

From: [Keith A. Bradley](#)
To: [Straight, Carrie A](#)
Subject: RE: [EXTERNAL] RE: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Tuesday, August 10, 2021 9:31:39 AM

Hi Carrie – I apologize for the delay but at the beginning of last week I broke my arm surveying mountain pitcher plants and had surgery yesterday. So I've gotten a bit behind but I do intend to get it to you this week maybe by tomorrow.

From: Straight, Carrie A <carrie_straight@fws.gov>
Sent: Tuesday, August 10, 2021 9:24 AM
To: Keith A. Bradley <BradleyK@dnr.sc.gov>
Subject: RE: [EXTERNAL] RE: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

Keith,

I hope you are feeling better and wanted to check in to see if you had time to finalize your review. Just let me know.

Thank you again for serving as a peer reviewer for these documents.

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)

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From: Straight, Carrie A <carrie_straight@fws.gov>
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Subject: RE: [EXTERNAL] RE: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Tuesday, August 3, 2021 1:23:00 PM

Thanks for the heads up Keith.

Carrie

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From: [Straight, Carrie A](#)
To: [Mizzi, Janet](#); [Peeples, Gary](#)
Subject: Dwarf-flower heartleaf PDM - peer review
Date: Monday, June 14, 2021 3:28:00 PM
Attachments: [Draft PDM dwarf flowered heartleaf Hexastylis naniflora draft v2 20190530.docx](#)
[2021-08459 proposed delisting rule dwarf flowered heartleaf.pdf](#)

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,

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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

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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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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

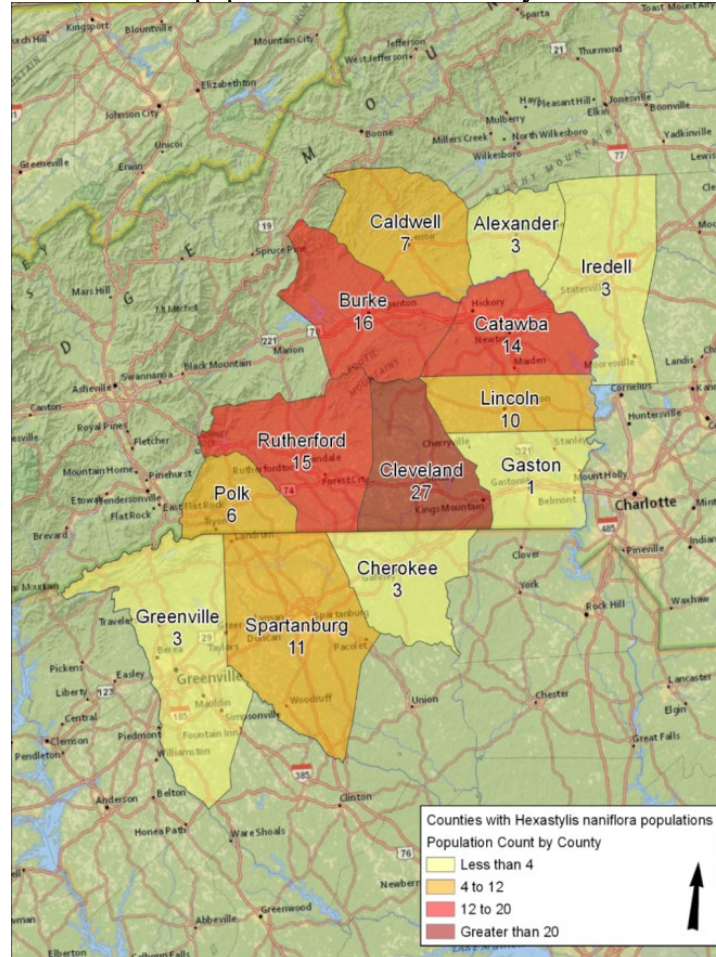
When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant “populations” (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears 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 (NCPCHP) 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.
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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.

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.

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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––0.2 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; Dalglish *et al.* 2010, p. 216).

Within the family Aristolochiaceae, 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 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 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.

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 resiliency 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.

○ 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 <i>Eugenia woodburyana</i> 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: [Keith A. Bradley](#)
Subject: RE: [EXTERNAL] RE: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Monday, August 23, 2021 5:22:00 PM

Hello Keith,

I hope this email is finding you better than the last time we spoke and that your arm is healing. Just wanted to check in and see where we stood with the peer review of this document.

Thank you again for your time,

Carrie

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Carrie A. Straight, PhD

She, her, hers

Regional Recovery Coordinator
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1875 Century Boulevard
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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: Straight, Carrie A
Sent: Tuesday, August 10, 2021 9:45 AM
To: Keith A. Bradley <BradleyK@dnr.sc.gov>
Subject: RE: [EXTERNAL] RE: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

Wow! A string of bad luck, please take care of yourself. If you have some time to review sometime soon, that would be great.

Thanks again,

Carrie

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Carrie A. Straight, PhD

She, her, hers

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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: Keith A. Bradley <BradleyK@dnr.sc.gov>
Sent: Tuesday, August 10, 2021 9:31 AM
To: Straight, Carrie A <carrie_straight@fws.gov>
Subject: RE: [EXTERNAL] RE: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

Hi Carrie – I apologize for the delay but at the beginning of last week I broke my arm surveying mountain pitcher plants and had surgery yesterday. So I've gotten a bit behind but I do intend to get it to you this week maybe by tomorrow.

From: Straight, Carrie A <carrie_straight@fws.gov>
Sent: Tuesday, August 10, 2021 9:24 AM
To: Keith A. Bradley <BradleyK@dnr.sc.gov>
Subject: RE: [EXTERNAL] RE: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

Keith,

I hope you are feeling better and wanted to check in to see if you had time to finalize your review. Just let me know.

Thank you again for serving as a peer reviewer for these documents.

Carrie

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Carrie A. Straight, PhD
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404.679.7226 (office) or via Teams (carrie_straight@fws.gov)

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From: Keith A. Bradley <BradleyK@dnr.sc.gov>

Sent: Monday, August 2, 2021 9:08 AM

To: Straight, Carrie A <carrie_straight@fws.gov>

Subject: RE: [EXTERNAL] RE: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

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From: Straight, Carrie A <carrie_straight@fws.gov>

Sent: Monday, July 26, 2021 4:07 PM

To: Keith A. Bradley <BradleyK@dnr.sc.gov>

Subject: RE: [EXTERNAL] RE: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

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Thank you for your time.

Carrie

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Regional Recovery Coordinator
South Atlantic-Gulf and Mississippi Basin Regions
U.S. Fish and Wildlife Service
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From: Keith A. Bradley <BradleyK@dnr.sc.gov>

Sent: Wednesday, June 30, 2021 4:15 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

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Keith A. Bradley, Botanist

SC Dept. of Natural Resources

Heritage Trust Program

1000 Assembly St., Columbia, SC 29201

BradleyK@dnr.sc.gov

mobile: 803-587-0755

office: 803-734-4032

From: Straight, Carrie A <carrie_straight@fws.gov>

Sent: Friday, June 25, 2021 3:37 PM

To: Keith A. Bradley <BradleyK@dnr.sc.gov>

Subject: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf;
response requested by COB 7/16/2021

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Date: Monday, August 2, 2021 9:09:47 AM

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From: [Straight, Carrie A](#)
To: bradleyk@dnr.sc.gov
Subject: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Friday, June 25, 2021 3:36:00 PM
Attachments: [Draft_PDM_dwarf_flowered_heartleaf_2021_for_peer_review.docx](#)
[20210625_dwarf_flowered_heartleaf_PDM_conflictinterestform.docx](#)

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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

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

2
3 **June 2019**
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40 **Recommended Citation:**

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42 US Fish and Wildlife Service. 2019. Draft Post-Delisting Monitoring Plan for Dwarf-Flowered
43 Heartleaf (*Hexastylis naniflora*). Asheville Ecological Services Field Office, Asheville, North
44 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.

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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,

1 inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989).
2 The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).
3

4 **B. Discussion of Populations**

5

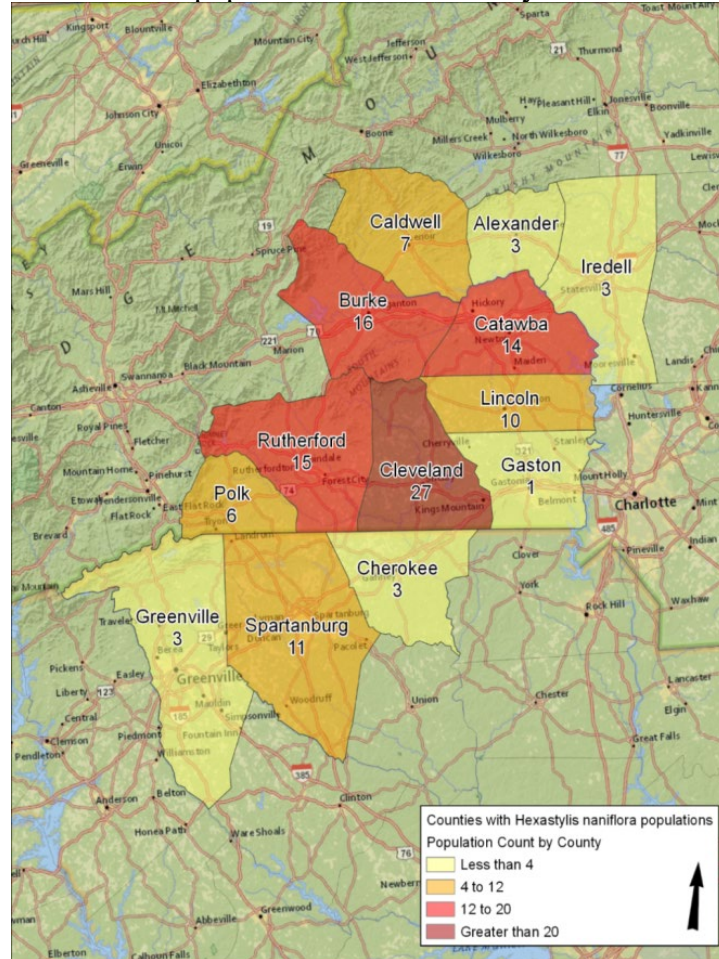
6 When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant
7 “populations” (Service 1989). Explicit criteria for recognizing these populations were not given in
8 the listing rule, but based on information in Asheville Ecological Services Field Office files, it
9 appears that each site-specific location containing the species was counted as a separate population
10 (Service 2011).
11

12 Since listing, many of those working with dwarf-flowered heartleaf have used the terms “sub site,”
13 “site,” “location,” “occurrence” (often, but not always, in reference to NCNHP Element
14 Occurrence (EO) records), and “population” interchangeably, while others have aggregated sites
15 into populations according to subjective criteria which have never been explicitly defined. This
16 generated considerable discrepancies among sources with respect to abundance and distribution of
17 the species, to the extent that data are usually not comparable from one source to the next (Service
18 2011).
19

20 NatureServe and its member Natural Heritage Programs (NHP) have devised mapping standards
21 to balance the need for fine-scale, highly site-specific EO records (required for monitoring and
22 management) with the need to aggregate these records into meaningful units of conservation
23 interest that may approximate biological populations (NatureServe 2004). The Service does not
24 maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards
25 the NHP databases as the best repository for this information.
26

27 As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and
28 South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).
29
30

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 (NCPCHP) 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

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

2
3 For this category, PDM would be concluded at the end of the timeframe specified in this draft
4 Plan.

5
6 **B. Category II**

7
8 PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of
9 delisting, but information does not indicate that the species meets the definition of threatened or
10 endangered.

11 This would be true if:

- 12
13 1) Number of plants within a population is below the standard deviation of the mean,
14 and
15
16 2) There are no new or increasing threats that are considered to be of a magnitude and
17 imminence that may threaten the continued existence of dwarf-flowered heartleaf
18 within the foreseeable future.

19
20 For this category, the PDM period may be extended for an additional four years (two monitoring
21 cycles), and if necessary, sampling intensity could be increased to provide greater precision in
22 detecting trends. Existing data will be analyzed to determine if any management actions should
23 be implemented that would be expected to reverse declines and stabilize or improve population
24 trends for the species.

25
26 **C. Category III**

27
28 PDM yields substantial information indicating that threats are causing a decline in the status of
29 dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or
30 endangered may be warranted.

31 This would be true if:

- 32
33 1) Number of plants within a population is below the standard deviation of the mean,
34 and
35
36 2) There are new or increasing threats that are considered to be of a magnitude and
37 imminence that they could threaten the continued existence of dwarf-flowered
38 heartleaf within the foreseeable future.

