subjective criteria which have never been explicitly defined. This generated considerable discrepancies among sources with respect to abundance and distribution of the species, to the extent that data are usually not comparable from one source to the next (Service 2011).

NatureServe and its member Natural Heritage Programs (NHP) 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 into meaningful units of conservation interest that may approximate biological populations (NatureServe 2004). The Service does not maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards the NHP databases as the best repository for this information.

As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).

Figure 1. Current county distribution for dwarf-flowered heartleaf, with number of known populations in each county.



The listing rule placed emphasis on populations containing more than 1,000 rosettes. This threshold has been used in subsequent reports to call attention to particularly large populations. Populations with greater than 1,000 rosettes increased from three in 1989 to 26 in 2016 (Robinson 2016). This is approximately 23% of the total known populations and many of these populations contain well over 1,000 rosettes. Twenty-five of the largest known populations have been monitored for at least 5 years by NCNHP (13 populations) and NCDOT (12 populations).

III. Public Review and Comment

The Service will announce the availability of the draft Plan for public review and comment in the publication of the proposed rule to delist dwarf-flowered heartleaf. At conclusion of the comment period, the Service will review each comment and prepare responses to substantive comments.

IV. Monitoring Methods and Locations

The PDM methods proposed for dwarf-flowered heartleaf are those that were developed in March 2012 and used by NCNHP during the 2012-2016 baseline monitoring period (Robinson and Padgett 2016). Baseline monitoring provided updated information on status and trends at populations expected to play a substantive role in the recovery of dwarf-flowered heartleaf. Five years of field surveys targeted those populations last estimated to contain over 1,000 rosettes of dwarf-flowered heartleaf and/or those populations expected to afford long-term protection to the species (Robinson and Padgett 2016). Below is a description of monitoring that occurred.

Where landowner permission was obtained, populations of dwarf-flowered heartleaf were delineated with a GPS and polygons were mapped during the first and last year (2012 and 2016). The second mapping effort improved the mapping accuracy and spatial extent of the populations and monitored changes to occupied habitat over time. In 2012, following the initial delineation of each dwarf-flowered heartleaf population, at least one randomly placed monitoring plot was established within each population to sample approximately 10% of the population. This method follows previously established monitoring protocol by NCDOT, as determined during a field coordination meeting in March 2012 with NCNHP, NCDOT, and the Service. Monitoring plots vary in size and shape, depending on the size of the population mapped and/or the shape of the mapped occurrence. In some populations, multiple monitoring plots were established, particularly when large populations with landowner permission covered multiple areas or mapped polygons. In locations with small populations, no plots were necessary and a complete census of the population was counted each year. Maps provided for each site include the polygon mapped in 2012, any changes in size mapped in 2016, and the monitoring plots.

Plants were counted annually in each plot during the spring of 2012-2016. The number of individuals in each plot was extrapolated to the entire size of the population to determine an estimate of the number of plants occurring at each site, based on the entire size of the delineated population. In cases where landowner permission was not obtained for the entire population or subpopulations, existing polygons in the NCNHP database from previous surveys or from other contributed data were used to determine the size of the entire population. When every tract could not be visited, data from previous surveys substantially increased the size of the population and extrapolated numbers of dwarf-flowered heartleaf individuals. The estimated extrapolated size of each population for each year was determined with the following formula:

$$\text{Estimated size (by year x)} = \frac{\text{plant count in plots (by year x)}}{\text{plot size} \div \text{total acres (by year x)}}$$

The formula was modified accordingly when the size of total acres changed between 2012 and 2016. The plot size remained the same in each year of the survey.

Each monitoring site was also assessed for threats based on the North Carolina Plant Conservation Program's (NCPCP) threats assessment protocol (Appendix B).

The PDM will be a continuation of the monitoring described above and occur within at least 12 previously monitored populations (Appendix A).

A. Procedures to Assure Consistency

The practices below will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- NCNHP, NCDOT, or a qualified contractor will be the primary entity conducting the PDM. Each agency employs multiple staff members that have conducted monitoring of dwarf-flowered heartleaf and are familiar with its locations and sampling procedures.
- Plots at each monitored population will be permanently marked or a complete census will be conducted. Area of populations will be delineated to determine acreage of occupied habitat.
- A field data sheet, developed and agreed upon prior to initiation of PDM, will be completed at each location. This will ensure that all necessary data are recorded for each location during each site visit.
- Threats will be assessed at each location using NCPCP guidelines (Appendix B).
- Field surveys will be completed during the flowering period for dwarf-flowered heartleaf: March-May.

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 12 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6 sites are monitored each year for six years (each site receives three complete monitoring cycles).

IV. Definition of Response Triggers for Potential Monitoring Outcomes

Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios.

After a monitoring period of six years, all years of data, including baseline data, will be analyzed for trends and factors that may be influencing the population (e.g., threats). From this analysis, it will be possible to categorize observations into one of three possible PDM outcomes listed below:

A. Category I

PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections.
This would be true if:

1) Number of plants within a population is within the standard deviation of the mean or above, and

2) No new or increasing threats to the species are observed.

For this category, PDM would be concluded at the end of the timeframe specified in this draft Plan.

B. Category II

PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.
This would be true if:

1) Number of plants within a population is below the standard deviation of the mean, and

2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, the PDM period may be extended for an additional four years (two monitoring cycles), and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or endangered may be warranted.
This would be true if:

1) Number of plants within a population is below the standard deviation of the mean, and

2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of dwarf-flowered heartleaf within the foreseeable future.

For this category, all actions from Category II will be implemented. Additionally, the Service will initiate a formal status review and determine whether a proposal for relisting is appropriate.

V. Data Compilation and Reporting Procedures

Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville Ecological Services Field Office by December 31st after each completed monitoring cycle. Each

report will synthesize all monitoring data and comment on the status of dwarf-flowered heartleaf. Threats assessments will also be included so the Service can determine if new factors may be negatively affecting the species. After six years of PDM data are available, the next report will also include an analysis of the overall population trend and status with respect to threats and the PDM outcome categories presented in Section IV of this draft Plan.

If response triggers in Section IV are met or exceeded, the Service will consult with NCNHP, NCDOT, and other partners to determine whether to conclude the PDM process or pursue management actions. The determination will also include, if necessary, an evaluation of the threats to dwarf-flowered heartleaf using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state and tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of dwarf-flowered heartleaf following removal from protections of the Act. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this draft Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

As staff resources and funding allow, the primary entities conducting the PDM and preparing reports will be NCNHP and/or NCDOT. Based on a funding estimate received from NCNHP, monitoring 6 sites each year would require approximately $6,100 in funding. A complete monitoring cycle of two years would require approximately $12,200 and the entire six years of monitoring (three monitoring cycles) would require approximately $36,600. The NCNHP funding estimates do not apply to NCDOT and NCDOT is unable to provide an estimate for monitoring additional sites at this time. The Service will provide assistance as needed and as resources permit.

VII. PDM Implementation Schedule

A schedule will be developed in coordination with NCNHP and/or NCDOT in order to ensure that it is feasible to accomplish PDM activities at all sites scheduled for a given year. An example schedule is shown below:

Sites	Year	Monitoring Cycle	Reporting
1-6	1	1	
7-12	2	1	Cycle 1 (end of year)
1-6	3	2	
7-12	4	2	Cycle 2 (end of year)
1-6	5	3	
7-12	6	3	Cycle 1-3 Final Report (end of year)

VIII. Literature Cited

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

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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.

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

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-----. 2018, August. Fact sheet for *Hexastylis naniflora*. Retrieved from https://www.fws.gov/raleigh/species/es_dwarf-flowered_heartleaf.html.

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.

Appendix A – Monitoring Sites with Baseline Data

NCNHP Sites:
Blalock Reservoir (SC EO 007, 031)
Broad River: Cleghorn Creek, US 221 (EO 176)
Broad River: Floyds Creek, Long Branch (EO 177)
Broad River: Henson's Creek, Brice, and Sandy Mush Outcrop (EO 099)
Cliffside Steam Station (EO 276)
Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Lovelady Site (EO 029)
Mills Creek Forest and Seep (EO 023)
New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
Rhyne Preserve (EO 302)
Second Broad River (Forest City Industrial Complex) (EO 154)

NCDOT Sites:
Broad River Greenway (EO 049-051, 073-074, 149, 233, 238-241)
Buffalo Shoals Creek (EO 275)
Extension of 15th Avenue (EO 031)
Gunpowder Creek (EO 077)
Little Gunpowder Creek (portion of EO 044)
Longview (EO 032)
Lovelady Road (EO 160, 280)
Micol Creek (EO 159)
Murray's Mill (EO 184)
Shelby Bypass Sites (EO 192, 194, 202, 203, 209, 213; portions of EO 188, 199, 208)
South Fork Catawba River: Jacob Fork, Camp Creek (EO 158, 162)
Tate Boulevard Extension (EO 030)
Tate Conservation Area (EO 106, 286)

Appendix B – Threats Assessment Guidance

This methodology was originally developed by the NC Plant Conservation Program (NCPCP) Scientific Committee in 2008 to assess the rarest and most imperiled plant species. This protocol was applied to individual populations of *Hexastylis naniflora*, during baseline monitoring, to develop a standardized assessment of threats and trends.

Threat Category = Indirect or direct threats that are observed, inferred, or suspected to have an impact on the plant species. Each threat is assigned a ranking for its severity, scope, and immediacy, as described below:

Threat Severity

- High: Loss of species population (all individuals) or destruction of species habitat in area affected, irreversible or requiring long-term recovery (>100 yr.).
- Moderate: Major reduction of species population or long-term degradation or reduction of habitat in area affected, requiring 50–100 yr. for recovery.
- Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10–50 yr.
- Insignificant: Essentially no reduction of population or degradation of habitat due to threats, or populations or habitats able to recover quickly (within 10 yrs.) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations is generally considered Insignificant as defined here.