39
40 For this category, all actions from Category II will be implemented. Additionally, the Service will
41 initiate a formal status review and determine whether a proposal for relisting is appropriate.

42
43 **V. Data Compilation and Reporting Procedures**

44
45 Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville
46 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.
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- 1987. A review of the taxonomy and biogeography of *Hexastylis* (Aristolochiaceae). *Castanea* 52(3):186-196.
- NatureServe. 2004. Habitat-Based Plant Element Occurrence Delimitation Guidance, October 1, 2004. NatureServe, Arlington, Virginia. Accessed at <http://help.natureserve.org/biotics/Content/Methodology/PlantEOSpecs.htm>.
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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.
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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.
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- 2011. 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.

1 -----, 2018, August. Fact sheet for *Hexastylis naniflora*. Retrieved from
2 https://www.fws.gov/raleigh/species/es_dwarf-flowered_heartleaf.html.

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

6

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.

*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 not 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
U.S. Fish and Wildlife Service

Date _____

From: [Straight, Carrie A](#)
To: raynerda@wofford.edu
Subject: RE: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Monday, July 26, 2021 4:05:00 PM

I was wondering if you have had time or still needed time to participate in the peer review of this monitoring plan. If you are not interested or do not have time to participate, please let me know and I can let the species lead know. I just wanted to follow up in case I missed a return email or if you still wanted to participate in the review.

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.

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

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.

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
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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: [Straight, Carrie A](#)
To: raynerda@wofford.edu
Subject: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Friday, June 25, 2021 3:35:00 PM
Attachments: [20210625_dwarf_flowered_heartleaf_PDM_conflictofinterestform.docx](#)
[Draft_PDM_dwarf_flowered_heartleaf_2021_for_peer_review.docx](#)

Dr. Rayner,

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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.

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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
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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: [Straight, Carrie A](#)
To: [L L Gaddy](#)
Subject: RE: [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 9:47:00 PM

Thank you for getting those back to me!

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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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: Sunday, August 8, 2021 12:03 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.

Ok, attached are the filled out and signed forms. Could not get it to work online.

Chick

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.

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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

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

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

From: [Straight, Carrie A](#)
To: [L L Gaddy](#)
Subject: RE: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Monday, July 26, 2021 4:06:00 PM

I was wondering if you have had time or still needed time to participate in the peer review of this monitoring plan. If you do not have time to participate, please let me know and I can let the species lead know. I just wanted to follow up in case I missed a return email or if you still wanted to participate in the review.

Thank you for your time.

Carrie

<°)))))< <°)))))< <°)))))< <°)))))<

Carrie A. Straight, PhD

She, her, hers

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From: L L Gaddy <llgaddy2@gmail.com>
Sent: Sunday, June 27, 2021 7:50 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.

Carrie

I would be glad to serve. Thanks for the opportunity

Chick Gaddy

803 629-6128

L. L. Gaddy, Ph. D., President
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All experience is an arch wherethro'
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Tennyson

On Jun 25, 2021, at 3:36 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

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<20210625_dwarf_flowered_heartleaf_PDM_conflictinterestform.docx>
<Draft_PDM_dwarf_flowered_heartleaf_2021_for_peer_review.docx>

From: [Straight, Carrie A](#)
To: [L L Gaddy](#)
Subject: RE: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Tuesday, August 3, 2021 11:22:00 AM
Attachments: [20210625_FL_golden_aster_PDM_conflictofinterestform.docx](#)

Thank you for your comments. Could you fill out and sign the attached conflict of interest form?

Thank you again,

Carrie

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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

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Sorry I am so late. See two attached letters. Call me to discuss.

Chick 803 629-6128

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"Ulysses," Tennyson

*U.S. Fish and Wildlife Service
Participation in Peer Review of the Draft Post Delisting Monitoring Plan
for Florida Golden Aster*

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 not 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
U.S. Fish and Wildlife Service

Date _____

From: [L.L. Gaddy](#)
To: [Straight, Carrie A](#)
Subject: Re: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Tuesday, August 3, 2021 1:17:51 PM

It is not a digital form. I cannot type into it.

On Tue, Aug 3, 2021 at 10:11 AM Straight, Carrie A <carrie_straight@fws.gov> wrote:

Thanks,

I would gladly accept a digital signature if you don't want to print/sign.

Thanks,

Carrie

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

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

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404.679.7226 (office) or via Teams (carrie_straight@fws.gov)

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From: L L Gaddy <llgaddy2@gmail.com>
Sent: Tuesday, August 3, 2021 12:33 PM
To: Straight, Carrie A <carrie_straight@fws.gov>
Subject: Re: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

No printer with me. Traveling today and tomorrow. Will do tomorrow night or early Thursday.

L. L. Gaddy, Ph. D., President

terra incognita

www.tibooks.org

All experience is an arch wherethro'

Gleams that untravell'd world...

Tennyson

On Aug 3, 2021, at 11:22 AM, Straight, Carrie A <carrie_straight@fws.gov> wrote:

Thank you for your comments. Could you fill out and sign the attached conflict of interest form?

Thank you again,

Carrie

<°)))))<

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<°)))))< <°)))))<

Carrie A. Straight, PhD

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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

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Sorry I am so late. See two attached letters. Call me to discuss.

Chick 803 629-6128

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To: [Straight, Carrie A](#)
Subject: [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 12:04:03 PM

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Ok, attached are the filled out and signed forms. Could not get it to work online.

Chick

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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)

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--

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

From: [L L Gaddy](#)
To: [Straight, Carrie A](#)
Subject: Re: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Tuesday, August 3, 2021 12:33:08 PM

No printer with me. Traveling today and tomorrow. Will do tomorrow night or early Thursday.

L. L. Gaddy, Ph. D., President
terra incognita
www.tibooks.org

All experience is an arch wherethro'
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Tennyson

On Aug 3, 2021, at 11:22 AM, Straight, Carrie A <carrie_straight@fws.gov> wrote:

Thank you for your comments. Could you fill out and sign the attached conflict of interest form?

Thank you again,

Carrie

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

Carrie A. Straight, PhD
She, her, hers

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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

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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:

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<20210625_FL_golden_aster_PDM_conflictinterestform.docx>

From: [L.L. Gaddy](#)
To: [Straight, Carrie A](#)
Subject: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Monday, August 2, 2021 3:09:55 PM
Attachments: [hexletter.08.02.21.docx](#)
[hexletter.06.24.21.docx](#)

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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 naniflora* (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

endangered species/natural areas/wetland inventory conservation easement and planning

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.

endangered species/natural areas/wetland inventory conservation easement and planning

From: [Straight, Carrie A](#)
To: [L L Gaddy](#)
Subject: RE: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Tuesday, July 27, 2021 9:00:00 AM

Thank you. I resent the documents just a minute ago.

Carrie

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Carrie A. Straight, PhD
She, her, hers

Regional Recovery Coordinator
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From: L L Gaddy <llgaddy2@gmail.com>
Sent: Monday, July 26, 2021 8:50 PM
To: Straight, Carrie A <carrie_straight@fws.gov>
Subject: Re: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

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Chick

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Tennyson

On Jul 26, 2021, at 4:06 PM, Straight, Carrie A <carrie_straight@fws.gov> wrote:

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Carrie

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From: L L Gaddy <llgaddy2@gmail.com>

Sent: Sunday, June 27, 2021 7:50 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

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Carrie

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Chick Gaddy
803 629-6128

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<20210625_dwarf_flowered_heartleaf_PDM_conflictinterestform.docx

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<Draft_PDM_dwarf_flowered_heartleaf_2021_for_peer_review.docx>

From: [L.L.Gaddy](#)
To: [Straight, Carrie A](#)
Subject: Re: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Monday, July 26, 2021 8:50:46 PM

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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](https://teams.microsoft.com/join/1875centuryboulevard))

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.

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<Draft_PDM_dwarf_flowered_heartleaf_2021_for_peer_review.docx>

From: [Straight, Carrie A](#)
To: ["L L Gaddy"](#)
Subject: FW: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Tuesday, July 27, 2021 8:59:00 AM
Attachments: [20210625_dwarf_flowered_heartleaf_PDM_conflictofinterestform.docx](#)
[Draft_PDM_dwarf_flowered_heartleaf_2021_for_peer_review.docx](#)

Please find the documents attached. Thank you,

Carrie

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Carrie A. Straight, PhD
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Regional Recovery Coordinator
South Atlantic-Gulf and Mississippi Basin Regions
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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: 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

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.

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Thank you for your time,

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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.

*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 not 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
U.S. Fish and Wildlife Service

Date _____

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

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

2
3 **June 2019**
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40 **Recommended Citation:**

41
42 US Fish and Wildlife Service. 2019. Draft Post-Delisting Monitoring Plan for Dwarf-Flowered
43 Heartleaf (*Hexastylis naniflora*). Asheville Ecological Services Field Office, Asheville, North
44 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.

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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,

1 inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989).
2 The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).
3

4 **B. Discussion of Populations**

5

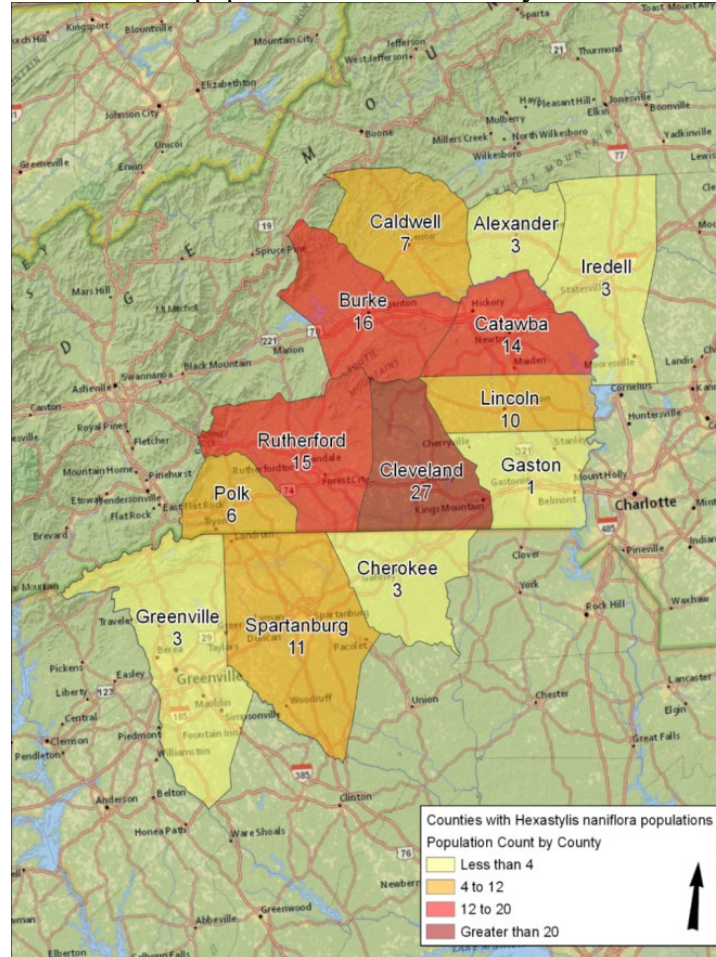
6 When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant
7 “populations” (Service 1989). Explicit criteria for recognizing these populations were not given in
8 the listing rule, but based on information in Asheville Ecological Services Field Office files, it
9 appears that each site-specific location containing the species was counted as a separate population
10 (Service 2011).
11

12 Since listing, many of those working with dwarf-flowered heartleaf have used the terms “sub site,”
13 “site,” “location,” “occurrence” (often, but not always, in reference to NCNHP Element
14 Occurrence (EO) records), and “population” interchangeably, while others have aggregated sites
15 into populations according to subjective criteria which have never been explicitly defined. This
16 generated considerable discrepancies among sources with respect to abundance and distribution of
17 the species, to the extent that data are usually not comparable from one source to the next (Service
18 2011).
19

20 NatureServe and its member Natural Heritage Programs (NHP) have devised mapping standards
21 to balance the need for fine-scale, highly site-specific EO records (required for monitoring and
22 management) with the need to aggregate these records into meaningful units of conservation
23 interest that may approximate biological populations (NatureServe 2004). The Service does not
24 maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards
25 the NHP databases as the best repository for this information.
26

27 As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and
28 South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).
29
30

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

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

2
3 For this category, PDM would be concluded at the end of the timeframe specified in this draft
4 Plan.

5
6 **B. Category II**

7
8 PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of
9 delisting, but information does not indicate that the species meets the definition of threatened or
10 endangered.

11 This would be true if:

- 12
13 1) Number of plants within a population is below the standard deviation of the mean,
14 and
15
16 2) There are no new or increasing threats that are considered to be of a magnitude and
17 imminence that may threaten the continued existence of dwarf-flowered heartleaf
18 within the foreseeable future.

19
20 For this category, the PDM period may be extended for an additional four years (two monitoring
21 cycles), and if necessary, sampling intensity could be increased to provide greater precision in
22 detecting trends. Existing data will be analyzed to determine if any management actions should
23 be implemented that would be expected to reverse declines and stabilize or improve population
24 trends for the species.

25
26 **C. Category III**

27
28 PDM yields substantial information indicating that threats are causing a decline in the status of
29 dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or
30 endangered may be warranted.

31 This would be true if:

- 32
33 1) Number of plants within a population is below the standard deviation of the mean,
34 and
35
36 2) There are new or increasing threats that are considered to be of a magnitude and
37 imminence that they could threaten the continued existence of dwarf-flowered
38 heartleaf within the foreseeable future.

39
40 For this category, all actions from Category II will be implemented. Additionally, the Service will
41 initiate a formal status review and determine whether a proposal for relisting is appropriate.

42
43 **V. Data Compilation and Reporting Procedures**

44
45 Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville
46 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 *Hexastylis 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.
- NatureServe. 2004. Habitat-Based Plant Element Occurrence Delimitation Guidance, October 1, 2004. NatureServe, Arlington, Virginia. Accessed at <http://help.natureserve.org/biotics/Content/Methodology/PlantEOSpecs.htm>.
- Newberry, G. 1993. Progress Report on Monitoring Studies of *Hexastylis naniflora*. Unpublished report. Copy submitted to the US Fish and Wildlife Service Asheville Field Office, on September 7, 2006.
- 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.
- 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.
- 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.
- 2011. 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.

1 -----, 2018, August. Fact sheet for *Hexastylis naniflora*. Retrieved from
2 https://www.fws.gov/raleigh/species/es_dwarf-flowered_heartleaf.html.

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

6

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: [L.L.Gaddy](#)
To: [Straight, Carrie A](#)
Subject: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Sunday, June 27, 2021 7:49:53 PM

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Carrie

I would be glad to serve. Thanks for the opportunity

Chick Gaddy
803 629-6128

L. L. Gaddy, Ph. D., President
terra incognita
www.tibooks.org

All experience is an arch wherethro'
Gleams that untravell'd world...

Tennyson

On Jun 25, 2021, at 3:36 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)

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<20210625_dwarf_flowered_heartleaf_PDM_conflictinterestform.docx>

<Draft_PDM_dwarf_flowered_heartleaf_2021_for_peer_review.docx>

From: [Straight, Carrie A](#)
To: [L L Gaddy](#)
Subject: RE: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Friday, August 6, 2021 10:23:00 AM
Attachments: [DwarfFloweredHeartleaf_conflictofinterestform_Fillable.pdf](#)

Here is a fillable version of the conflict of interest form for you.

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
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404.679.7226 (office) or via Teams (carrie_straight@fws.gov)

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From: L L Gaddy <llgaddy2@gmail.com>
Sent: Tuesday, August 3, 2021 1:17 PM
To: Straight, Carrie A <carrie_straight@fws.gov>
Subject: Re: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

It is not a digital form. I cannot type into it.

On Tue, Aug 3, 2021 at 10:11 AM Straight, Carrie A <carrie_straight@fws.gov> wrote:

Thanks,

I would gladly accept a digital signature if you don't want to print/sign.

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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404.679.7226 (office) or via Teams (carrie_straight@fws.gov)

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From: L L Gaddy <llgaddy2@gmail.com>
Sent: Tuesday, August 3, 2021 12:33 PM
To: Straight, Carrie A <carrie_straight@fws.gov>
Subject: Re: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

No printer with me. Traveling today and tomorrow. Will do tomorrow night or early Thursday.

L. L. Gaddy, Ph. D., President
terra incognita
www.tibooks.org

All experience is an arch wherethro'
Gleams that untravell'd world...

Tennyson

On Aug 3, 2021, at 11:22 AM, Straight, Carrie A <carrie_straight@fws.gov> wrote:

Thank you for your comments. Could you fill out and sign the attached conflict of interest form?

Thank you again,

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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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

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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.

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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.

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Thank you for your time,

Carrie

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Carrie A. Straight, PhD
She, her, hers

Regional Recovery Coordinator
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--

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Columbia, South Carolina 29205

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Yet all experience is an arch wherethro'
Gleams that untravell'd world...

"Ulysses," Tennyson

<20210625_FL_golden_aster_PDM_conflictinterestform.docx>

--

L. L. Gaddy, Ph. D., President
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"Ulysses," Tennyson

U.S. Fish and Wildlife Service
Participation in Peer Review of the
Post Delisting Monitoring Plan 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 not 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:

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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
U.S. Fish and Wildlife Service

Date

From: [Straight, Carrie A](#)
To: llgaddy2@gmail.com
Subject: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Friday, June 25, 2021 3:36:00 PM
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.

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.

*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 not 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
U.S. Fish and Wildlife Service

Date _____

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

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

2
3 **June 2019**
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40 **Recommended Citation:**

41
42 US Fish and Wildlife Service. 2019. Draft Post-Delisting Monitoring Plan for Dwarf-Flowered
43 Heartleaf (*Hexastylis naniflora*). Asheville Ecological Services Field Office, Asheville, North
44 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.

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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,

1 inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989).
2 The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).
3

4 **B. Discussion of Populations**

5

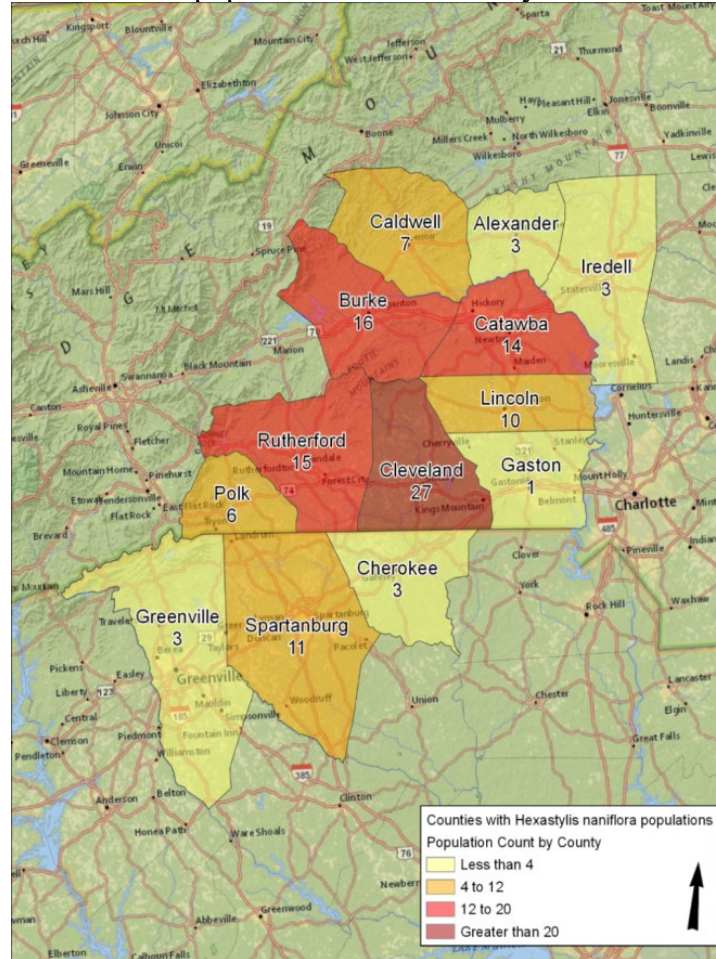
6 When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant
7 “populations” (Service 1989). Explicit criteria for recognizing these populations were not given in
8 the listing rule, but based on information in Asheville Ecological Services Field Office files, it
9 appears that each site-specific location containing the species was counted as a separate population
10 (Service 2011).
11

12 Since listing, many of those working with dwarf-flowered heartleaf have used the terms “sub site,”
13 “site,” “location,” “occurrence” (often, but not always, in reference to NCNHP Element
14 Occurrence (EO) records), and “population” interchangeably, while others have aggregated sites
15 into populations according to subjective criteria which have never been explicitly defined. This
16 generated considerable discrepancies among sources with respect to abundance and distribution of
17 the species, to the extent that data are usually not comparable from one source to the next (Service
18 2011).
19

20 NatureServe and its member Natural Heritage Programs (NHP) have devised mapping standards
21 to balance the need for fine-scale, highly site-specific EO records (required for monitoring and
22 management) with the need to aggregate these records into meaningful units of conservation
23 interest that may approximate biological populations (NatureServe 2004). The Service does not
24 maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards
25 the NHP databases as the best repository for this information.
26

27 As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and
28 South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).
29
30

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 (NCPCHP) 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

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

2
3 For this category, PDM would be concluded at the end of the timeframe specified in this draft
4 Plan.

5
6 **B. Category II**

7
8 PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of
9 delisting, but information does not indicate that the species meets the definition of threatened or
10 endangered.

11 This would be true if:

- 12
13 1) Number of plants within a population is below the standard deviation of the mean,
14 and
15
16 2) There are no new or increasing threats that are considered to be of a magnitude and
17 imminence that may threaten the continued existence of dwarf-flowered heartleaf
18 within the foreseeable future.

19
20 For this category, the PDM period may be extended for an additional four years (two monitoring
21 cycles), and if necessary, sampling intensity could be increased to provide greater precision in
22 detecting trends. Existing data will be analyzed to determine if any management actions should
23 be implemented that would be expected to reverse declines and stabilize or improve population
24 trends for the species.

25
26 **C. Category III**

27
28 PDM yields substantial information indicating that threats are causing a decline in the status of
29 dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or
30 endangered may be warranted.

31 This would be true if:

- 32
33 1) Number of plants within a population is below the standard deviation of the mean,
34 and
35
36 2) There are new or increasing threats that are considered to be of a magnitude and
37 imminence that they could threaten the continued existence of dwarf-flowered
38 heartleaf within the foreseeable future.

39
40 For this category, all actions from Category II will be implemented. Additionally, the Service will
41 initiate a formal status review and determine whether a proposal for relisting is appropriate.

42
43 **V. Data Compilation and Reporting Procedures**

44
45 Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville
46 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.
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3 Weakley, A. 2015. Flora of the Southern and Mid-Atlantic States. University of North Carolina
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6

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: raynerda@wofford.edu
Subject: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Friday, June 25, 2021 3:35:00 PM
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.

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.

*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 not 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
U.S. Fish and Wildlife Service

Date _____

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

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

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3 **June 2019**
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40 **Recommended Citation:**

41
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43 Heartleaf (*Hexastylis naniflora*). Asheville Ecological Services Field Office, Asheville, North
44 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.