Scope

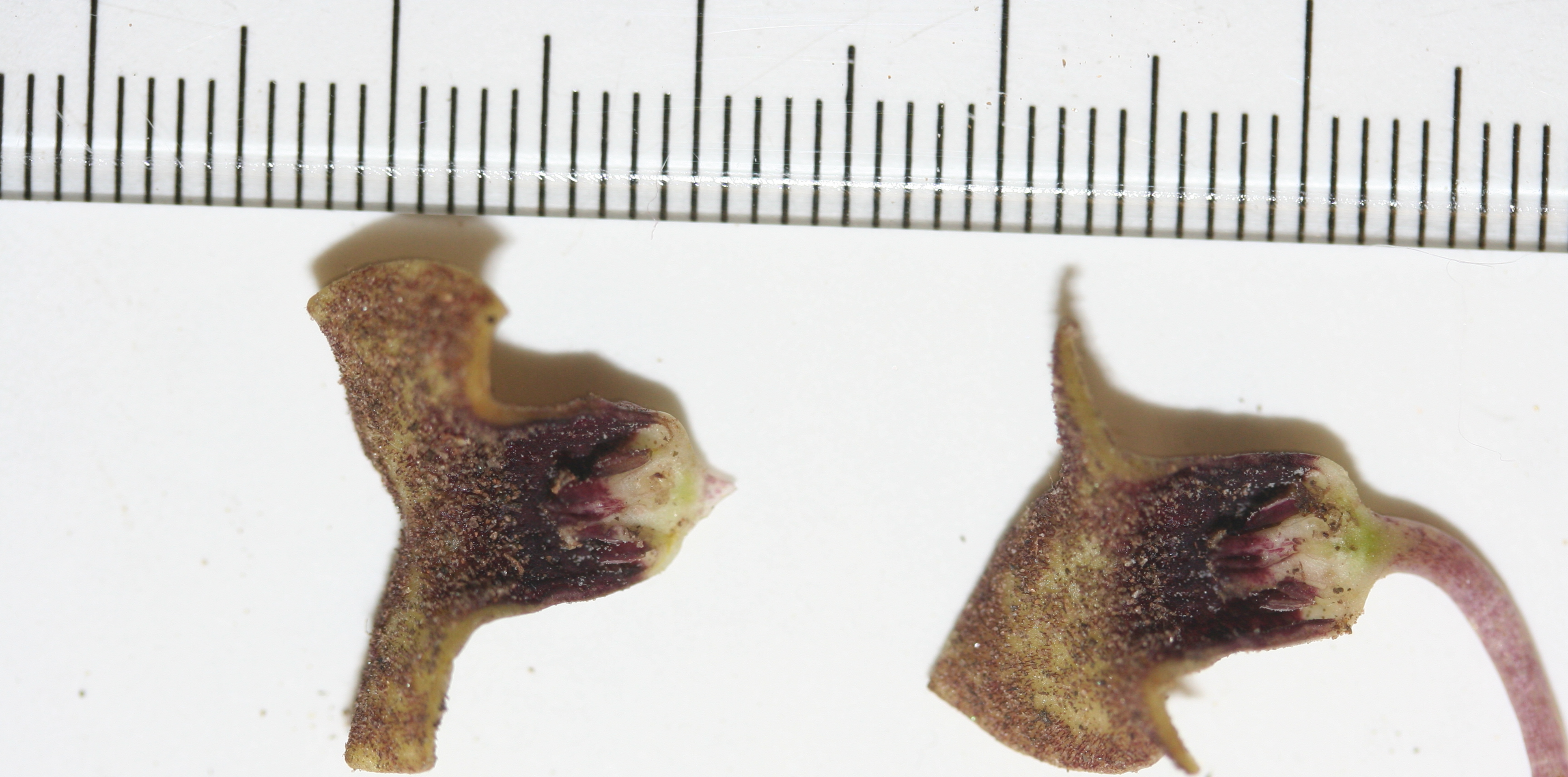
- High: >60% of total population, occurrences, or area affected.
- Moderate: 20–60% of total population, occurrences, or area affected.
- Low: 5–20% of total population, occurrences, or area affected.
- Insignificant: <5% of total population or area affected.

Immediacy

- High: Threat is operational (happening now) or imminent (within a year).
- Moderate: Threat is likely to be operational within 2–5 yr.
- Low: Threat is likely to be operational within 5–20 yr.
- Insignificant: Threat not likely to be operational within 20 yr.








IN GOD WE TRUST

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1875 Century Boulevard
Atlanta, Georgia 30345

In Reply Refer To:
FWS/R4/BA/CGS

September 15, 2011

Ms. Dee Freeman
Secretary
North Carolina Department of Environment and
Natural Resources
512 North Salisbury Street
Raleigh, North Carolina 27604

Dear Ms. Freeman:

Enclosed for your files is an executed copy of Cooperative Agreement No. F11AC00697. Also enclosed are Standard Forms 425 and 270 for your use under this agreement. A copy of the Project Officer delegation is also enclosed.

If you have any questions concerning this action, please contact Janice McNeill, Contract Specialist, at the above address, Suite 310, or at telephone number (404) 679-4056.

Sincerely,

Don Calder
Chief, Contracting and Grant
Services Division

Enclosures

AGREEMENT NO: ***F11AC00697***
CHARGE CODE: 42910-1113-0000-D2 (FY 11)
AMOUNT: $46,500.00
DUNS NO: *809785280*

COOPERATIVE AGREEMENT

Between

U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

and

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

I. COOPERATIVE AGREEMENT RECIPIENT:

Linda Pearsall, Director
Office of Conservation, Planning & Community Affairs
North Carolina Dept. of Environment & Natural Resources
1601 Mail Service Center
Raleigh, NC 27699-1601
919-715-4195

Recipient Class: State Government
Catalog of Federal Domestic Assistance Number: 15.657 Endangered Species Conservation- Recovery Implementation Funds

II. AUTHORITY:

This cooperative agreement between the North Carolina Department of Environment and Natural Resources (hereinafter referred to as the ("Recipient") and the U.S. Fish and Wildlife Service (hereinafter referred to as the "Service"), is hereby entered into under the authority of the *Endangered Species Act of 1973 (16 USC 1531-44).*

III. PURPOSE:

This Cooperative Agreement is being implemented in order to inform possible de-listing decisions for dwarf-flowered heartleaf (*Hexastylis naniflora*) by conducting a comprehensive review of a subset of known populations to determine current population size, trends and threats for the target populations.

While preparing the most recent five year review for *H. naniflora*, the Service noted significant concerns with the best available estimates of population size across the range of the species, for both protected and unprotected populations. Most available estimates represent partial population surveys conducted by different observers in different years, usually using widely different protocols and levels of survey effort. As a conservation measure in a 2009 Biological Opinion for a Federal Highways/North Carolina Department of Transportation (NCDOT) project, the NCDOT pledged to provide status updates for all or portions of 12 populations of *H. naniflora*. The current proposal seeks to leverage the matching contributions from NCDOT by obtaining contemporaneous updates at additional populations across the range of the species.

The Service will work cooperatively with the Recipient and the NCDOT to develop and review monitoring protocols and a standardized assessment of threats (employing the use of categorical rankings) to ensure that data collection is standardized among all targeted populations and among agencies.

IV. BACKGROUND:

When *Hexastylis naniflora* (dwarf-flowered heartleaf) was federally listed in 1989, there were 24 extant populations across the species' range. The estimated number of individuals (typically counted as "clumps", or rosettes) exceeded 5,000 plants, with > 60% of these occurring in three large populations each estimated to contain over 1,000 rosettes. As of 2010, there are an estimated 108 populations of the species. Thus, the total number of populations has increased roughly four-fold (from 24 to 108) since the species was listed. The total number of populations last estimated to exceed 1,000 rosettes (27 populations, or 24%) is also now greater than the total number of populations known when the species was listed.

Given the nearly four-fold increase in the number of known populations, *H. naniflora* is not likely to be as threatened with extinction as previously thought. However, in addition to considerations relating to overall abundance, the decision to remove *H. naniflora* from the federal list must include an assessment of whether identified threats to the species have been appreciably reduced, or else a demonstration that *H. naniflora* is more resilient to identified threats than previously thought.

V. SCOPE OF EFFORT:

This cooperative agreement provides funds to develop protocols for objectively monitoring population trends, a standardized assessment of threats (employing the use of categorical rankings) and to conduct site visits for each targeted population and collect the following information:

- An updated estimate of population size
- A geo-referenced delineation of occupied habitat

The Service will work cooperatively with the Recipient and the NCDOT to develop and review monitoring protocols and a standardized assessment of threats (employing the use of categorical rankings) to ensure that data collection is standardized among all targeted populations and among agencies.

The Recipient will provide a performance schedule to the Service's Project Officer showing each major planned milestone for the project and an estimated completion date within 90 days of the Service's signature date on this agreement. In particular before beginning field work, the Recipient will ensure appropriate Federal, State and Local permits and authorizations are obtained prior to beginning work, and that the project is in compliance with all applicable state, local and federal laws.

The Recipient will convene an initial meeting or conference call including the NCDOT and the Service to discuss and establish monitoring protocols for population estimation and discuss coordination of data collection, including specific methods to collect geo-referenced data to delineate habitat extent. After monitoring protocols are established, the target sites (approximately 15) will be visited during the field season and data will be gathered to meet the previously described objectives.

The Recipient will provide quarterly interim updates to the Service, either electronically via e-mail to Marella Buncick marella_buncick@fws.gov and Mara Alexander mara_alexander@fws.gov or by meeting. Invoices may be submitted with interim reports. Because project activities are somewhat seasonal, the report content will vary by activities appropriate for the time of year but should include the following:

1. An update on monitoring and threat assessment protocols, specifically decisions or any points of significant deviation;
2. A current field schedule and any difficulties associated with landowner contacts or other access issues;
3. An update on most recent site data obtained from SC;
4. Identification of any substantive issues or concerns in meeting project objectives and proposed solutions for addressing these.

The project will be regarded as complete upon submission of a final report to the Service. This report should provide a list of sites and data for each site including a population estimate, the extent of habitat currently occupied, trend of the population, threats to the population, and the extent to which the site is protected. A map/shape file of the sites should accompany the report.

VI. PERIOD OF PERFORMANCE:

The period of performance of this agreement is from September 1, 2011 through August 31, 2014.

VII. AWARD AMOUNT:

A. TOTAL (NOT-TO-EXCEED) AWARD AMOUNT: $95,842.00
B. TOTAL AMOUNT FUNDED TO DATE: $46, 500.00
C. FUNDING INCREMENTS: The Recipient is advised that the Service's obligation to provide funding for funding increments included in this agreement is contingent upon (i) satisfactory performance and (ii) the availability of funds. Accordingly, no legal liability on the part of the Service exists unless or until funds are made available to the Recipient and notice of such availability is confirmed in writing to the Recipient.

VIII. APPROPRIATION DATA:

APPROPRIATION: 42910-1113-0000-D2 (FY 11) $46,500.00

IX. PAYMENT PROVISIONS:

A. Upon acceptance of the terms and conditions of this agreement, the Recipient may submit requests for payment using Standard Form 270, Request for Advance or Reimbursement, no more frequently than monthly. (Standard Form 271 must be used if agreement is for construction.) The Debt Collection Improvement Act of 1996 (P.L. 104-134) requires that all federal payments made by an agency after July 26, 1996, must be made by electronic funds transfer unless the Recipient certifies that they do not have an account at a financial institution or authorized payment agent.

B. The original and two copies of each payment request (SF 270) shall be submitted to the Service Project Officer identified in Article XI.A. of this agreement. Payment requests need to specify which projects to be funded. Upon approval, the Service

Project Officer shall forward the payment request and one copy to the Budget, Planning and Financial Services Officer for processing.

C. Should the Recipient be unable to complete the provisions of this agreement, all monies provided by the Service which prove to be cancelable obligations or unallowable costs in accordance with 2 CFR 220/225/230 (*as applicable to the Organization type*) or the approved budget, shall be refunded to the Service.

D. This agreement is intended to support a particular project for a specific period of time. Any portion of funds advanced to the Recipient that are not expended at the completion of the period of performance of this agreement shall be returned to the Service, along with any interest earned on that amount.

NOTE: DOI intends to migrate to new payment system (U.S. Treasury's Automated Standard Application for Payments (ASAP) www.asap.gov) by mid to late FY2011. This will require recipient registration and password access to process payments. The notice of requirement for registration will occur prior to implementation.

X. ADMINISTRATIVE OFFICER:

The Administrative Officer for this agreement is:

Janice McNeill
U.S. Fish and Wildlife Service
Contracting and Grant Services
1875 Century Boulevard, Room 310
Atlanta, GA 30345
Phone: 404-679-4056
Fax: 404-679-4057
Email: janice_mcneill@fws.gov

XI. PROJECT OFFICERS:

A. U.S. Fish and Wildlife Service
Marella Buncick
160 Zillicoa Street
Asheville, NC 28801
Phone: 828-258-3939 ex 237
Email: marella_buncick@fws.gov

U.S. Fish and Wildlife Service
Mara Alexander
160 Zillicoa Street
Asheville, NC 28801

Phone: 828-258-3939 ex 237
Email: mara_alexander@fws.gov

B. Linda Pearsall, Director
Office of Conservation, Planning & Community Affairs
North Carolina Dept. of Environment & Natural Resources
1601 Mail Service Center
Raleigh, NC 27699-1601
Phone: 919-715-4195
Email: Linda.Pearsall@ncdenr.gov

XII. REPORTING/DELIVERY REQUIREMENTS:

A. Interim Reports: See Scope of Effort

B. Final Reports: See Scope of Effort

C. Federal Financial Reports (SF 425):

An **annual** Federal Financial Report (Standard Form 425) shall be submitted within 90 calendar days after the agreement year (i.e. 12 months after the approved effective date of the agreement and every 12 months thereafter until expiration date of the agreement.) Recipient shall submit an ***original*** to the Service Administrative Officer and a ***copy*** to the Service Project Officer

Final
A **final** Federal Financial Report (Standard Form 425) shall be submitted within 90 calendar days after the expiration date of the agreement or termination of support. Recipient shall submit an ***original*** to the Service Administrative Officer and a ***copy*** to the Service Project Officer

XIII. TERMS AND CONDITIONS:

The Department of Interior regulations governing assistance agreements with state and local governments, institutions of higher education, hospitals, and other non-profit organizations at subparts A, C, E-F of 43 CFR Part 12, Administrative and Audit Requirements and Cost Principles for Assistance Programs, (plus relevant circulars of the Office of Management and Budget as referenced in these regulations), are applicable to this agreement and are incorporated by reference with the same force and effect as if they were given in full text. Upon request the

Service's Division of Contracting and Grant Services will make the full text of these regulations available.

Acceptance of a Federal Financial Assistance award from the Department of the Interior (DOI) carries with it the responsibility to be aware of and comply with the terms and conditions of award. http://www.doi.gov/pam/TermsandConditions.html

Acceptance is defined as the start of work, drawing down funds, or accepting the award via electronic means. Awards are based on the application submitted to, and as approved by DOI and are subject to the terms and conditions incorporated either directly or by reference in the following:

- Program legislation\regulation.
- Special terms and conditions.
- Code of Federal Regulations/Regulatory Requirements, as applicable (Contact your program officer with any questions regarding the applicability of the following):

2 CFR Part 25 Central Contractor Registration and Data Universal Numbering System

2 CFR Part 170 Reporting Subawards and Executive Compensation
FEDERAL FUNDING ACCOUNTABILITY and TRANSPARENCY ACT (FFATA) (P.L. 109-281)
http://www.doi.gov/pam/Federal_Register_FFATA_Implementation.pdf
2 CFR Part 1400 Governmentwide Debarment and Suspension (Nonprocurement)

2 CFR Part 175 Trafficking Victims Protection Act of 2000

43 CFR 12(A) Administrative and Audit Requirements and Cost Principles for Assistance Programs

43 CFR 12(E) Buy American Requirements for Assistance Programs

43 CFR 12(C) Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local

43 CFR 12(F)Uniform Administrative Requirements for Grants and Cooperative Agreements with Institutions of Higher Education, Hospitals, other Non-Profit and Commercial Organizations

43 CFR 43 Governmentwide Requirements for a Drug-Free Workplace

43 CFR 18 New Restrictions on Lobbying

305 DM 3 Integrity of Scientific and Scholarly Activities

XIV. MODIFICATIONS:

Modifications or renewals may be proposed at any time during the period of performance by either party and shall become effective upon approval of both parties.

XV. SPECIAL CONDITIONS AND PROVISIONS:

A. Pre-approval requirements. The recipient will obtain all necessary state, federal, county, and municipal permits consistent with applicable laws and regulations before commencing work under this cooperative agreement.

B. The Service's liability will be governed by the Federal Tort Claims Act (28 U.S.C. 2671 et seq.). The extent of the Recipient's liability shall be governed by the laws of the State of North Carolina.

IN WITNESS WHEREOF, the parties hereto have caused this Cooperative Agreement to be executed as of the date therein written.

NORTH CAROLINA DEPARTMENT OF EVNIRONMENT AND NATURAL RESOURCES	U.S. DEPARTMENT OF THE INTERIOR FISH AND WILDLIFE SERVICE
BY: Dee A Freeman	BY: Don Calder
TITLE: Secretary	TITLE: Chief Contracting and Grant Services
DATE: Sept 1, 2011	DATE: 9-15-2011

North Carolina Department of Environment and Natural Resources
Division of Natural Resources Planning and Conservation

Beverly Eaves Perdue
Governor

Linda Pearsall
Director

Dee Freeman
Secretary

July 20, 2011

(1) Project Title: **Collection of data to support delisting of *Hexastylis naniflora***

Background

When *Hexastylis naniflora* (dwarf-flowered heartleaf) was federally listed in 1989, there were 24 extant populations across the species' range. The estimated number of individuals (typically counted as "clumps", or rosettes) exceeded 5,000 plants, with > 60% of these occurring in three large populations each estimated to contain over 1,000 rosettes. As of 2010, there are an estimated 108 populations of the species (USFWS 2010; NC NHP, 2010; SCDNR, 2010). Thus, the total number of populations has increased roughly four-fold (from 24 to 108) since the species was listed. The total number of populations last estimated to exceed 1,000 rosettes (27 populations, or 24%) is also now greater than the total number of populations known when the species was listed.

Given the nearly four-fold increase in the number of known populations, *H. naniflora* is not likely to be as threatened with extinction as previously thought. However, in addition to considerations relating to overall abundance, any the decision to remove *H. naniflora* from the federal list must include an assessment of whether identified threats to the species have been appreciably reduced, or else a demonstration that *H. naniflora* is more resilient to identified threats than previously thought.

H. naniflora is regularly subject to adverse impacts from activities requiring formal consultation with USFWS, with all or portions of 22 populations of *H. naniflora* having been adversely impacted from activities requiring formal Section 7 consultation (USFWS 2010). A review of best available information reveals that another 20 populations are imminently threatened by one or more factors known to adversely affect the species (e.g., encroaching residential development, invasive exotic vegetation, sedimentation/erosion, trash disposal, or all-terrain vehicles) (USFWS 2010; NC NHP 2010; SCDNR 2010). Therefore, demonstrable threats either have already affected or are imminent at nearly 40% of all known populations. Given this reality, any proposal to remove *H. naniflora* from the federal list must first demonstrate that the species is either adequately protected from, or resilient to, these threats.

Section 7 consultations addressing adverse effects to *H. naniflora* have resulted in protections for significant portions of 30 populations, either through conservation measures or conservation recommendations. The majority of these protected areas have been acquired or otherwise set aside by the North Carolina Department of Transportation (NCDOT), either in the form of off-site (located outside of the footprint of road projects) or on-site (within road rights-of-way) conservation areas. Significant portions of other populations are

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Natural Resources Planning and Conservation

protective measures were either pledged or recommended in conjunction with previous Section 7 consultations. Three years of field work would target those populations last estimated to contain over 1,000 rosettes of *H. naniflora* and/or those populations expected to afford long-term protection to the species, for which the USFWS currently lacks updated information on species' status, trends and threats. The populations targeted by this proposal are in addition to the 12 populations for which NCDOT has previously pledged to provide substantive status updates.

During the first field season, monitoring protocols and a standardized assessment of threats (employing the use of categorical rankings) will be developed in coordination with NCDOT and USFWS to ensure that data collection is standardized among all targeted populations and among agencies.

At each targeted population, the following information will be provided during the first field season:

- An updated estimate of population size
- A geo-referenced delineation of occupied habitat
- A protocol for objectively monitoring population trends (obtained either through a census or sampling, depending upon the overall size of the population and other factors)

During the following two field seasons, each population will again be monitored for significant changes in overall abundance, spatial extent, and the magnitude, severity and scope of known or suspected threats. These trend data will provide the baseline for comparison to post-delisting monitoring data.

Additional time will be spent coordinating and collecting population data from the South Carolina Natural Heritage Program, making landowner contacts, and obtaining landowner permission to visit the sites each year.