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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,

1 inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989).
2 The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).
3

4 **B. Discussion of Populations**

5

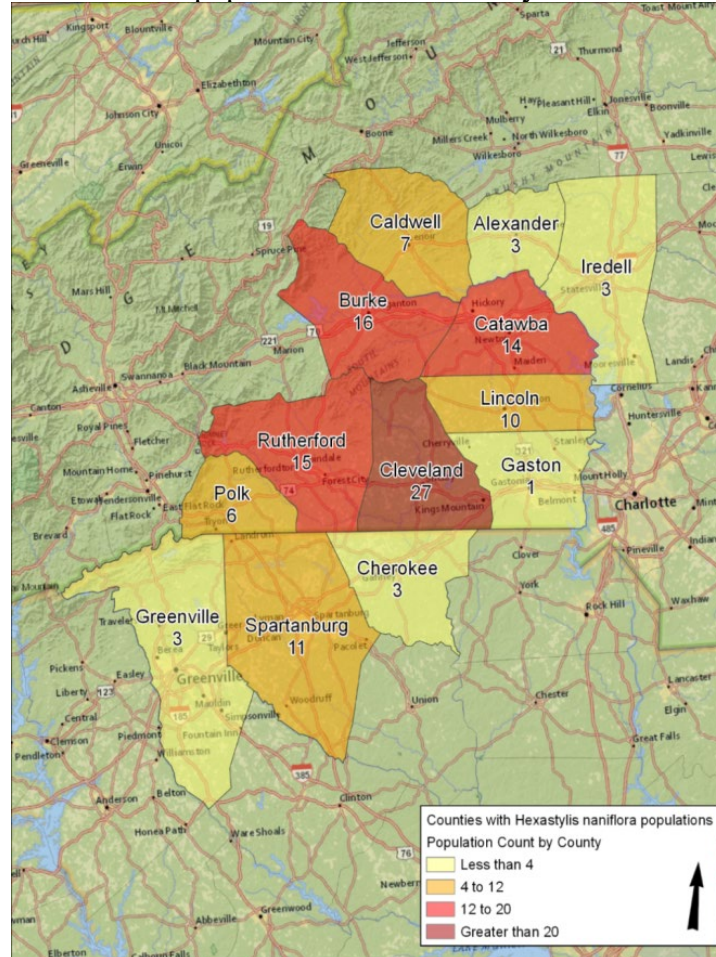
6 When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant
7 “populations” (Service 1989). Explicit criteria for recognizing these populations were not given in
8 the listing rule, but based on information in Asheville Ecological Services Field Office files, it
9 appears that each site-specific location containing the species was counted as a separate population
10 (Service 2011).
11

12 Since listing, many of those working with dwarf-flowered heartleaf have used the terms “sub site,”
13 “site,” “location,” “occurrence” (often, but not always, in reference to NCNHP Element
14 Occurrence (EO) records), and “population” interchangeably, while others have aggregated sites
15 into populations according to subjective criteria which have never been explicitly defined. This
16 generated considerable discrepancies among sources with respect to abundance and distribution of
17 the species, to the extent that data are usually not comparable from one source to the next (Service
18 2011).
19

20 NatureServe and its member Natural Heritage Programs (NHP) have devised mapping standards
21 to balance the need for fine-scale, highly site-specific EO records (required for monitoring and
22 management) with the need to aggregate these records into meaningful units of conservation
23 interest that may approximate biological populations (NatureServe 2004). The Service does not
24 maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards
25 the NHP databases as the best repository for this information.
26

27 As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and
28 South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).
29
30

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 (NCPCHP) 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:

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PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections.

This would be true if:

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

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

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6 **B. Category II**

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8 PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of
9 delisting, but information does not indicate that the species meets the definition of threatened or
10 endangered.

11 This would be true if:

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13 1) Number of plants within a population is below the standard deviation of the mean,
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16 2) There are no new or increasing threats that are considered to be of a magnitude and
17 imminence that may threaten the continued existence of dwarf-flowered heartleaf
18 within the foreseeable future.

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

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

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33 1) Number of plants within a population is below the standard deviation of the mean,
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36 2) There are new or increasing threats that are considered to be of a magnitude and
37 imminence that they could threaten the continued existence of dwarf-flowered
38 heartleaf within the foreseeable future.

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

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43 **V. Data Compilation and Reporting Procedures**

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45 Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville
46 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.

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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.

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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.

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

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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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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,

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

3 4 **B. Discussion of Populations**

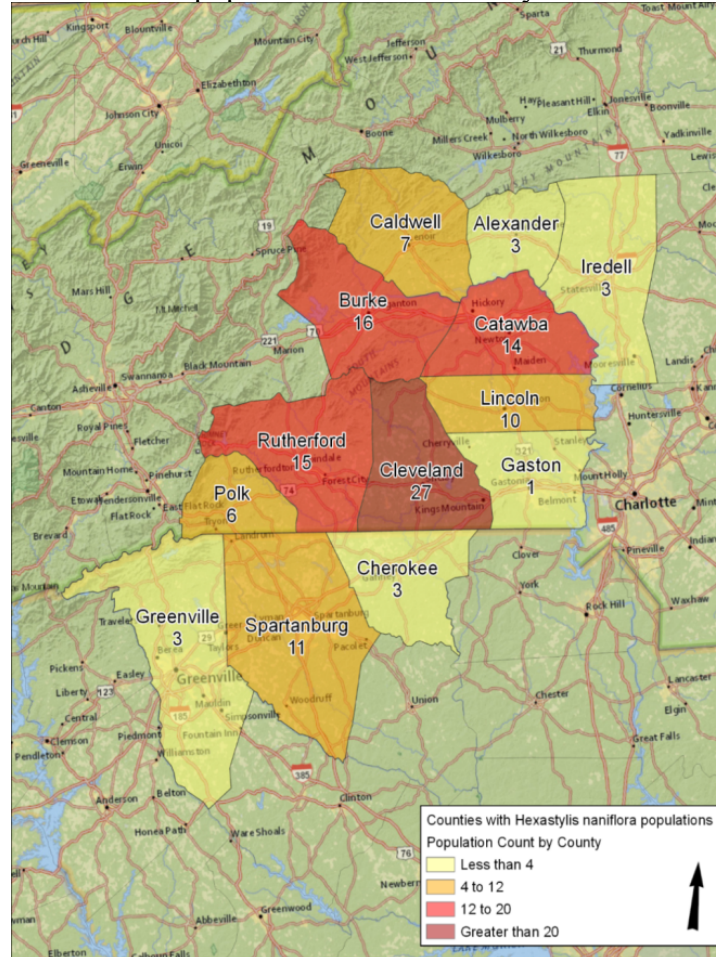
5
6 When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant
7 “populations” (Service 1989). Explicit criteria for recognizing these populations were not given in
8 the listing rule, but based on information in Asheville Ecological Services Field Office files, it
9 appears that each site-specific location containing the species was counted as a separate population
10 (Service 2011).

11
12 Since listing, many of those working with dwarf-flowered heartleaf have used the terms “sub site,”
13 “site,” “location,” “occurrence” (often, but not always, in reference to NCNHP Element
14 Occurrence (EO) records), and “population” interchangeably, while others have aggregated sites
15 into populations according to subjective criteria which have never been explicitly defined. This
16 generated considerable discrepancies among sources with respect to abundance and distribution of
17 the species, to the extent that data are usually not comparable from one source to the next (Service
18 2011).

19
20 NatureServe and its member Natural Heritage Programs (NHP) have devised mapping standards
21 to balance the need for fine-scale, highly site-specific EO records (required for monitoring and
22 management) with the need to aggregate these records into meaningful units of conservation
23 interest that may approximate biological populations (NatureServe 2004). The Service does not
24 maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards
25 the NHP databases as the best repository for this information.

26
27 As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and
28 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.

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Cowpens National Battlefield (SC EO 016, 017, 018)
Island Creek Bluff/Lovelady Site (EO 029)
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New Hope Springhead Swamp (EO 125)
Peters Creek Preserve (SC EO 011)
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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.

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

From: [Straight, Carrie A](#)
To: bradleyk@dnr.sc.gov
Subject: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Friday, June 25, 2021 3:36:00 PM
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.

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.

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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.

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

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

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3 **June 2019**
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40 **Recommended Citation:**
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42 US Fish and Wildlife Service. 2019. Draft Post-Delisting Monitoring Plan for Dwarf-Flowered
43 Heartleaf (*Hexastylis naniflora*). Asheville Ecological Services Field Office, Asheville, North
44 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.

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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,

1 inconspicuous, and found near the base of the petioles, often beneath leaf litter (Service 1989).
2 The fruits mature from mid-May to early July (Blomquist 1957, Gaddy 1980, 1981).
3

4 **B. Discussion of Populations**

5

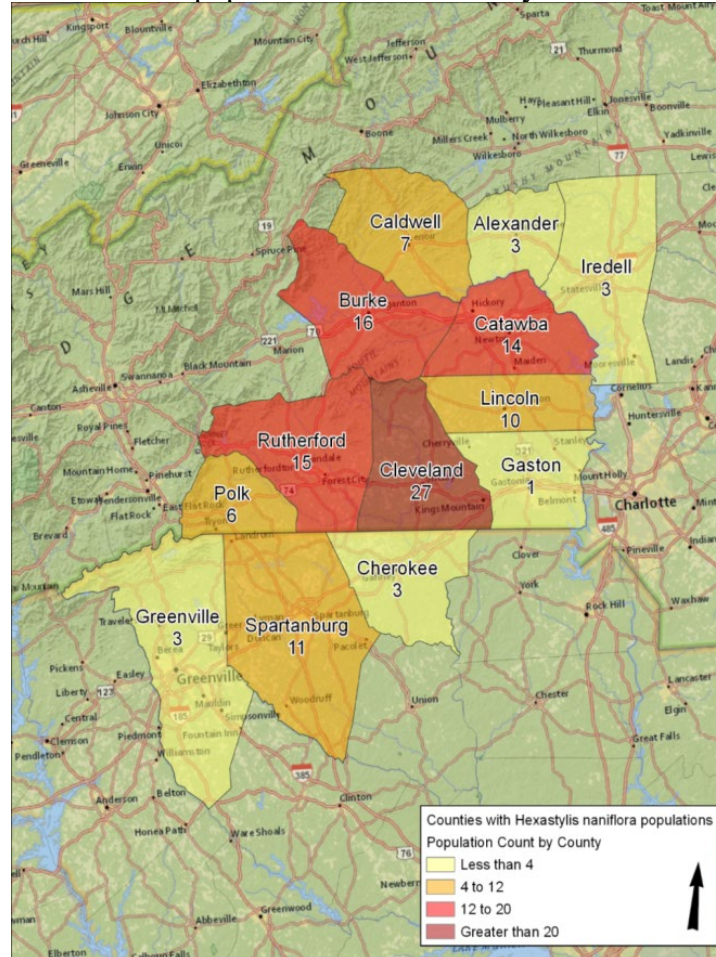
6 When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant
7 “populations” (Service 1989). Explicit criteria for recognizing these populations were not given in
8 the listing rule, but based on information in Asheville Ecological Services Field Office files, it
9 appears that each site-specific location containing the species was counted as a separate population
10 (Service 2011).
11

12 Since listing, many of those working with dwarf-flowered heartleaf have used the terms “sub site,”
13 “site,” “location,” “occurrence” (often, but not always, in reference to NCNHP Element
14 Occurrence (EO) records), and “population” interchangeably, while others have aggregated sites
15 into populations according to subjective criteria which have never been explicitly defined. This
16 generated considerable discrepancies among sources with respect to abundance and distribution of
17 the species, to the extent that data are usually not comparable from one source to the next (Service
18 2011).
19

20 NatureServe and its member Natural Heritage Programs (NHP) have devised mapping standards
21 to balance the need for fine-scale, highly site-specific EO records (required for monitoring and
22 management) with the need to aggregate these records into meaningful units of conservation
23 interest that may approximate biological populations (NatureServe 2004). The Service does not
24 maintain its own database of known occurrences of dwarf-flowered heartleaf; instead it regards
25 the NHP databases as the best repository for this information.
26

27 As of 2018, dwarf-flowered heartleaf is known from 119 populations in 13 counties in North and
28 South Carolina (Figure 1) (NCNHP 2018, SCDNR 2018).
29
30

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 (NCPCHP) 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

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

2
3 For this category, PDM would be concluded at the end of the timeframe specified in this draft
4 Plan.

5
6 **B. Category II**

7
8 PDM indicates that dwarf-flowered heartleaf may be less secure than anticipated at the time of
9 delisting, but information does not indicate that the species meets the definition of threatened or
10 endangered.

11 This would be true if:

- 12
13 1) Number of plants within a population is below the standard deviation of the mean,
14 and
15
16 2) There are no new or increasing threats that are considered to be of a magnitude and
17 imminence that may threaten the continued existence of dwarf-flowered heartleaf
18 within the foreseeable future.

19
20 For this category, the PDM period may be extended for an additional four years (two monitoring
21 cycles), and if necessary, sampling intensity could be increased to provide greater precision in
22 detecting trends. Existing data will be analyzed to determine if any management actions should
23 be implemented that would be expected to reverse declines and stabilize or improve population
24 trends for the species.

25
26 **C. Category III**

27
28 PDM yields substantial information indicating that threats are causing a decline in the status of
29 dwarf-flowered heartleaf since the time of delisting, such that listing the species as threatened or
30 endangered may be warranted.

31 This would be true if:

- 32
33 1) Number of plants within a population is below the standard deviation of the mean,
34 and
35
36 2) There are new or increasing threats that are considered to be of a magnitude and
37 imminence that they could threaten the continued existence of dwarf-flowered
38 heartleaf within the foreseeable future.

39
40 For this category, all actions from Category II will be implemented. Additionally, the Service will
41 initiate a formal status review and determine whether a proposal for relisting is appropriate.

42
43 **V. Data Compilation and Reporting Procedures**

44
45 Biennial reports summarizing the PDM activities will be submitted to the Service's Asheville
46 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)

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5 Working Draft as of 21 May 2015.

6

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)
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Second Broad River (Forest City Industrial Complex) (EO 154)

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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.

*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 not 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
U.S. Fish and Wildlife Service

Date _____

From: [Straight, Carrie A](#)
To: [L L Gaddy](#)
Subject: RE: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021
Date: Tuesday, August 3, 2021 1:11:00 PM

Thanks,

I would gladly accept a digital signature if you don't want to print/sign.

Thanks,

Carrie

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

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: Tuesday, August 3, 2021 12:33 PM
To: Straight, Carrie A <carrie_straight@fws.gov>
Subject: Re: [EXTERNAL] Re: Peer Review Request: draft Post Delisting Monitoring Plan Dwarf-Flowered Heartleaf; response requested by COB 7/16/2021

No printer with me. Traveling today and tomorrow. Will do tomorrow night or early Thursday.

L. L. Gaddy, Ph. D., President
terra incognita
www.tibooks.org

All experience is an arch wherethro'
Gleams that untravell'd world...

Tennyson

On Aug 3, 2021, at 11:22 AM, Straight, Carrie A <carrie_straight@fws.gov> wrote:

Thank you for your comments. Could you fill out and sign the attached conflict of interest form?

Thank you again,

Carrie

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

Carrie A. Straight, PhD
She, her, hers

Regional Recovery Coordinator
South Atlantic-Gulf and Mississippi Basin Regions
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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

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

Carrie A. Straight, PhD
She, her, hers

Regional Recovery Coordinator
South Atlantic-Gulf and Mississippi Basin Regions
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L. L. Gaddy, Ph. D., President
terra incognita

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803 629-6128

www.tibooks.org

Yet all experience is an arch wherethro'
Gleams that untravell'd world...

"Ulysses," Tennyson

<20210625_FL_golden_aster_PDM_conflictinterestform.docx>

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 9:50:00 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
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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
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L. L. Gaddy, Ph. D., President
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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 naniflora* (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 ever 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

endangered species/natural areas/wetland inventory conservation easement and planning

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.

endangered species/natural areas/wetland inventory conservation easement and planning

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.**

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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?

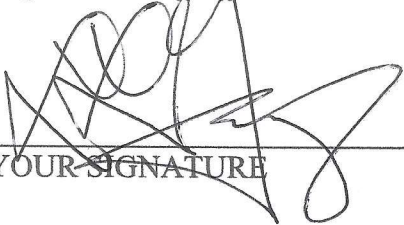
If the answer to all of the above questions under RESEARCH FUNDING OR OTHER INTERESTS is either "no" or "not applicable," check here ☒ (NO).

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.

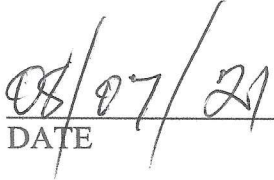
EXPLANATION OF “YES” RESPONSES:



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
U.S. Fish and Wildlife Service

CARRIE
STRAIGHT

Digitally signed by CARRIE
STRAIGHT
Date: 2021.08.08 21:41:03 -04'00'

Date

From: [Straight, Carrie A](#)
To: [Reid, Rebekah N](#)
Cc: [Peeples, Gary](#)
Subject: RE: DFHL Post Delisting Monitoring Plan
Date: Tuesday, June 22, 2021 9:18:00 AM

Thanks for the update. Do you have the most recent version of the PDM or was that put up with the original docket?

Carrie

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

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 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 Zillico 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, 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,

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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

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From: [Reid, Rebekah N](#)
To: [Straight, Carrie A](#)
Cc: [Peeples, Gary](#)
Subject: DFHL Post Delisting Monitoring Plan
Date: Tuesday, June 22, 2021 7:43:55 AM

Hi Carrie,

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Keith Bradley
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From: [Reid, Rebekah N](#)
To: [Straight, Carrie A](#)
Cc: [Peeples, Gary](#)
Subject: Re: DFHL Post Delisting Monitoring Plan
Date: Tuesday, June 22, 2021 8:37:06 AM

No, as planned none of those folks will be conducting the monitoring.

Rebekah Reid

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From: [Reid, Rebekah N](#)
To: [Straight, Carrie A](#)
Cc: [Peeples, Gary](#)
Subject: Re: DFHL Post Delisting Monitoring Plan
Date: Tuesday, June 22, 2021 9:23:03 AM

Hey Carrie,

It hasn't changed from when you and Byron asked for it last summer.

Rebekah Reid

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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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Survey of Plant Species of Federal Concern on Lands of the South Carolina Department of Natural Resources

E-1-32 - E-1-34: Final Report



South Carolina Endangered Species Program

October 1, 2010 - September 30, 2013

SOUTH CAROLINA ENDANGERED SPECIES PROGRAM

Segment E-1-32 through E-1-34

October 1, 2009 - September 30, 2012

Project 3 Final Report: Survey of Plant Species of Federal Concern on Lands of the South Carolina Department of Natural Resources.

The South Carolina Department of Natural Resources (SCDNR) manages land through two separate but related programs. The South Carolina Heritage Trust Program (SCHTP) was created to conserve those natural features and cultural resources that are quickly disappearing as the state develops and grows. The Wildlife Management Area Program was initially created to provide state-wide public hunting opportunities, but today its multiple-use policy provides opportunities for many types of wildlife enthusiasts.

The Heritage Trust Program was created in 1976 to collect data about the state's biota and cultural history, and to preserve and manage significant natural features and cultural remains throughout the state. Included targets of preservation as outlined by the Heritage Trust Act include "relatively undisturbed ecosystems, landforms, threatened, endangered, or unique plant life or animal habitats, or other unusual or outstanding scientific, educational, aesthetic, or recreational characteristics, and sites, structures, and areas of special historic interest containing outstanding remnants or elements of the way of life and significant events of the human past." Adding substantially to the Heritage Trust acreage, Wildlife Management Areas include several large tracts in relatively undeveloped parts of the state. These properties encompass a great variety of forest types which in many instances afford excellent habitat for unique and significant plant life, as well as opportunities for hunting and outdoor recreation.

Need

In accordance with the Heritage Trust Act, a significant number of Heritage Preserve acquisitions were made for the protection of plant species of federal and state concern; however these populations generally

were not fully inventoried or adequately mapped with today's highly accurate global positioning systems (GPS) and geographic information systems (GIS). Indeed some properties had not been thoroughly surveyed since acquisition. The cultural/historic preserves, most bearing evidence of human impact to a degree that did not encourage botanical survey, have long been overlooked and yet state and federal plant species of concern have been discovered on these sites.

Recent advances in networked databases have brought new capabilities to the botanical survey effort. With the advent of online catalogs of herbarium and museum collections, searches for species locales can now be efficiently conducted to determine important historical collections in and near current property boundaries. This capability is particularly important for South Carolina, since many important historic and recent collections were made by collectors at the herbaria at the University of South Carolina (USCH), Clemson University (CLEMS), and the University of North Carolina (NCU). Before today's digital databases, the sharing of species occurrence information between these institutions and SCHTP, SCDNR, and US Fish and Wildlife Service (USFWS) was inconsistent and cumbersome.

Objectives

There were four major objectives:

1. Locate and describe the presence of plant species of federal and state concern with an emphasis on those listed as endangered (LE) and threatened (LT) under the US Endangered Species Act (USES) for all appropriate properties owned and managed by the SCDNR.
2. Relocate and revisit all previously known populations, and determine their biological status and habitat conditions.
3. Update species occurrence information in the database of rare, threatened, and endangered plant species maintained by SC Heritage Trust.
4. Make land management recommendations to secure, maintain, and restore these populations.

<i>Amaranthus pumilus</i>	Seabeach Amaranth	LT: Listed threatened
<i>Amphianthus pusillus</i>	Pool Sprite	LT: Listed threatened
<i>Helonias bullata</i>	Swamp-pink	LT: Listed threatened
<i>Hexastylis naniflora</i>	Dwarf-flowered Heartleaf	LT: Listed threatened
<i>Ribes echinellum</i>	Miccosukee Gooseberry	LT: Listed threatened
<i>Echinacea laevigata</i>	Smooth Coneflower	LE: Listed endangered
<i>Helianthus schweinitzii</i>	Schweinitz's Sunflower	LE: Listed endangered
<i>Isoetes melanospora</i>	Black-spored Quillwort	LE: Listed endangered
<i>Lindera melissifolia</i>	Pondberry	LE: Listed endangered
<i>Oxypolis canbyi</i>	Canby's Dropwort	LE: Listed endangered
<i>Ptilimnium nodosum</i>	Harperella	LE: Listed endangered
<i>Sagittaria fasciculata</i>	Bunched Arrowhead	LE: Listed endangered
<i>Sarracenia rubra</i> ssp. <i>jonesii</i>	Mountain Sweet Pitcher-plant	LE: Listed endangered
<i>Schwalbea americana</i>	Chaffseed	LE: Listed endangered
<i>Sisyrinchium dichotomum</i>	Reflexed Blue-eyed Grass	LE: Listed endangered
<i>Trillium reliquum</i>	Relict Trillium	LE: Listed endangered
<i>Trillium persistens</i>	Persistent Trillium	LE: Listed endangered

Geographic Location

SCDNR Wildlife Management Areas and Heritage Trust Preserves, totaling some 360,000 acres, are concentrated in the mountains and the coastal zone, with several important properties in the fall-line sandhills, middle coastal plain, and Piedmont.

Approach

The primary purpose of this study was to locate, identify, and describe occurrences of USESA plants and, by systematic searches, determine the extent of their distribution across SCDNR properties. Other rare plant species – ‘G1’ through ‘G3’ as assessed by NatureServe – would be targeted as well. G1 and G2 species are those which are imperiled because of extreme rarity or because of other factors that make them very vulnerable; G3 species are those which are at risk because they are rare throughout a region, or

local to abundant within a restricted range, or subject to other factors that make them vulnerable. In addition to issues of vulnerability, these plants are of interest because they may serve as indicators of unique habitats and substrates. Particular attention was given to wetland plants because of the many threats facing their habitats.

In preparation for field survey, GIS compilations of Heritage tracked-plant locations, current and archival aerial photography, soil and geologic types, and other relevant spatial data layers were made on a backdrop of 7.5-minute topographic maps. Scientific literature and previous botanical studies of the area were reviewed, and the collections at USCH, CLEMS, and NCU were queried through 'Specify,' the museum database platform funded and supported by the National Science Foundation. With ArcMap GIS as a visual and analytic aid, extrapolations were made from known stands of rare species to potential sites suitable for ground survey.

In the field, an observation of a target species was considered by SC Heritage staff to be an 'occurrence' if it represented a location with one or more living plants, generally at least one-tenth mile distant from the next such location (separations of shorter distances are thought to indicate two 'patches' of a single occurrence rather than two occurrences). If the site was one already known and databased at SC Heritage Trust, the current observation would be considered an 'occurrence confirmation.' In either case, the observer would assess the size and status of the population, noting in particular the presence/absence of reproductive structures. Detailed observations were also made on habitat, including (1) landforms, (2) slope and aspect, (3) rock and soil types, (4) dominant vegetation in the canopy, midstory, and herbaceous layers, (5) NatureServe natural community, classified to the level of 'association,' and (6) disturbances and threats, together with recommended management responses. An overall 'viability rating' was assigned to the occurrence -- A, B, C, or D, signifying excellent, good, fair, or poor -- to represent the likelihood that the plants would survive another 20-30 years at this site. This information was then submitted to the Heritage database, to be stored in both paper and digital form.

Where appropriate, voucher specimens were collected and curated at USCH, with duplicates shared with CLEMS and NCU. Recognized specialists were asked to corroborate problematic or technically difficult identifications.

Results and Benefits

Each USESA plant population was mapped as described above, with habitat, surrounding landscape, and geologic context noted. All data were entered into the South Carolina Heritage Trust 'Biotics' database and shared with land managers. Using modern GPS and GIS technologies, the data on rare plant species is more precisely mapped and efficiently shared with SCDNR land managers and USFWS.