Budget for proposed project

The proposed budget for this project is attached. In all cases, we will implement close coordination with USFWS and NCDOT to select sites and specific data that will be compiled and incorporated into the report.

Tangible benefits resulting from this proposal

The activities to be funded by this proposal represent those which the USFWS has previously identified as necessary to support a proposal to remove *H. naniflora* from the federal list of threatened and endangered species (USFWS 2010). Although the Asheville Field Office (AFO) and many of its conservation partners have long sensed that *H. naniflora* may warrant de-listing, a review of currently available information does not support assertions that existing populations are stable, or that threats have been effectively eliminated or reduced (USFWS 2010). Acquisition of data capable of supporting these assertions would enable a de-listing to proceed, ultimately enabling limited resources (within and external to the AFO) to focus on other higher priority species more critically threatened with extinction.

As noted above, in 2009 the NCDOT pledged to provide status updates for all or portions of 12 populations of *H. naniflora*. The current proposal seeks to leverage the matching contributions from NCDOT by obtaining contemporaneous updates at additional populations across the range of the species, in the hopes that this

collective body of information will provide the information necessary for an objective assessment of whether or not de-listing is appropriate, and an adequate baseline against which the statutorily required post-delisting monitoring data can be compared.

Sources cited

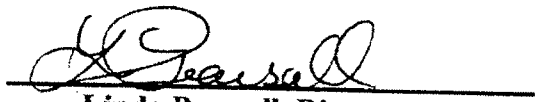
Bassette, T. 2010. Tim Bassette, North Carolina Department of Transportation. Personal communication with Carolyn Wells (USFWS).

North Carolina Natural Heritage Program (NC NHP). 2010. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: April 7, 2010.

South Carolina Department of Natural Resources (SCDNR) Heritage Trust. 2010. Element Occurrence Records for *Hexastylis naniflora* (dwarf-flowered heartleaf). As of: August 19, 2010.

U.S. Fish and Wildlife Service. 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, 2009. Biological Opinion for the Proposed Upgrade of Lovelady Road, TIP No. R-2824, in Burke County, North Carolina. USFWS log number 4-2-09-367. November 13, 2009.

Submitted by: 

Linda Pearsall, Director
Office of Conservation, Planning, and Community Affairs

BUDGET INFORMATION - Non-Construction Programs

OMB Approval No. 0348-0044

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. Endangered Species	15.657	$ 95,842.00	$	$	$	$ 95,842.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 95,842.00	$ 0.00	$ 0.00	$ 0.00	$ 95,842.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total
	(1) Endangered Species	(2)	(3)	(4)	(5)
a. Personnel	$ 64,891.00	$	$	$	$ 64,891.00
b. Fringe Benefits	16,478.00				16,478.00
c. Travel	7,200.00				7,200.00
d. Equipment	200.00				200.00
e. Supplies					0.00
f. Contractual					0.00
g. Construction					0.00
h. Other					0.00
i. Total Direct Charges *(sum of 6a-6h)*	88,769.00	0.00	0.00	0.00	88,769.00
j. Indirect Charges	7,073.00				7,073.00
k. TOTALS *(sum of 6i and 6j)*	$ 95,842.00	$ 0.00	$ 0.00	$ 0.00	$ 95,842.00
7. Program Income	$	$	$	$	$ 0.00

SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	$	$	$	$ 0.00
9.				0.00
10.				0.00
11.				0.00
12. TOTAL *(sum of lines 8-11)*	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 42,484.00	$ 3,000.00	$ 2,000.00	$ 34,484.00	$ 3,000.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 42,484.00	$ 3,000.00	$ 2,000.00	$ 34,484.00	$ 3,000.00

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

(a) Grant Program	FUTURE FUNDING PERIODS (Years)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16.	$ 27,985.00	$ 25,373.00	$	$
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 27,985.00	$ 25,373.00	$ 0.00	$ 0.00

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:
88769

22. Indirect Charges:
7073

23. Remarks: Indirect rate of 10.9%

FEDERAL FINANCIAL REPORT

(Follow form instructions)

1. Federal Agency and Organizational Element to Which Report is Submitted	2. Federal Grant or Other Identifying Number Assigned by Federal Agency (To report multiple grants, use FFR Attachment)	Page 1	of pages
3. Recipient Organization (Name and complete address including Zip code)			

4a. DUNS Number	4b. EIN	5. Recipient Account Number or Identifying Number (To report multiple grants, use FFR Attachment)	6. Report Type ☐ Quarterly ☐ Semi-Annual ☐ Annual ☐ Final	7. Basis of Accounting ☐ Cash ☐ Accrual

8. Project/Grant Period From: (Month, Day, Year)	To: (Month, Day, Year)	9. Reporting Period End Date (Month, Day, Year)

10. **Transactions**	Cumulative
(Use lines a-c for single or multiple grant reporting)	
Federal Cash (To report multiple grants, also use FFR Attachment):	
a. Cash Receipts	
b. Cash Disbursements	
c. Cash on Hand (line a minus b)	
(Use lines d-o for single grant reporting)	
Federal Expenditures and Unobligated Balance:	
d. Total Federal funds authorized	
e. Federal share of expenditures	
f. Federal share of unliquidated obligations	
g. Total Federal share (sum of lines e and f)	
h. Unobligated balance of Federal funds (line d minus g)	
Recipient Share:	
i. Total recipient share required	
j. Recipient share of expenditures	
k. Remaining recipient share to be provided (line i minus j)	
Program Income:	
l. Total Federal program income earned	
m. Program income expended in accordance with the deduction alternative	
n. Program income expended in accordance with the addition alternative	
o. Unexpended program income (line l minus line m or line n)	

11. Indirect Expense	a. Type	b. Rate	c. Period From	Period To	d. Base	e. Amount Charged	f. Federal Share
				g. Totals:			

12. *Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation:*

13. Certification: By signing this report, I certify that it is true, complete, and accurate to the best of my knowledge. I am aware that any false, fictitious, or fraudulent information may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)

a. Typed or Printed Name and Title of Authorized Certifying Official	c. Telephone (Area code, number and extension)
	d. Email address
b. Signature of Authorized Certifying Official	e. Date Report Submitted (Month, Day, Year)
	14. Agency use only:

Standard Form 425
OMB Approval Number: 0348-0061
Expiration Date: 10/31/2011

Paperwork Burden Statement

According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number. The valid OMB control number for this information collection is 0348-0061. Public reporting burden for this collection of information is estimated to average 1.5 hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0060), Washington, DC 20503.

REQUEST FOR ADVANCE OR REIMBURSEMENT

(See instructions on back)

OMB APPROVAL NO. 0348-0004

PAGE ____ OF ____ PAGES

1. TYPE OF PAYMENT REQUESTED
a. *"X" one or both boxes* ☐ ADVANCE ☐ REIMBURSEMENT
b. *"X" the applicable box* ☐ FINAL ☐ PARTIAL

2. BASIS OF REQUEST ☐ CASH ☐ ACCRUAL

3. FEDERAL SPONSORING AGENCY AND ORGANIZATIONAL ELEMENT TO WHICH THIS REPORT IS SUBMITTED

4. FEDERAL GRANT OR OTHER IDENTIFYING NUMBER ASSIGNED BY FEDERAL AGENCY

5. PARTIAL PAYMENT REQUEST NUMBER FOR THIS REQUEST

6. EMPLOYER IDENTIFICATION NUMBER

7. RECIPIENT'S ACCOUNT NUMBER OR IDENTIFYING NUMBER

8. **PERIOD COVERED BY THIS REQUEST**
FROM *(month, day, year)*
TO *(month, day, year)*

9. RECIPIENT ORGANIZATION

Name:

Number and Street:

City, State and ZIP Code:

10. PAYEE *(Where check is to be sent if different than item 9)*

Name:

Number and Street:

City, State and ZIP Code:

11. **COMPUTATION OF AMOUNT OF REIMBURSEMENTS/ADVANCES REQUESTED**

PROGRAMS/FUNCTIONS/ACTIVITIES ►		(a)	(b)	(c)	TOTAL
a. Total program outlays to date	*(As of date)*	$	$	$	$
b. *Less:* Cumulative program income					
c. Net program outlays *(Line a minus line b)*					
d. Estimated net cash outlays for advance period					
e. Total *(Sum of lines c & d)*					
f. Non-Federal share of amount on line e					
g. Federal share of amount on line e					
h. Federal payments previously requested					
i. Federal share now requested *(Line g minus line h)*					
j. Advances required by month, when requested by Federal grantor agency for use in making prescheduled advances	1st month				
	2nd month				
	3rd month				

12. **ALTERNATE COMPUTATION FOR ADVANCES ONLY**

a. Estimated Federal cash outlays that will be made during period covered by the advance	$
b. *Less:* Estimated balance of Federal cash on hand as of beginning of advance period	
c. Amount requested *(Line a minus line b)*	$

AUTHORIZED FOR LOCAL REPRODUCTION

(Continued on Reverse)

13. **CERTIFICATION**

I certify that to the best of my knowledge and belief the data on the reverse are correct and that all outlays were made in accordance with the grant conditions or other agreement and that payment is due and has not been previously requested.	SIGNATURE OR AUTHORIZED CERTIFYING OFFICIAL	DATE REQUEST SUBMITTED
	TYPED OR PRINTED NAME AND TITLE	TELEPHONE (AREA CODE, NUMBER, EXTENSION)

This space for agency use

Public reporting burden for this collection of information is estimated to average 60 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0004), Washington, DC 20503.

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

INSTRUCTIONS

Please type or print legibly. Items 1, 3, 5, 9, 10, 11e, 11f, 11g, 11i, 12 and 13 are self-explanatory; specific instructions for other items are as follows:

Item	*Entry*
2	Indicate whether request is prepared on cash or accrued expenditure basis. All requests for advances shall be prepared on a cash basis.
4	Enter the Federal grant number, or other identifying number assigned by the Federal sponsoring agency. If the advance or reimbursement is for more than one grant or other agreement, insert N/A; then, show the aggregate amounts. On a separate sheet, list each grant or agreement number and the Federal share of outlays made against the grant or agreement.
6	Enter the employer identification number assigned by the U.S. Internal Revenue Service, or the FICE (institution) code if requested by the Federal agency.
7	This space is reserved for an account number or other identifying number that may be assigned by the recipient.
8	Enter the month, day, and year for the beginning and ending of the period covered in this request. If the request is for an advance or for both an advance and reimbursement, show the period that the advance will cover. If the request is for reimbursement, show the period for which the reimbursement is requested.
Note:	The Federal sponsoring agencies have the option of requiring recipients to complete items 11 or 12, but not both. Item 12 should be used when only a minimum amount of information is needed to make an advance and outlay information contained in item 11 can be obtained in a timely manner from other reports.
11	The purpose of the vertical columns (a), (b), and (c) is to provide space for separate cost breakdowns when a project has been planned and budgeted by program, function, or activity. If additional columns are needed, use as many additional forms as needed and indicate page number in space provided in upper right; however, the summary totals of all programs, functions, or activities should be shown in the "total" column on the first page.
11a	Enter in "as of date," the month, day, and year of the ending of the accounting period to which this amount applies. Enter program outlays to date (net of refunds, rebates, and discounts), in the appropriate columns. For requests prepared on a cash basis, outlays are the sum of actual cash disbursements for goods and services, the amount of indirect expenses charged, the value of in-kind contributions applied, and the amount of cash advances and payments made to subcontractors and subrecipients. For requests prepared on an accrued expenditure basis, outlays are the sum of the actual cash disbursements, the amount of indirect expenses incurred, and the net increase (or decrease) in the amounts owed by the recipient for goods and other property received and for services performed by employees, contracts, subgrantees and other payees.
11b	Enter the cumulative cash income received to date, if requests are prepared on a cash basis. For requests prepared on an accrued expenditure basis, enter the cumulative income earned to date. Under either basis, enter only the amount applicable to program income that was required to be used for the project or program by the terms of the grant or other agreement.
11d	Only when making requests for advance payments, enter the total estimated amount of cash outlays that will be made during the period covered by the advance.
13	Complete the certification before submitting this request.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1875 Century Boulevard
Atlanta, Georgia 30345

In Reply Refer To:
FWS/R4/BA/CGS

September 15, 2011

Memorandum

To: Marcella Buncick, U. S. Fish and Wildlife Service, Asheville Field Office, Asheville, North Carolina

From: Chief, Contracting and Grant Services Division

Subject: Designation as Project Officer for Cooperative Agreement No. F11AC00697
TITLE: Delisting of Hexastylis Maniflora

You have been designated as the Project Officer for the above referenced agreement. This guidance is provided to assist you in clarifying your Service responsibilities as a Project Officer.

FUNCTIONS AND DUTIES
You are authorized by this designation to take any or all actions with respect to the following which could lawfully be taken by me as Contracting Officer/Grants Officer except any action specifically prohibited by the terms of the agreement or by the referenced documents cited therein. Note that references to "recipient" below refer to the grantee/cooperator. These duties and authorities are not redelegable to any other individual, unless the agreement is modified to reflect the designation of a new Project Officer.

a. Ensure that the recipient performs the technical requirements of the agreement in accordance with its terms, conditions, and specifications. Answer technical questions, address issues, and ensure compliance with all technical aspects of the assigned agreement.

b. Ensure that work is not performed outside the scope or funding in the agreement.

c. Review all proposed requests for modifications and provide comments and/or approval to the Administrative or Contracting Officer.

d. Ensure that all reporting requirements are met as specified in the agreement. Review reports for adequacy, accuracy, and timeliness. Notify the Contracting Officer if reports are not submitted in a timely manner or do not provide proper information.

e. Coordinate and communicate as needed with the Service Contracting Officer and with the recipient's agreement coordinator. Work with the recipient's agreement coordinator to set up and conduct meetings as needed.

f. Review and approve Requests for Advance or Reimbursement (SF 270) submitted to the Service by the recipient or return rejected requests to the recipient with an explanation. Forward approved SF 270 to CGS for payment. Your approval of these requests constitutes your acknowledgment the recipient's performance and reporting has been satisfactory.

g. Ensure that advance payments are not authorized unless they (1) have been authorized in the agreement and (2) include a justification of expenditures to your satisfaction.

h. Track the status/usage of any government-owned equipment and review the final SF 270, the final SF 425, relative to the status of any government-owned equipment in possession of the recipient prior to agreement close-out.

i. Monitor expiration dates, determine if extensions are needed, and contact CGS 60 days in advance of expiration to request extensions.

LIMITATIONS

Under this appointment, except as noted herein, you are not authorized under any circumstances to perform any of the following tasks. If uncertain, contact the Service Contracting Officer for a case-by-case review and decision.

a. Take any action that may change the funding, scope, reporting requirements, or other essential terms and conditions of the agreement unless such changes are specifically stated in a written agreement modification signed by the Contracting Officer.

b. Make commitments on behalf of the recipient. This means making commitments with vendors, subgrantees, or private landowners. Only an authorized official of the recipient organization may make those commitments.

c. Direct recipient personnel. When lines of authority and responsibility blur, the recipient may be viewed as an agent of the federal government acting at its direction, thereby exposing the federal government to lawsuits for injury or wrongful action actually conducted by the recipient. Remember that under agreements, the lines of responsibility must remain clear at all times.

d. Serve in the capacity of an official of the recipient organization. Sometimes, however, Service personnel are requested to serve in an advisory capacity on boards of nonprofit organizations or planning committees. In such cases, the Service official must request a review by the Service's Division of Human Resources to ensure there are not restrictions or conflicts of interest unless written approval has been obtained per 212 FW 4 and provided to the Contracting Officer.

Exceptions to Limitations b and c

Under a cooperative agreement (including the Wildlife Cooperative Extension Agreement (WCEA) that is a type of cooperative agreement) where the Service is expected to be "substantially involved" with the project, the Service Project Officer may direct contractor or recipient personnel if specifically and clearly defined in the cooperative agreement. Thus, a "Statement of Federal Substantial Involvement" shall be included in all cooperative agreements (Item 2 of the WCEA Project Plan, Exhibit A; or within the Scope of Work, Service Responsibilities section of other cooperative agreements). This Statement of Federal Substantial Involvement must clearly describe those categories of activities in which the Service Project Officer expects to be substantially involved.

For example, the Service Project Officer may provide direction and guidance to the cooperator's personnel or vendors in the planting of trees and other vegetation (how, when, where, species, etc.), including the review and technical approval of each stage of the planting process; the installation of in-stream habitat improvement structures (how, when, where, specific location, etc.); and the construction of wetlands and hydrologic reestablishment.

In applying these exceptions, the Service Project Officer shall notify and discuss with the Cooperator any deviations from the Project Plan (Exhibit A) or Scope of Work.

CAUTION: Although the Service Project Office under a cooperative agreement may provide direction and guidance to the Cooperator's personnel or vendor as specified in the agreement, such direction by Service personnel could result in a cost overrun or claim by the contractor against the landowner. Any such cost overrun generally would be the responsibility of the Government to cover the additional costs to the landowner.

TERM OF DESIGNATION

This designation as Project Officer shall remain in effect through the life of the agreement unless revoked sooner by the Contracting Officer. An official change to the designated Project Officer must be made through a written modification to the agreement signed by the Contracting Officer. The Contracting Officer will notify the recipient of any changes to the Project Officer designation through issuance of a written modification.

RECORDS AND REPORTS

You are required to maintain adequate records to sufficiently record the performance of your duties as Project Officer during the life of this agreement or during your designation as the Service Project Officer. If your role as Project Officer changes before completion of the agreement, please turn your records over to the successor Project Officer or obtain disposition instructions from the Contracting Officer.

ETHICAL RESPONSIBILITIES

See "Standards of Ethical Conduct for Employees of the Executive Branch" (5 CFR 2635.201) and Service Manual Chapter 212 FW 4.

PROJECT OFFICER ACKNOWLEDGMENT
Please sign a copy of the delegation and return to the issuer within 10 days of receipt.

_____ _____

Project Officer's Signature Date

QUARTERLY RESEARCH PROGRESS REPORT

Date of Report ....February 10, 2013

Calendar Quarter ending June 30, 2012 **Research Project No.** _2012-17

Contract Start Date _August 16, 2011 Contract Expiration Date August 2013

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Research and Development

Project Title: Development of molecular and morphological tools to circumscribe and identify the Dwarf Flowered Heartleaf (*Hexastylis naniflora*)

RESEARCH CONTRACTOR:

Institution: Appalachian State University
P. I. Zack E. Murrell
Mailing Address:
Department of Biology
Appalachian State University
572 Rivers Street
Boone, NC 28608
Telephone No. (828) 262-2674
FAX (828) 262-2127
Email murrellze@appstate.edu

TECHNICAL ADVISORY COMMITTEE:

Heather Wallace (Chair)
- Donnie Brew
- Tim Bassette
- Marella Buncick
- Laura Gadd
- James Padgett
- Logan Williams
- Mrinmay Biswas
- Clarence Coleman
- John W. Kirby

(Submit as many copies as number of members in the committee)

WORK PROGRESS SUMMARY:

Task No.	Abbreviated Task Title	Task as a percent of Total Effort	Percent of Task Completed	Scheduled Start Date	Actual or Planned Start Date	Scheduled Completion Date	Actual or Planned Completion Date
1.	Develop sampling strategy		85	Aug 2011	Aug '11	Mar 2012	Mar 2012
2.	Sampling H. naniflora		60	Mar 2012	Feb '12	April 2013	April 2013
3.	Sampling of congeners		50	Mar 2012	Mar '12	April 2013	April 2013
4.	High resolution photos		40	Mar 2012	Feb '12	April 2013	April 2013
5.	SEM		10	Aug 2012	Aug '12	Dec 2012	Dec 2013
6.	Microsat Development		10	May 2012	May '12	June 2012	July 2012
7.	Microsat screen		0	July 2012	July '12	Dec 2012	April 2013
8.	Congener Microsat screen		0	July 2012	July '12	Dec 2012	April 2012
9.	Lab work		0	July 2012	Feb '12	June 2013	June 2013
n							

BUDGET SUMMARY

	(FY 2012)		(FY 2013)	
	Budgeted	Current	Budgeted	Current
Personnel (Itemized, including fringe benefits)				
ZACK MURRELL (ACADEMIC YEAR)	$14,686/$2,208	$14,686/$2,208	$8,655/$2,231	0
ZACK MURRELL (SUMMER)	$7,325	0	$7,792	0
GRADUATE STUDENT (JACKIE WAGNER)	$27,000	$22,500	$20,000	0
UNDERGRADUATE (TWO STUDENTS)	$5,200/$459	$3,860/$300	$5,200/$459	0/0
1. SUBTOTAL: (Personnel)	$63,257	$43,544	$46,747	
2. Supplies	$29,500	$6,500	$29,500	0
3. Travel:	$2,750	$2,652	$2,750	0
4. Services (Itemized)				
5. Contracted services	$12,000	0	5,000	0
5. Other (Itemized)				
6. Equipment (Itemized)				
SUBTOTAL DIRECT COST	$107,507	$52,696	$83,997	
7. INDIRECT COST	$21,501	$10,724	$16,799	
TOTAL COST:	$129,008	$63,420	$100,796	

OVERALL PROJECT SCHEDULE STATUS: AHEAD ..... ON TIME ..X. BEHIND .....