SC DEPT of NATURAL RESOURCES PROPERTY	COUNTY	ACRES	Amphianthus pusillus	Helonias bullata	Ribes edinellum	Echinacea laevigata	Isoetes melanospora	Lindera melissifolia	Oxypolis canbyi	Ptilimnium nodosum	Sarracenia rubra ssp. jonesii	Trillium persistens
Ashmore HP	Greenville	1119.12									E	
Bald Rock HP	Greenville	162.89									<>	
Battle Creek Registration Site	Oconee	179										E
Bennett's Bay HP	Clarendon	678.84						<>	<>			
Brasstown Creek HP	Oconee	467.48										<>
Buzzard Roost HP	Oconee	502.18				E						
Catawba River WMA and Landsford Canal	Chester	3982										
Crosby Oxypolis HP	Colleton	31.41							E			
Ditch Pond - Hoffmeier Tract	Aiken & Barnwell	224.17						<>	<>	<>		
Eva Russell Chandler HP	Greenville	252.83									E	
Forty Acre Rock HP	Lancaster	2311.63	E			H	E					
Henderson HP	Aiken	449.88				<>						
Longleaf Pine HP	Lee	842.2						<>	E			
Lynchburg Savanna HP	Lee	290.83						<>	<>			
Marsh WMA	Marion	8586.39						<>	<>			
Peachtree Rock HP	Lexington	156.23				<>						
Stevens Creek HP	McCormick & Edgefield	430.72			E							
Watson-Cooper HP	Greenville	1703.54		E								
Windmill Highpond (Janet Harrison) HP	Aiken	30.1							<>	E		
Woodbury WMA	Marion	25924.02						E	<>			
Woods Bay HP	Clarendon	476.5						<>	<>			

Symbols:
 E indicates a population that is believed to be extant, having been seen within the last 25 years, including during the most recent survey
 H indicates a population that is considered historical, having been seen at some point in time, but not, despite survey, within the last 25 years
 <> indicates the possibility, based on observed suitable habitat, that a population is in the area, however despite survey no population has yet been found

Table 1. Summary of survey effort, 2010-2013, for USESA plant species on SCDNR lands.

Technical Personnel

Albert B. Pittman, Ph.D., Project Leader

Katherine A. Boyle, Community Ecologist

Herrick H. K. Brown, Assistant Botanist

Julie W. Holling, Data Manager

Herbarium Records

Enhanced Access to Voucher Specimen Information (*Flora Caroliniana*). Heritage staff relies on well curated herbarium collections to link voucher specimens to existing Element Occurrence Records (EOR) in the SC Heritage Trust Database. This same methodology may also reveal previously undocumented element occurrences which may then be added to the database based on the specimen label information. Access to these data is facilitated through the *Flora Caroliniana* portal (<http://herbarium.biol.sc.edu/floracaroliniana/>). The portal is powered by Symbiota, an open source code content management system supported in part by the National Science Foundation. The site is publicly accessible and offers customizable queries capable of mining data from multiple collections simultaneously. Continued cooperation with the Consortium of South Carolina Herbaria (COSCH) has expanded the number of collections offered from the two largest herbaria in the state - the A.C. Moore Herbarium at the University of South Carolina (USCH) and the Clemson University Herbarium (CLEMS) - to one additional collection held at the University of South Carolina - Salkehatchie. Despite its comparatively small size, the Salkehatchie collection includes specimens from localities that are significantly underrepresented in other herbaria within the state.

Additional enhancements to the *Flora Caroliniana* portal include an annual update which added more than 11,500 new specimen records from the collections at USCH and CLEMS. The total number of specimen records currently available from the combined collections is just over 131,300. Across all collections detailed locality information beyond the county of occurrence is hidden from public view for all state tracked and USESA species. Access to locality details for protected species is provided to staff of the SC Heritage Trust Program, USFWS, collection curators, and other qualified personnel upon request. All query results can be exported as a Comma Separated Variable (.CSV) file which is compatible with a variety of spreadsheet management software packages (e.g., MS Excel).

Vouchers of Priority Species for Conservation. Data captured through queries of the USCH and CLEMS collections in the *Flora Caroliniana* portal, and specimen records provided by staff of the herbarium at the University of North Carolina (NCU) yielded 235 voucher specimens of

USESA species. Heritage staff has evaluated the locality information associated with these specimens for redundancy within the SC Heritage Trust Database and found 184 vouchers matching EORs. Of the remaining 51 vouchers, 4 undoubtedly represent new occurrences; these will be added to the database. On the other 47 vouchers, locality is not clearly described and the specimens cannot be matched with certainty to existing EORs. These specimens will undergo further review to verify their status as 'new' or 'existing' EORs and treated accordingly.

Additional queries were conducted for vouchers of species of high priority G1-G3 species. Results number 322 specimens total from the three herbaria (USCH, CLEMS, and NCU) that were searched.

Smooth Coneflower (*Echinacea laevigata*), LE: Buzzard Roost and Forty Acre Rock Heritage Preserves

Echinacea laevigata (Asteraceae) is a long-lived, rhizomatous perennial herb inhabiting open woodlands dominated by pyrophylllic pine and fire tolerant oak and hickory species in a variety of sites across an array of natural communities (USFWS, 1995). It has been documented by voucher collection and observation to inhabit several very distinct geological formations and soil orders from the Inner to the Outer Piedmont to the Inner Coastal Plain. In addition, the habitats can vary greatly in relation to underlying geologic substrate and land use history (Pittman and others, 2011).

There are only three sites in the mountains of South Carolina that harbor large, sustainable populations of *E. laevigata*; all are in the on properties managed by USFS (Sumter National Forest) or SCDNR: Pine Mountain (USFS), Joel's Ridge (USFS), and Poor Mountain – Buzzard Roost Heritage Preserve (USFS and SCDNR). Three extant *E. laevigata* sites were surveyed and voucher label information were evaluated for Buzzard Roost and Forty Acre Rock Heritage Preserves. The precise locations of the two historically significant voucher collections curated at the University of North Carolina (NCU) and Kansas University (KANU) herbaria, citing Forty Acre Rock in the recorded label information, were unsuccessfully searched. *E. laevigata* is now considered extirpated there.

The folded and deeply eroded ridges of the Buzzard Roost- Poor Mountain- Rich Mountain ridges are where some of the earliest collections and protection efforts were made for *E. laevigata* in South Carolina (Figure 1). Lying southeast of the Brevard Fault Zone, the Buzzard Roost Heritage Preserve is located in the Chauga Belt which stretches in a generally northeast trend from Georgia to South Carolina into North Carolina. It consists of metamorphic rocks and is overlain by Henderson Gneiss which was thrust over the Poor Mountain Formation (SC Geological Survey, 2011). The Henderson Gneiss is hard augen gneiss capping the crest of Buzzard Roost. All the known populations of *E. laevigata* are generally south -facing on small isolated ridges separated by shallow ravines almost impenetrable with dense growth of

understory evergreen shrubs (*Kalmia latifolia*, *Rhododendron minus* and *Smilax* spp.) with *Liriodendron tulipifera*, *Nyssa sylvatica*, and *Quercus alba* forming the canopy. Before the USFS-SCDNR era of prescribed burns, the woodlands supporting Smooth Coneflower were often overgrown with ericaceous evergreen shrubs making discovery and relocation of the populations difficult. Indeed, the earliest voucher collections in the area were made along trails or unpaved, abandoned roadbeds in the gap between Buzzard Roost and Poor Mountain. With the last prescribed fire in 2010 (Mackie, 2012), a more accurate census and coordinate determination were possible (Appendix 9).

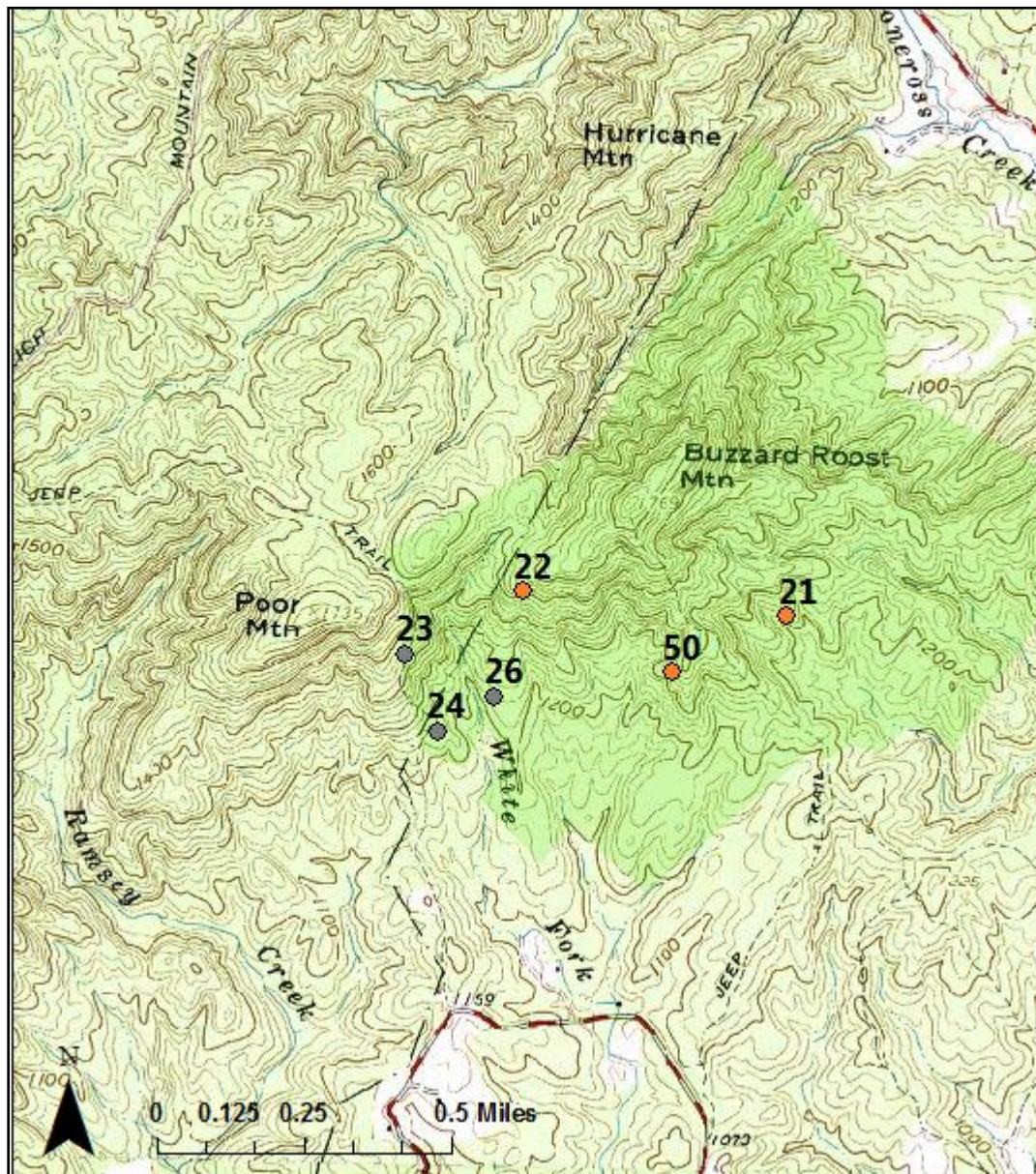


Figure 1. *Echinacea laevigata* on Buzzard Roost Heritage Preserve. Sites revisited shown in red.

Management Recommendations. Except for Pine Mountain in Oconee County, most sites in the mountains of South Carolina are thought to be remnants of fire maintained Pine-Oak forests comprising small isolated populations-- all at risk of being overgrown and shaded by dense thickets of ericaceous shrubs and fast growing hardwoods (Pittman and others, 2011). Continued prescribed fire and vegetation control of competing woody vegetation by selecting for pyrophyllic pines (*Pinus echinata*, *P. pungens*, and *P. rigida*) and fire-resistant oaks (*Quercus prinus*) should promote all species dependent upon more open, grass- and forb -dominated woodlands correlated with *E. laevigata* upland sites across its range. Additional studies comparing the habitat and soil characteristics of the more mesic hardwood sites versus the drier heath-dominated ones at Buzzard Roost and the Sumter National Forest would be useful.

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Swamp-pink (*Helonias bullata*), LT: Watson-Cooper Heritage Preserve

Helonias bullata was first discovered and collected in South Carolina in 1971 along Matthews Creek, now part of Watson-Cooper Heritage Preserve, near Caesars Head in northwestern Greenville County (McDowell, 1973). Porcher and Rayner (2001) described the habitat as “montane bog.” However, Wichmann (2009) restricts “Bogs and Fens” to larger saturated areas (>0.5 ha) that are “typically open, generally flat or slightly sloping, and lack shading from overhanging canopy trees of adjacent forest.” At Watson-Cooper Heritage Preserve the *H. bullata* sites are small, and side slopes provide runoff and seepage (Figure 2). Canopy is in fact largely absent but only because of historic logging and ongoing management. The natural community may therefore be more accurately described as “Saturated Forest and Seep” as outlined by Wichmann (2009). Because the large trees on the preserve were removed prior to acquisition by SCDNR, a more precise classification may not be possible. Neither understood is the role of disturbance such as beaver impoundment and cattle grazing – which are thought to be important factors in the history of high elevation bogs in North Carolina (Schafale, 2012).