OVERALL PROJECT BUDGET STATUS: UNDER ..... EVEN ..X OVER .....

QUARTERLY RESEARCH PROGRESS REPORT

Calendar Quarter Ending June 30, 2012 **Research Project No.** 2012-17

Executive summary of significant research progress made in this quarter, by task:
(Include, as attachments, extended narratives, tables, charts, figures and bibliography, as appropriate)

Task 1. Develop sampling Strategy

Completed first year sampling. Begun strategy planning for 2013 growing season.

Task 2. Sampling H. naniflora

Finished field sampling.

Task 3. Sampling of congeners

Completed year one sampling of congeners. Begun planning for year two sampling.

Task 4. High resolution photos

Completed high resolution photos of all field collected materials. We now have both leaf and flower photos for analysis.

Task 5. Scanning Electron Microscopy (SEM)

We have begun the SEM imaging. We have a protocol and have begun capturing images.

Task 6. Microsatellite Development

Developing protocols and examining vendor capabilities.

Task 7. Microsatellite screening

Continuing DNA extractions.

Task 8. Congener Microsatellite screening

Continuing DNA extractions.

Task 9. Lab work

Developed extraction protocols for samples. Trained students in DNA technologies.

QUARTERLY RESEARCH PROGRESS REPORT

Calendar Quarter Ending Dec. 31, 2011 **Research Project No.** 2012-17

Problems and deviations encountered this quarter:
Including delayed deliverables and anticipated submission dates:

NONE

Work planned next quarter:
Including anticipated of utilization NCDOT personnel and resources:

Develop lab effort and analysis of morphological data.

Problems and deviations anticipated next quarter:

NONE.

QUARTERLY RESEARCH PROGRESS REPORT

Date of Report ....February 10, 2013

Calendar Quarter ending September 30, 2012 **Research Project No.** _2012-17

Contract Start Date _August 16, 2011 Contract Expiration Date August 2013

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Research and Development

Project Title: Development of molecular and morphological tools to circumscribe and identify the Dwarf Flowered Heartleaf (*Hexastylis naniflora*)

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GRADUATE STUDENT (JACKIE WAGNER)	$27,000	$27,000	$20,000	0
UNDERGRADUATE (TWO STUDENTS)	$5,200/$459	$4,200/$500	$5,200/$459	0/0
1. SUBTOTAL: (Personnel)	$63,257	$55,919	$46,747	
2. Supplies	$29,500	$15,500	$29,500	0
3. Travel:	$2,750	$3,500	$2,750	0
4. Services (Itemized)				
5. Contracted services	$12,000	$1000	5,000	0
5. Other (Itemized)				
6. Equipment (Itemized)				
SUBTOTAL DIRECT COST	$107,507	$75,919	$83,997	
7. INDIRECT COST	$21,501	$15,000	$16,799	
TOTAL COST:	$129,008	$90,919	$100,796	

OVERALL PROJECT SCHEDULE STATUS: AHEAD ..... ON TIME ..X. BEHIND .....

OVERALL PROJECT BUDGET STATUS: UNDER ..... EVEN ..X OVER .....

QUARTERLY RESEARCH PROGRESS REPORT

Calendar Quarter Ending September 30, 2012 **Research Project No.** 2012-17

Executive summary of significant research progress made in this quarter, by task:
(Include, as attachments, extended narratives, tables, charts, figures and bibliography, as appropriate)

Task 1. Develop sampling Strategy

Completed strategy planning for 2013 growing season.

Task 2. Sampling H. naniflora

Finished field sampling.

Task 3. Sampling of congeners

Planning for year two sampling of congeners.

Task 4. High resolution photos

Morphometric analysis of leaf and flower begun. Using MorphoJ to designate landmarks and analyze shapes.

Task 5. Scanning Electron Microscopy (SEM)

We have captured SEM images of internal flower surface and shapes. We are examining a new technique called Direct Microscopy that can provide measurement of the X, Y and Z axes. If we can get access to this technology, we can use it in various analyses of internal flower structure.

Task 6. Microsatellite Development

We made a decision to develop the microsatellites in house. We have begun that process.

Task 7. Microsatellite screening

Completed DNA extractions.

Task 8. Congener Microsatellite screening

Completed DNA extractions.

Task 9. Lab work

Most of the effort has been toward development of microsatellite primers.

QUARTERLY RESEARCH PROGRESS REPORT

Calendar Quarter Ending Dec. 31, 2011 **Research Project No.** 2012-17

Problems and deviations encountered this quarter:

Including delayed deliverables and anticipated submission dates:

We made a decision to develop the primers "in house". We may need to move funds from the contracted services to supplies, due to this shift in strategy.

Work planned next quarter:

Including anticipated of utilization NCDOT personnel and resources:

1. Complete development of microsatellite primers.
2. Develop new microscope technique to obtain 3-D measures for inner calyx.
3. Continue GIS efforts for species habitat suitability analysis.
4. Continue multivariate analysis of leaf and flower shapes.

Problems and deviations anticipated next quarter:

NONE.

NC Natural Heritage Program *Hexastylis naniflora* Flex Fund

2013 Annual report
Submitted by NC Natural Heritage Program
to the US Fish and Wildlife Service – Asheville Office
January 15, 2014

Update on monitoring and threat assessment protocols:

Monitoring Methodology:

In 2012, NC Natural Heritage Program (NHP) initiated the Dwarf-flowered Heartleaf (*Hexastylis naniflora*) status survey in North and South Carolina. NHP botanist, James Padgett, delineated *H. naniflora* populations with GPS and polygons were mapped in the first year of the study. Following the delineation of each *H. naniflora* population, NHP set up at least one randomly placed monitoring plot within each Element Occurrence to capture and sample approximately 10% of the population, following the North Carolina Department of Transportation (DOT) established monitoring protocol. Monitoring plots were either 200'x50' or 100'x25' in size, depending on the size of the population. This methodology is consistent with DOT monitoring methodology, as determined during the field coordination meeting on March 15, 2012. All plants were counted in each plot, and the number was extrapolated to determine an estimate of how many plants occur at each site, based on the entire size of the delineated population. In addition to the DOT protocol, given that some plants may have been overlooked within the plots during the plant counts, extrapolations with five percent margin of error above and below the extrapolated estimate were also calculated to account for any plants that may have been overlooked or missed.

2013 was the second year of the status survey. In the summer of 2013, surveys for *Hexastylis naniflora* populations were conducted by Padgett, with assistance from Kimberly Israel (NHP). Site visits included the same 13 Element Occurrences in North and South Carolina that were surveyed in 2012. All populations and tracts where landowner permission was granted were included in the surveys. Table 1 shows details regarding landowner access and summary of work for each site for 2012-2013.

Visits to the monitoring plots were initially scheduled for April and May of 2013. Upon visiting the first three sites in April, we found the plant counts within the plots to be reduced by 30-60% from the previous year. After closer examination we noticed that the emergent leaves were not yet out at the time of the initial counts due to the unseasonably cold weather in the spring. We decided to postpone surveys in monitoring plots until the weather warmed up sufficiently to allow the leaves to fully emerge. All of the plots were revisited and counted in June and July of 2013, with the results greatly improved from earlier visits.

Monitoring Results:

Table 2 shows the results of 2013 field surveys, including the acreage of the populations delineated in 2012, the numbers of individuals counted in each plot in 2012 and 2013, and the difference between the two monitoring years, and the 2013 extrapolated estimate of number of individuals in the entire population based on the plot counts.

As previously reported in 2012, we were not able to access the entire population at Broad River/Floyd's Branch site and Island Creek Lovelady site because we did not gain landowner permission for all the tracts. Although most of the sites were visited, we were unable to visit every location at the Cliffside Steam Station on Duke Energy property this year, because of restrictions with needing a land manager escort at all times on site. At these three sites, however, NHP had detailed population data from recent surveys for areas that we could not include in this year's surveys. The Island Creek Bluff/Love Lady Tracts had been surveyed and delineated by James Padgett and other NHP staff in 2005. The other two sites, Cliffside Steam Station and Broad River/Floyds Creek have recently been mapped by a contract biologist in 2011 and by DOT biologists in 2005, respectively.

The supplemental acreage from recent surveys in these three sites listed above substantially increased the size of the population and extrapolated numbers of *Hexastylis naniflora* individuals. We believe this additional data more accurately portrays the actual size of the population. The accuracy of the mapping at these three sites is likely high, but to account for some uncertainty and to show what data was collected in 2012 and 2013 by NHP, we present the additional data in two data sets. Table 2 shows the total population size and extrapolated numbers of individuals for data collected in 2012-2013 and data provided by partners. Table 3 shows only the population size estimates for population sampled by NHP at Cliffside Steam Station, Broad River, Floyds Branch, Long Branch, and Island Creek Bluff/Lovelady Site in 2012 and 2013.

Delineations of these populations were completed and maps provided in 2012. For maps of each site, please refer to the 2012 annual report.

Table 1: Summary of *Hexastylis naniflora* populations surveyed by NHP in 2012 and 2013.

Site Name	County	NHP Element Occurrence #	Sub EO(s) # (if applicable)	Landowner permission obtained	Comment
North Carolina Sites					
Island Creek Bluff/ Love Lady Site	Burke	029	N/A	Mostly	This site had been previously surveyed and delineated in 2005; In 2012 and 2013 we did not gain access to the entire population; however NHP mapped additional 18 acres of previously unknown plants.
South Fork Catawba River: Jacob Fork, Camp Creek	Catawba	158	N/A	Yes	Mapped and all of the plants were counted (complete census).
Catawba Wildlife Club	Catawba	243	012, 242, 269, 270	No	Preliminary landowner permission was obtained in September 2012, after optimal survey season and NHP was unable to make contact or gain access in 2013. This site was not surveyed in 2013.
Cliffside Steam Station	Cleveland/ Rutherford	276	N/A	Yes	The entire population was not remapped due to limited access to the entire Duke Energy property. However, we do have supplement population data from recent years collected by other biologists. See note in monitoring results section and Table 2 and 3.
Rhyne Preserve	Lincoln	262	131, 260	Yes	This site was added to replace the Lincoln Co. Airport site, where permission to survey was denied.
Mills Creek Forest and Seep	Polk	23	N/A	Yes	Remapped and sampled entire population
Broad River: New Hope Springhead Swamp	Polk	125	N/A	Yes	Remapped and sampled entire population.
Second Broad River (Forest City Industrial Complex)	Rutherford	154	N/A	Yes	Remapped and sampled entire population.
Broad River: Henson's Creek Ravine, Brice Rare Plant Site, and Sandy Mush Outcrop	Rutherford	099	10, 37, 55, 75, 76, 79, 90, 121, 181	Mostly	Where landowners have granted permission, we remapped and sampled the population.

Site Name	County	NHP Element Occurrence #	Sub EO(s) # (if applicable)	Landowner permission obtained	Comment
Broad River: Cleghorn Creek tributary/US221	Rutherford	176	167-170	Yes	Mapped and sampled all but one of the sites.
Broad River: Floyds Creek, Long Branch	Rutherford	177	16, 107, 122, 163-166	Mostly	Mapped and sampled most of the population. Not all tracts at this site have been visited yet.
South Carolina Sites					
Cowpens Battlefield	Cherokee	016, 017, 018	N/A	Yes	Remapped and sampled entire population.
South Pacolet River and Tributaries	Greenville/ Spartanburg	002, 004, 024, 032, 033, 036, 038, 039, 040, 041	N/A	No	We do not anticipate getting landowner permission to visit this population. See explanation under SC data heading.
Peters Creek Heritage Preserve/ Mineral Springs Creek	Spartanburg	011, 014, 026-028, 047, 048, 057	N/A	Yes	Remapped and sampled entire population.
Blalock Reservoir	Spartanburg	007, 029	N/A	Yes	Obtained detailed maps of population locations from Reservoir officials (Spring 2012). NHP staff revisited and sampled the population.

Table 2: 2013 *Hexastylis naniflora* population size estimates

Site Name	NHP EO #	Sub EO(s) # (if applicable)	Acres of *H. naniflora* mapped by NHP	Acres previously reported by partners	Total delineated population acreage (including previous data from partners)	Sample plot size(s) (acres)	Actual plant count in plots (2012)	Actual plant count in plots (2013)	Difference (+ or -) in plant count from previous year	Extrapolated total number of plants (estimate)[1] (2013)	5% Margin of error <u>below</u> extrapolated number of plants (number of plants)[1] (2013)	5% Margin of error <u>above</u> extrapolated number of plants (number of plants)[1] (2013)
Island Creek Bluff/ Love Lady Site[1]	029	N/A	18	47	**65**	1.8	1,015	**1,715**	+700	**61,930**	58,834	62,027
South Fork Catawba River: Jacob Fork, Camp Creek	158	N/A	0.2	NA	**0.2**	0.2	256	**204**	-52	**204**	194	214
Cliffside Steam Station[1]	276	N/A	10.22	41.78	**52**	3.72	2,287	**2,909**	+622	**40,663**	38,630	42,697
Rhyne Preserve	262	131, 260	19.31	NA	**19.31**	1.5	1,378	**1,492**	+114	**19,207**	18,247	20,167
Mills Creek Forest and Seep	023	N/A	1.17	NA	**1.17**	0.14	208	**211**	+3	**1,763**	1,675	1,852
New Hope Springhead Swamp	125	N/A	4	NA	**4**	0.4	950	**983**	+33	**9,830**	9,339	10,322
Second Broad River (Forest City Industrial Complex)	154	N/A	5.3	NA	**5.3**	0.53	315	**353**	+38	**3,530**	3,353	3,707

Site Name	NHP EO #	Sub EO(s) # (if applicable)	Acres of *H. naniflora* mapped by NHP	Acres previously reported by partners	Total delineated population acreage (including previous data from partners)	Sample plot size(s) (acres)	Actual plant count in plots (2012)	Actual plant count in plots (2013)	Difference (+ or -) in plant count from previous year	Extrapolated total number of plants (estimate)[1] (2013)	5% Margin of error below extrapolated number of plants (number of plants)[1] (2013)	5% Margin of error above extrapolated number of plants (number of plants)[1] (2013)
Broad River: Henson's Creek, Brice, & Sandy Mush Outcrop	099	10, 37, 55, 75, 76, 79, 90, 121, 181	24.61	NA	**24.61**	2.29	2551	**3,302**	+751	**35,486**	33,712	37,260
Broad River: Cleghorn Creek, US 221	176	167-170	6.84	NA	**6.84**	0.68	638	**780**	+142	**7,846**	7,454	8,238
Broad River: Floyds Creek, Long Branch[1]	177	16, 107, 122, 163-166	2.35	2.86	**5.21**	0.24	204	**240**	+36	**5,210**	4,950	5,471
South Carolina Sites												
Cowpens National Battlefield	016, 017, 018	N/A	6.05	NA	**6.05**	0.69[2]	459	**328**	-131	**2,876**	2,732	3,020
Peters Creek Preserve	011, 014, 026-028, 047, 048, 057	N/A	8.98	NA	**8.98**	0.91	432	**534**	+102	**5,270**	5,006	5,533

Site Name	NHP EO #	Sub EO(s) # (if applicable)	Acres of *H. naniflora* mapped by NHP	Acres previously reported by partners	Total delineated population acreage (including previous data from partners)	Sample plot size(s) (acres)	Actual plant count in plots (2012)	Actual plant count in plots (2013)	Difference (+ or -) in plant count from previous year	Extrapolated total number of plants (estimate)[1] (2013)	5% Margin of error <u>below</u> extrapolated number of plants (number of plants)[1] (2013)	5% Margin of error <u>above</u> extrapolated number of plants (number of plants)[1] (2013)
Blalock Reservoir	007, 029	N/A	7.59	NA	**7.59**	0.76	404	**340**	-64	**3,396**	3,226	3,565
TOTAL for all sites							5,094	**5,133**		**60,079**	**57,075**	**63,083**

[1]Extrapolated total number of plants and 5% margins of error were calculated based on the total acreage from population delineated in2012 and counted in 2012 and 2013, plus additional population data provided by partners for Cliffside Steam Station, Broad River, Floyds Branch, Long Branch, and Island Creek Bluff/Lovelady Sites. A subset of the data sampled by NHP for these sites is presented separately in Table 3.

Table 3: 2013-2013 Hexastylis naniflora population size estimates for population sampled by NHP at Cliffside Steam Station; Broad River, Floyds Branch, Long Branch; and Island Creek Bluff/Lovelady Site.

Site Name	NHP EO #	Sub EO(s) # (if applicable)	Acres of *H. naniflora* mapped by NHP	Actual plant count in plots (2012)	Actual plant count in plots (2013)	Difference (+ or -) in plant count from previous year	Extrapolated total number of plants (estimate)[1] (2013)	5% Margin of error <u>below</u> extrapolated number of plants (number of plants)[1] (2013)	5% Margin of error <u>above</u> extrapolated number of plants (number of plants)[1] (2013)
Cliffside Steam Station	276	N/A	10.22	1,430	**1,715**	+285	**17,184**	16,324	18,043
Broad River, Floyds Creek, Long Branch	177	16, 107, 122, 163-166	2.35	204	**240**	+36	**2,350**	2,233	2,468
Island creek Bluff/Love Lady Site	029	N/A	18	1,015	**1,715**	+700	**17,150**	16,293	18,008

Threat and trend assessment protocols:

NHP initiated discussions with USFWS and DOT in March 2012 to develop a standardized assessment of trends and threats, using categorical rankings. NHP organized a conference call with biologists from DOT, USFWS, and Appalachian State University on June 25, 2012 to confirm using the threat assessment protocol that was developed by the North Carolina Plant Conservation Program (PCP) Scientific Committee and applied to all tracked plant species in 2008-2010. During the conference call, all parties agreed to use the protocol that was established by PCP. The threat assessment for *Hexastylis naniflora* sites visited in 2012 and 2013 is shown in Table 3. The methodology and definitions for the threat assessment protocol were previously provided and discussed (Appendix A, 2012 *Hexastylis naniflora* annual report).

No significant changes in threats within populations were noted between 2012 and 2013. Threats observed during these two years included development, incompatible forestry practices, agriculture use, trampling, invasive exotic species, sedimentation, erosion, and road construction. For each site, up to three threats were identified and the severity, scope and immediacy were ranked to create an overall threat rank (see Table 4). The highest ranked threat for each population or subpopulation overrides other threats and used for the overall threat rank.

Overall trends for each site have not yet been assessed at this time, and will be assessed upon completion of the status survey (2014).