Based upon observations made at six sites in the Southern Appalachians, Sutter (1984) tentatively concluded that *H. bullata* reproduction by seed is negligible. Vegetative reproduction by ramets was posited to be the primary means of population maintenance. These findings were later corroborated in both the field and greenhouse, as reviewed by USFWS (2008). Sutter sampled the population at the Matthews Creek site, estimating *H. bullata* to number more than 1000 rosettes with 120 inflorescences.

Management Recommendations. Woody plant encroachment is a threat to herbaceous species diversity in mountain wetlands throughout the southern Appalachians (Warren and others, 2007). At Matthews Creek, as seeps closed in with dense stands of evergreen shrubs (*Leucothoe fontanesiana* and *Rhododendron maximum*, in particular), the growth potential of *H. bullata* and other herbaceous plants became limited by loss of space, light, and soil moisture. After acquisition of the property in 1980 by SCDNR, control of woody vegetation, including chemical and mechanical removal, has had a positive effect on *H. bullata* flower production with over 600 inflorescences counted in recent years. Because there is a positive response in the size and

number of rosettes as a function of light intensity (USFWS, 2008), the total number of rosettes can also be expected to increase over time.

The Atlanta Botanical Garden has proposed to cooperate with the South Carolina Heritage Trust Program to place *H. bullata* into long-term storage and to propagate wild-collected seeds for long-term storage as recommend in the Recovery Plan (USFWS, 2008). Such materials can serve as a source for restoration activities in the event of a catastrophic loss of South Carolina's only known site (Cruse-Sanders, 2012). The Garden will follow the guidelines for *ex situ* conservation as outlined by the Center for Plant Conservation, of which it is a member.

With precipitation often exceeding 80 inches per year, the mountainous region on the GA-NC-SC border has been described by Billings and Anderson (1966) as one of North America's most important regions for diversity of plant life, particularly for bryophytes. In addition, Konrad (1996) found that annual precipitation totals in the Southern Appalachians are most highly correlated with southern exposure and elevation. An area bounded to the north by Caesars Head State Park and to the east and west by the Bald Rock and Watson-Cooper Heritage Preserves respectively, including the region known as “the Dismals,” is a landscape of exceptional rainfall and high topographic relief. The many generally south-facing slopes are likely to encompass a number of undocumented saturated forests and seeps. In the vicinity of the *H. bullata* site at Matthews Creek, there are several unnamed and poorly explored tributaries. Nearby properties in the Greenville Watershed - Table Rock Reservoir have been surveyed and rare species cataloged (Hill, 1992), but basic floristic surveys in the Dismals area have been limited. Therefore, it is recommended that the intermittent stream heads from the Dismals east to Bald Rock be surveyed for both *Helonias bullata* and *Sarracenia jonesii*.

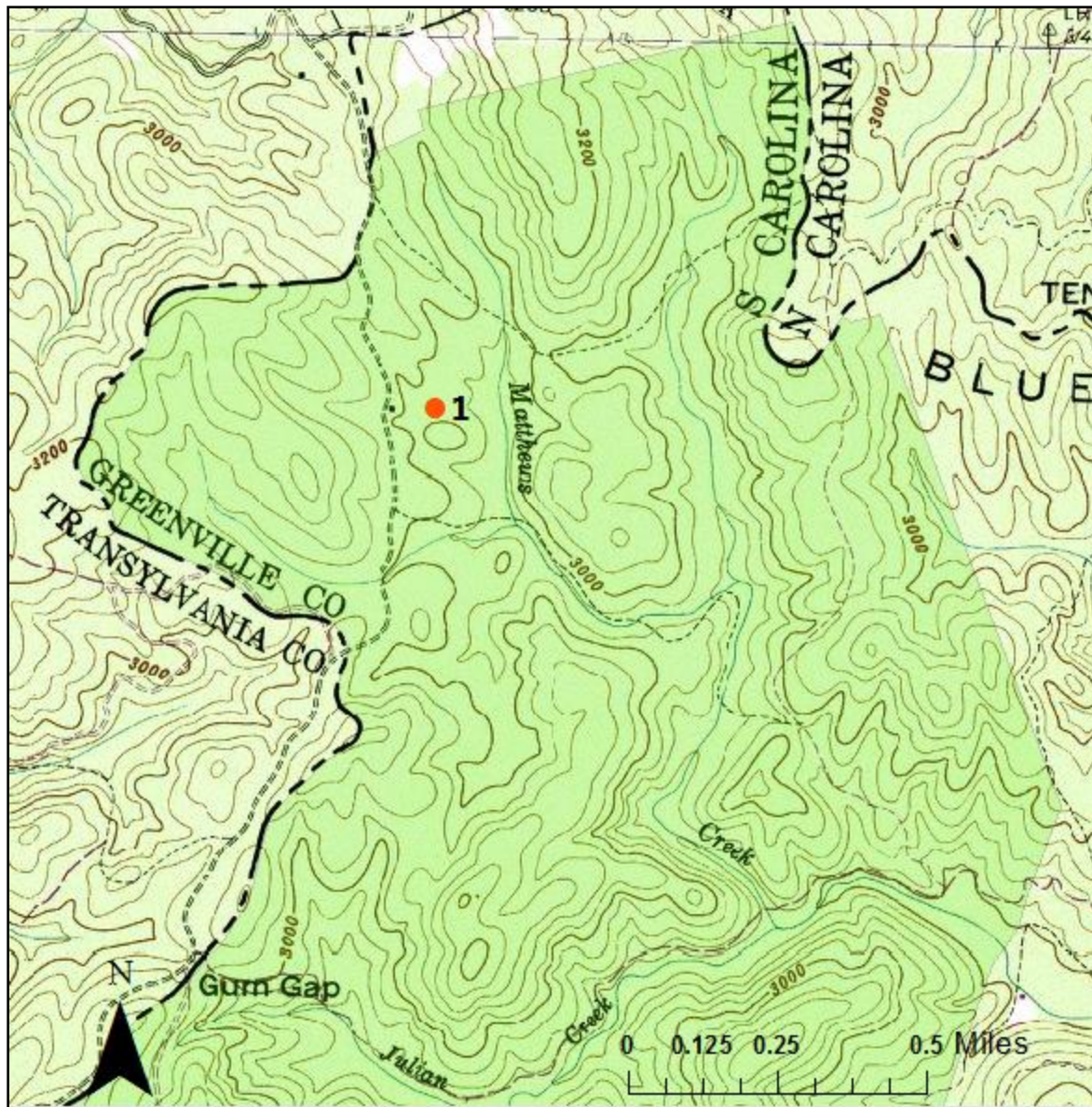


Figure 2. *Helonias bullata* occurrence 1 on 7.5-minute topographic map (Table Rock SC, 1978).

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**Black-spored Quillwort (*Isoetes melanospora*), LE and Pool Sprite (*Amphianthus pusillus*),
LT: Forty Acre Rock Heritage Preserve**

Forty Acre Rock Heritage Preserve is one of eastern North America's most renowned sites for the study of plant evolution, ecological isolation, and sympatric speciation. The preserve protects essential pool habitats for two narrow vascular plant endemics, *A. pusillus* (Scrophulariaceae) and *I. melanospora* (Isoetaceae). Through the erosive effects of water, slight depressions in exposed near-horizontal granitic surfaces can widen, deepen, and eventually coalesce with neighboring depressions. If the resulting weathering or erosion pits retain sufficient rainfall or runoff, vernal or ephemeral pools may develop with sufficient moisture to support highly specialized endemics such as *A. pusillus* and *I. melanospora*, plus a number of other semi-aquatic tracheophytes (Figure 3). Weathering pits and ephemeral pools can be found on flatrock communities throughout the Piedmont Plateau of the southeastern United States. However, the precise factors predicting pool occupation and abundance of *A. pusillus* and *Isoetes* spp. at sites like Forty Acre Rock remain unknown (USFWS 1993).

In their review of rock outcrop endemics, Baskin and Baskin (1988) identify an environment with high photosynthetic photon flux density as the single most critical ecological factor across all known specialist species, irrespective of taxonomic classification. Neither *I. melanospora* nor *A. pusillus* are light saturated at illuminances below 108,000 lux -- well within measured values of full sunlight of 100,000 to 130,000 lux (Electro-Optics, Handbook, 2013). Secondary correlates include observations that these species do not grow and thrive in low light environments, compete poorly with taller plants, and do not inhabit adjacent forests. Because *A. pusillus* is an obligate aquatic biennial requiring inundation in cool months, plants are limited to ephemeral pools over shallow soils (USFWS, 1993) with a range of reported water depths ranging from 0.1 - 10 cm (Hilton and Boyd, 1996). In contrast, the *Isoetes* taxa at Forty Acre can occupy both well-defined pools and the much more extensive seepages spread along the periphery of the massive granite exposure, where the flatrock community meets woodland edges (Heafner and Bray, 2005).



Figure 3. Early spring view of vernal pool and woodland edges over granitic rock.

Isoetes melanospora. Because hybridization and polyploidization are known to occur in the genus, the exact identification of *I. melanospora* at Forty Acre Rock has long been problematic (Matthews and Murdy, 1969; Taylor and others, 1993; Heafner and Bray, 2005; USFWS, 1993). For the purposes of this study, additional field collection and experimental taxonomy by specialists was deemed necessary to determine the exact status of the *Isoetes* species long reported to be indigenous to Forty Acre Rock. Earliest known collections of “*Isoetes melanospora*” include the voucher citations published in R. McVaugh (1943) and C. F. Reed (1965).

All major granitic flatrocks at Forty Acre Rock Heritage Preserve were surveyed for *I. melanospora* in cooperation with *Isoetes* experts from the James F. Matthews Center for Biodiversity Studies, Old Dominion University, the Milwaukee Museum of Natural History, the Smithsonian Institute, and Catawba College. Samples were collected from ephemeral pools in 2012 and 2013 for cytogenetic analysis, morphometric measurements, and DNA sequencing.

Tentative field observations and systematic study propose that there are perhaps three separate morphotypes or "taxa" present in the pools (Musselman, 2013). Solely for the purpose of this report they are labeled (Figure 4) as follows: M-T IP, M-T IM, and H. Taxon M-T IP is apparently closely related to *I. piedmontana* (Pfeiffer) Reed, which inhabits the edge of many granitic outcrops including Forty Acre Rock (Heafner and Bray, 2005). M-T IP has a spiral leaf arrangement and can grow in pools with relatively deep soils. Taxon M-T IM, with gray to black spores and an equitant leaf arrangement, resides in shallower pools. This is the morphotype that seems to have been misidentified as *I. melanospora* by numerous botanists since 1943. A third taxon, H, is hypothesized to be a hybrid of the two taxa described above and exhibits characteristic heterosis.

Because hybridization and polyploidization are known to occur in the genus *Isoetes*, these observations are being analyzed by both genetic and herbarium methods. Although investigations are not final, the genetic, greenhouse, and morphological studies completed to date indicate that the three "morphotypes" are in fact two separate undescribed species plus a resultant hybrid. In conclusion, *I. melanospora* was not observed at Forty Acre Rock during the course of the present study and apparently is not indigenous to South Carolina. Once the systematic studies are completed and taxonomic determinations published, Musselman will provide precise maps to South Carolina Heritage Trust. A review of all questionable voucher specimens from Forty Acre Rock and other sites in the state will then be conducted to confirm the assumption that *I. melanospora* does not occur in South Carolina.



Figure 4. *Isoetes* morphotypes Forty Acre Rock. Left, MT- IP. Center, H. Right, MT- IM. (Photograph by L. J. Musselman, 2013)

Amphianthus pusillus. Although there are a great many ephemeral pools at Forty Acre Rock that seemly should support *A. pusillus*, most do not. Here as at other granitic flatrocks, there is a wide range in pool area, depth, shape, water holding capacity, soil particle size, and organic matter content. Even during the wettest years not all depressions retain standing water, or even significant soil moisture, for long periods. In order to accurately map each occurrence, all pools were inspected in early spring, 2012. Only the "semi-permanent" pools were observed to be populated with *A. pusillus*.

For each depression containing emergent scapes of *A. pusillus*, the semi-permanent pool area was circumscribed and delimited as a polygon feature in ArcMap (Figure 5). Within each polygon the percent cover of all vascular or bryophyte vegetation was estimated; then, within the

vegetated area, percent cover of *A. pusillus* was estimated (Appendix 9). Summed for all pools, the resulting estimate of total area occupied by *A. pusillus* at Forty Acre Rock was approximately 50 square meters.