Table 4: Threat assessment for *Hexastylis naniflora* sites visited in 2012-2013

Site Name	NHP EO #	NHP sub EO # (if applicable)	Threat 1	Threat 1 Severity	Threat 1 Scope	Threat 1 Immediacy	Overall Threat 1 rank	Threat 2	Threat 2 Severity	Threat 2 Scope	Threat 2 Immediacy	Overall threat 2 rank	Threat 3	Threat 3 Severity	Threat 3 Scope	Threat 3 Immediacy	Overall threat 3 rank	Overall Threat Assessment (all threats)
North Carolina Sites																		
Island Creek Bluffs/ Love Lady Site	29	NA	Incompatible Forestry Practices	low	high	low?	F											F
South Fork Catawba River: Jacobs Fork; Camp Creek	158	NA	Incompatible Forestry Practices	mod.	high	high	A	Erosion	mod.	high	high	A						A
Cliffside Steam Station	276		Invasive Exotic Species	low	mod.	low	F	Development	mod.	mod.	mod.	B						B
Rhyne Preserve	262	131	Invasive Exotic Species	mod.	mod.	mod.	B											B
		260	Invasive Exotic Species	low	low	low	G	Incompatible Forestry Practices (in areas not within the preserve)	mod.	low	mod.?	B						B
Mills Creek Forest and Seep	23	NA	Agricultural - Cattle	low	low	mod.	G	Incompatible Forestry Practices	low	low	low	G						G
Broad River: New Hope Springhead Swamp	125	NA	Invasive Exotic Species	low	low	low	G	Development	low	high	low	F	Incompatible Forestry Practices/ Clearing	low	mod.	mod.	E	F
Second Broad River (Forest City Industrial Complex)	154	NA	Development	high	high	high	A	Invasive Exotic Species	mod.	mod.	mod.	B	Sedimentation	mod.	high	high	A	A
Broad River: Henson's Creek Ravine, Brice Rare Plant Site, and Sandy Mush Outcrop	099	10	Incompatible Forestry Practices	high	mod.	high	B	Agricultural Use	mod.	high	low	C	Invasive Exotic Species	mod.	low	high	E	B
		37	Agricultural Use	mod.	high	high	A	Incompatible Forestry Practices	low	high	low	F						
		55	Agricultural Use	low	mod.	low	F	Incompatible Forestry Practices*	mod.	mod.	mod./high	B	Invasive Exotic Species	low	mod.	high	F	
		62	Incompatible Forestry	mod.	mod.	low	D											D

			Practices															
		75	Habitat Degradation/Sedimentation	high	high	high	A	Industrial Development	high	mod.	high	B	Invasive Exotic Species	low	mod.	mod.	F	A
		76	Road Construction	mod.	low	high	E	Invasive Exotic Species	mod.	low	high	E						E
		79	Incompatible Forestry Practices	mod.	mod.	high	B											B
		121	Incompatible Forestry Practices	low	mod.	mod.	F											F
		181	Incompatible Forestry Practices	low	mod.	mod.	F	Erosion	high	low	high	E						E
Broad River: Cleghorn Creek tributary/US221	176	167	Incompatible Forestry Practices	low	high	low	F	Invasive Exotic Species	low	mod.	low	E						D
		168	Incompatible Forestry Practices	low	high	mod.	F	Development	low	high	mod.	F						F
		169	Extirpated?	high	high	high	A (failed to find)											A
		170	Incompatible Forestry Practices	mod.	high	mod.	A	Invasive Exotic Species	low	low	high	G	Development	mod.	mod.	mod.	B	A
Broad River: Floyds Creek, Long Branch	177	16	Extirpated?	high	high	high	A											A
		163	Incompatible Forestry Practices	mod.	mod.	high	B *	Development	mod.	low	high	E						B
		164	Incompatible Forestry Practices	mod.	mod.	mod.	B	Development *	low	high	low	F						F
		165	Incompatible Forestry Practices	low	low	low	G	Development	low	high	mod.	F						F
		166	Not assessed															
		107	Incompatible Forestry Practices	low	mod.	mod.	F	Development	low	mod.	mod.	F						F

		122	Incompatible Forestry Practices	low	mod.	mod.	F	Development	low	mod.	mod.	F	Erosion/ Sedimentation	mod.	high	mod.	A	A
South Carolina Sites																		
Cowpens National Battlefield	016, 017, 018	NA	Trampling	mod.	mod.	high	B	Invasive Exotic Species	low	low	low	G						B
Peters Creek Preserve	011, 014, 026-028, 047, 048, 057	NA	Trampling	low	low	mod.	G	Invasive Exotic Species	low	mod.	low	F						F
Blalock Reservoir	007, 029	NA	Development	mod.	low	high	E	Invasive Exotic Species	low	mod.	mod.	F						E

***NOTES on threats for specific sites**:

Broad River: Floyds Creek, Long Branch; EO 177.163: The effects of timber harvest are unclear as there seems to be a population increase after the surrounding areas were clear cut.

Broad River: Floyds Creek: Long Branch; EO 177.164: This site is for sale and given its location along both US 221 and US 74, it is a likely site for development.

Broad River: Henson's Creek; Brice; etc. EO 99.55: Population density is high over a small area; possibly a short-term increase due to opening of canopy from adjacent timber harvest.

Current field schedule and access issues:

The field schedule has not changed since submission in previous quarterly reports. In 2013, the field season was modified for later in the season due to weather patterns, as explained above.

Update on most recent site data obtained from SC.

As previously stated in the 2012 annual report, we do not anticipate getting access to the South Pacolet River and Tributaries (Element Occurrences 002, 004, 024, 032, 033, 036, 038, 039, 040, and 041) because locations for these populations obtained from SCNHP had very low accuracy, making it extremely difficult to identify who the landowners were or where the populations occur. We were unable to track down any additional information for this site, despite several attempts to contact previous surveyors in SC. Data from status surveys are also being sent to the landowners and to the South Carolina Natural Heritage Program.

Issues in meeting project objectives and proposed solutions.

No new issues identified at this time.

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

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Potential Elicitation Questions for Species Experts

1. How would you suggest delineating populations for this species?
2. What factors are important for characterizing resilience for this species? These include population factors (e.g. population size/density) and habitat factors (e.g. soil type).
3. How would you suggest delineating representative units for this species (e.g. physiographic, latitudinal, elevational, habitat types)?
4. In thinking about future scenarios and viability of this species, what are the most pertinent risk factors to consider (e.g. development, drought, invasive species)?
5. Based on the primary risk factors identified in question #4, what do you think an appropriate future time frame to project future conditions might be?

Responses to HENA Dear Interested Party Letters
Week of January 8, 2018

January 11, 2018

- Call from David Brown with the USACE. Reminded me of three HENA mitigation projects that we spoke about in September.
    - Henrietta Quarry – Has HENA preservation in place. Site looks good according to David. FWS Log # 4-2-05-355, USACE Action ID 2005-532586. EO229. 10% of impacted plants were transplanted, unimpacted plants were preserved on site (9/8 Brown)
    - Facebook Site aka Rutherford 74 Corporate Center – Site has a deed restriction and signage. Site looks good according to David. FWS Log #s – 04-24-7, 4-2-16-010, USACE Action ID 2011-00569. EO154. Included in NHP report.
    - Rock Barn Solar Farm – In Hickroy, 2-3 years old. 1,000+ plants on 6-7 acres. Some portion of population protected. 35.718311, -81.156472. Originally 1,021 plants, 200 impacted by project. Deed restriction was recorded (9/21 Tompkins). Not in NHP database.
- Email from Jennifer Robertson with Atlas Environmental. She knows of two sites with HENA. Henrietta Quarry (now owned by the Rogers Group) and the McLeod ski lake in Catawba County.
    - Henrietta Quarry – see above
    - McLeod ski lake – EO183. Surrounding land has been designated as common open space. Eastern-most portion of the polygon falls partially in a DMS easement.
- Added Brett Moule with NRCS to the distribution list.

6.1.2 FWS responsibilities and approval process (updated July 2018)

Unless otherwise agreed among the regions, all phases of PDM planning and implementation, except coordination with states, tribes, and other cooperating agencies and organizations in non-lead regions, are the responsibility of the lead Region charged with recovery plan development and preparation of the delisting package. Monitoring following delisting of a species is required by the ESA, however production of a formal PDM plan is not (see section 1.2 *Legal requirements*); therefore, the lead Region is responsible for determining the degree of planning needed for each delisted species. A PDM plan is recommended as a means to ensure effective monitoring and coordination with the state(s) in which the species occurs; however the extensiveness of the planning should be consistent with species needs. And, although section 3.2 (*Consideration during the delisting process)* of this guidance discusses the need to prepare a PDM plan, we recognize that if effective coordination with our state partners (and other partners as necessary) occurs, preparation of a formal plan may not be necessary.

The lead Region may seek public comment on its PDM plan; however, section 6.3, *Notifications*, of this guidance recognizes that the ESA does not require notification of availability of, or public comment on, the PDM plan. If the lead Region chooses to seek public comment on its PDM plan, a Notice of Availability (NOA) of the plan may be included in the proposed delisting rule published in the *Federal Register* (see section 3.2*, Consideration during the delisting process)*. Review of comments, if received, revisions to the draft plan, preparation of the administrative record, and approval of the final PDM plan are the responsibility of the lead Regional Director, with the review and concurrence by the non-lead Regional Directors. If the lead region determines that a draft PDM plan does not need to be noticed in the *Federal Register*, the lead region will ensure that collaborating with states and other partners responsible for PDM implementation for input on planning for post-delisting monitoring occurs through other means and is documented in the administrative record. Regional Directors may delegate PDM plan approvals and concurrence as appropriate.

The lead region is responsible for including in the Effects of the Rule section of the proposed and final rules a summary of the requirements of section 4(g) of the Act and a general summary of how the FWS intends to meet those requirements, in cooperation with the states and our partners. The lead region is responsible for ensuring that PDM plans are posted in ECOS.

Non-lead regions will coordinate involvement of states, tribes, and other cooperating agencies and organizations in their regions, and provide the lead region with copies of all relevant correspondence, reports, meeting summaries, etc. Non-lead regions will provide the lead region with timely comments and concurrence/non-concurrence memoranda.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

JUL 0 5 2018

In Reply Refer To:
FWS/AES/DRR/BRCPC/068444

Memorandum

To: Assistant Regional Directors, Regions 1-8

From: Acting Assistant Director – Ecological Services Gina Shultz

Subject: Clarification and Revision of Post-Delisting Monitoring Plan Notice Requirements and Guidance

Attached is the revised version of *Section 6.1.2 FWS responsibilities and approval process* of the August 2008 U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service joint *Post-Delisting Monitoring Plan Guidance*. This revised section applies only to the USFWS and supersedes the 2008 version.

We are required by section 4(g) of the Endangered Species Act (ESA) to monitor, in cooperation with the states, any species delisted due to recovery. We are not required to produce a post delisting monitoring (PDM) plan by the ESA or our implementing regulations; publication of a Federal Register notice for review of a PDM plan is also not required. While a formal plan noticed in the Federal Register is not required, we must still document our coordination, planning, and implementation of PDM. Our experiences with the wide variety of circumstances, types of partnerships, and the availability of various means of communicating and collaborating with states and other partners, indicates that noticing draft and final post-delisting monitoring plans in the Federal Register may not be the most effective way to collaborate. This revision clarifies that there is flexibility in the 2008 guidance for announcing the availability of post-delisting monitoring plans in the Federal Register.

This guidance is posted in the Endangered Species Act Document Library at: https://www.fws.gov/endangered/esa-library/index.html. If you have any questions, please contact Ms. Lisa Ellis, Chief, Branch of Recovery, Conservation Planning, and Communication at (703) 358-2307 or lisa_ellis@fws.gov.

Attachments