No attempt was made to measure exact numbers of *A. pusillus* or to characterize the physical dimensions and chemical properties of the pools. Neither was a full floristic tally made of all vascular/ non-vascular species present; however, prominent associates were noted. *Diamorpha cymosa* and *Minuartia* spp. were present in 18 of the 22 *A. pusillus* pools on the flatrock.



Figure 5. Aerial view, looking north, of the flatrock at Forty Acre Rock Heritage Preserve. *A. pusillus* pools are outlined in red. (Image from Google Earth, 2012, at <http://www.google.com/earth/>)

Management Recommendations. Protection of the pool microhabitats across the Forty Acre Rock exposure is both critical and problematic, as these pools must sustain ephemeral aquatic conditions for both *Isoetes* spp. and *A. pusillus*. Both are at risk of habitat loss where sediments from the main trail to the flatrock are gradually washing down into nearby pools, and an earthen path is bisecting what may once have been a very large pool (T1/T2 in Figure 5; Figure 6). In 2012 and 2013, previously undocumented populations of both *A. pusillus* and *Isoetes* spp. were observed in this pool, suggesting potential for recovery. Other depressions on the flatrock are also being silted in and some are being colonized with weedy herbaceous and arborescent species. Infestations of *Paspalum urvillei* and Loblolly Pine seedlings in particular are contributing to the overall drying of the area through increased evapotranspiration and deposition of organic detritus. To better protect the pools, visitor access to the flatrock should be redesigned and weedy vegetation removed.

Hilton and Boyd (1996) used seed transplant studies across a variety of ephemeral pools at a Georgia site to test the significance of various environmental variables long associated with *A. pusillus*. Such factors as soil texture, organic matter, macronutrients (NPK), and maximum water depth were not found to be strongly correlated with overall fecundity and seedling establishment. These authors suggest that some of the variation in *A. pusillus* density may have been attributable to variation in seed bank size and also to undetermined factors such as seed dispersal and predation. They recommend transplanting seeds to suitable or previously occupied pools, followed by long-term monitoring, as a prudent way to artificially augment population size.



Figure 6. Vernal pool with both *Isoetes* spp. and *Amphianthus pusillus*, Spring 2012. Note earthen path bisecting pool.

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Pondberry (*Lindera melissifolia*), LE: Woodbury Heritage Preserve and Wildlife Management Area

Lindera melissifolia is a soboliferous shrub (Lauraceae) inhabiting a variety of shallow, non-alluvial wetlands, ponds, lime sinks, and other ephemeral wetlands stretching from the Coastal Plain of South Carolina to the Boot Heel region of Missouri (USFWS, 1993). A total of 15 occurrences of *Lindera melissifolia* were confirmed, mapped, and documented at the Woodbury Wildlife Management Area and Heritage Preserve. By overlaying black and white images from the Agricultural Stabilization and Conservation Service (ASCS) aerial photography archives (1940's) with 2006 digital orthophoto quadrangles, past and present vegetation conditions and patterns were compared and evaluated as potential habitat for *L. melissifolia*. As the digital images were layered into a geographic information system (GIS), disturbance patterns, natural landscapes, and vegetation features were readily located and compared (Figure 7).

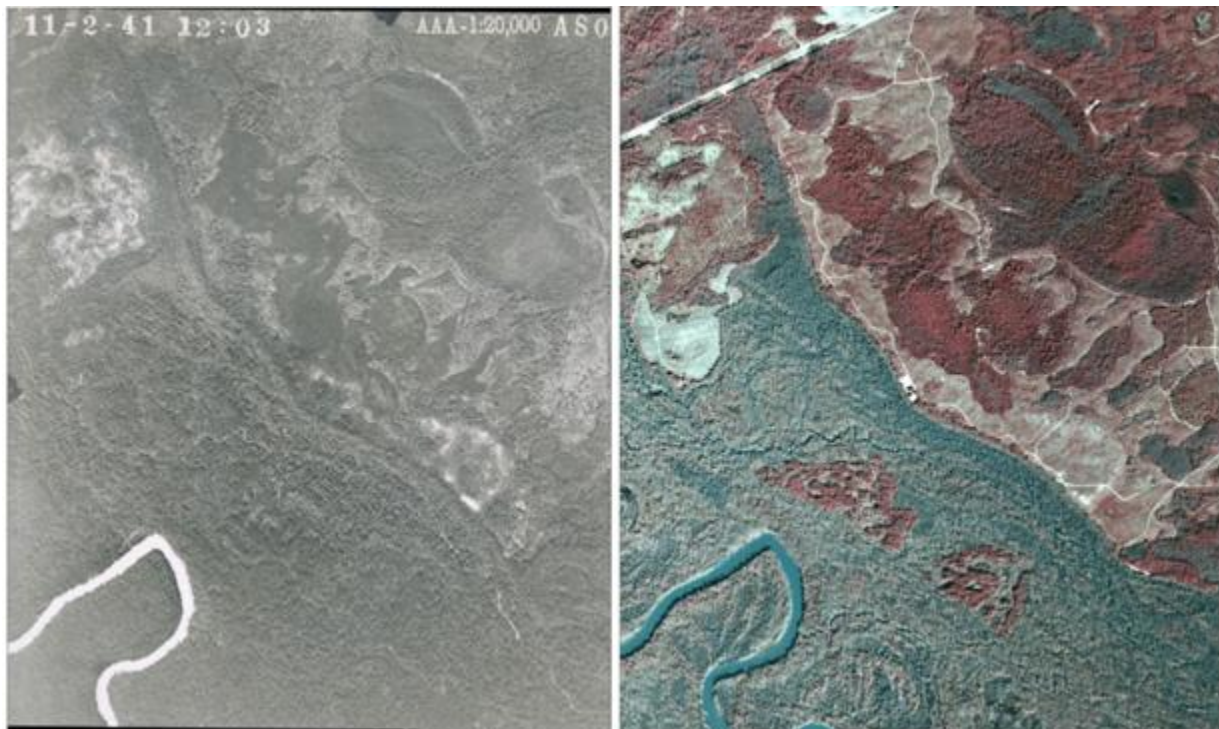


Figure 7. Left: 1941 ASCS black and white print. Right: 2006 Outland and Yauhannah 2006 orthophoto quadrangles.

L. melissifolia was documented in several similar but distinct natural community types, with all sites being closely related to Carolina Bays that predominate at the southeastern extreme of the Britton's Neck peninsula. Underlain by deep, xeric sands typical of the Lakeland and Cahaba Series, and once dominated by Longleaf Pine and Turkey Oak woodlands, the uplands are readily observable as sand sheets and parabolic inland dune slopes (Figure 8) with a presumed windward direction to the northeast (Thom, 1967). Another salient feature of these sandy uplands is the rims of Carolina Bays.

The typical vegetation that defines *L. melissifolia* habitat varies from dense shrub pocosin to Pond Cypress savanna to small ponds, open grasslands or woodlands. It is in the lower-lying portions of this environment of subtle "ridges" and "depressions" and the ecotones between them, that *L. melissifolia* thrives.

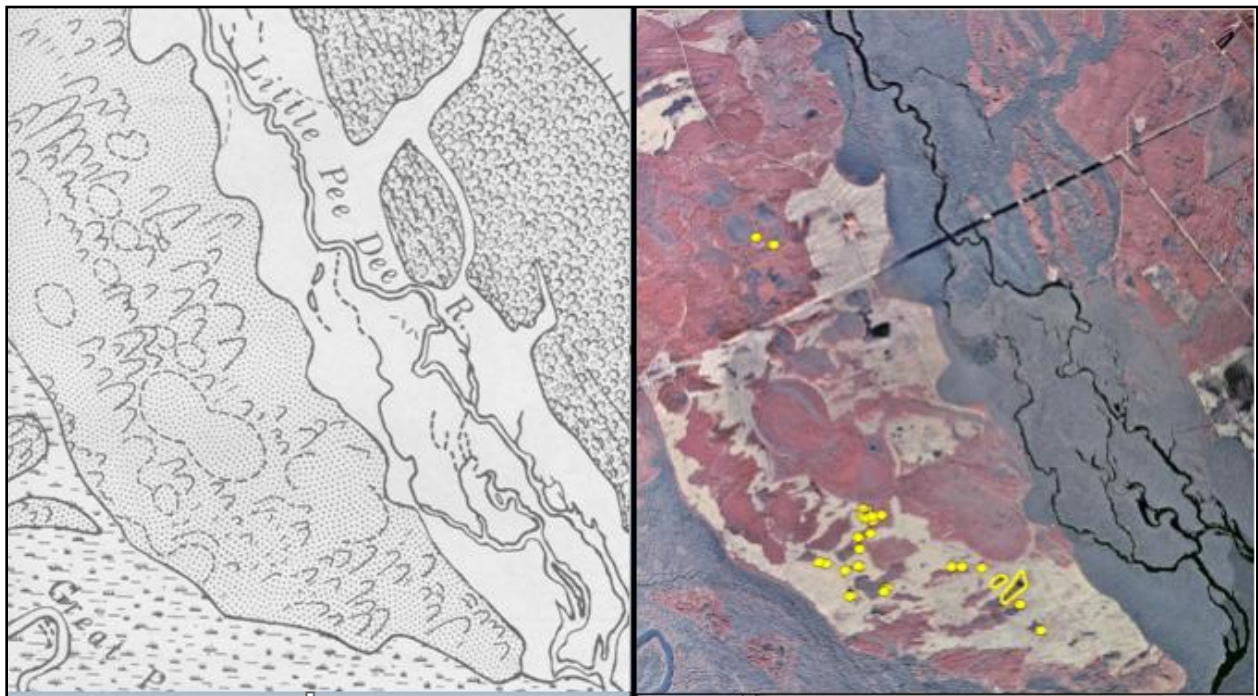


Figure 8. Left: Stream and dune patterns near the junction of the Little and Great Pee Dee Rivers, as interpreted by Thom (1967). Right: Distribution of *L. melissifolia* shown in yellow, on Snow Island, Dongola, Outland, and Yauhannah 1999 digital orthophoto quadrangles.

In an attempt to delineate and predict vegetation patterns, USDA Soil Series and digitized NAPP imagery were used to classify the vegetation. The following generalizations are useful in

describing the known populations of *L. melissifolia* at Woodbury. The majority of these bays and depressions are described generically as "peat-filled" and are dominated by evergreen pocosin vegetation classified under "Pond Pine Saturated Woodland Alliance." Soils are classified as Typic Medisaprists (partially decomposed accumulations of soil organic matter), occurring primarily in landscapes dominated by sterile, coarse, white sands and in low depressions with most sites classified as Rutledge Series. They are easily discerned in false-color aerial photography due to the high reflectance in the near-infrared spectrum typical of evergreen gymnosperm and angiosperm species. The shrub layer is nearly impenetrable and the herbaceous diversity extremely limited (Sharitz and Gibbons, 1982). In such areas *L. melissifolia* is usually restricted to ecotones between the upland Longleaf Pine and the broadleaf sclerophyllous evergreen shrub layer that encircles them. The ecotones are best developed on the eastern and southern quadrants of the Carolina Bays.

In contrast to the "peat-filled" bays are those that are more open, lack a continuous canopy, and support only a sparse development of shrub pocosin vegetation. They are classified as "Pond-cypress Seasonally Flooded Forest and Woodland Alliances." The herbaceous diversity can be very high, with a variety of carnivorous plants and graminoid species present. Pond-cypress bays are often referred to as "clay-based," due to the presence of subsurface clay lenses. Soils are classified as Fragiaquults, Paleaquults, or Humaquents, reflecting the importance of loamy soils in these landscapes. Because they so readily hold water and are more open, with a dearth of pocosin species, they may form ponds and appear dark blue in aerial false-color imagery. In those communities where graminoid species clearly dominate the herbaceous layer, the term "depression meadow" or "savanna" is used. At Woodbury such soils are often classified as Spodosols in the Leon and Lynn Haven Series. The diagnostic spodic horizon is often poorly developed with little or no humate accumulation typical of Humods or Aquods. These areas are often quite small (ten acres or less) and lack the oval shape and longitudinal orientation typical of Carolina Bays. It is in such upland depressions are where *L. melissifolia* was first documented in 2008. The largest populations of *L. melissifolia*, totaling many thousands of stems and covering several acres as almost monotypic stands due to its soboliferous habit, are in these areas with savanna vegetation structure (Figure 9).

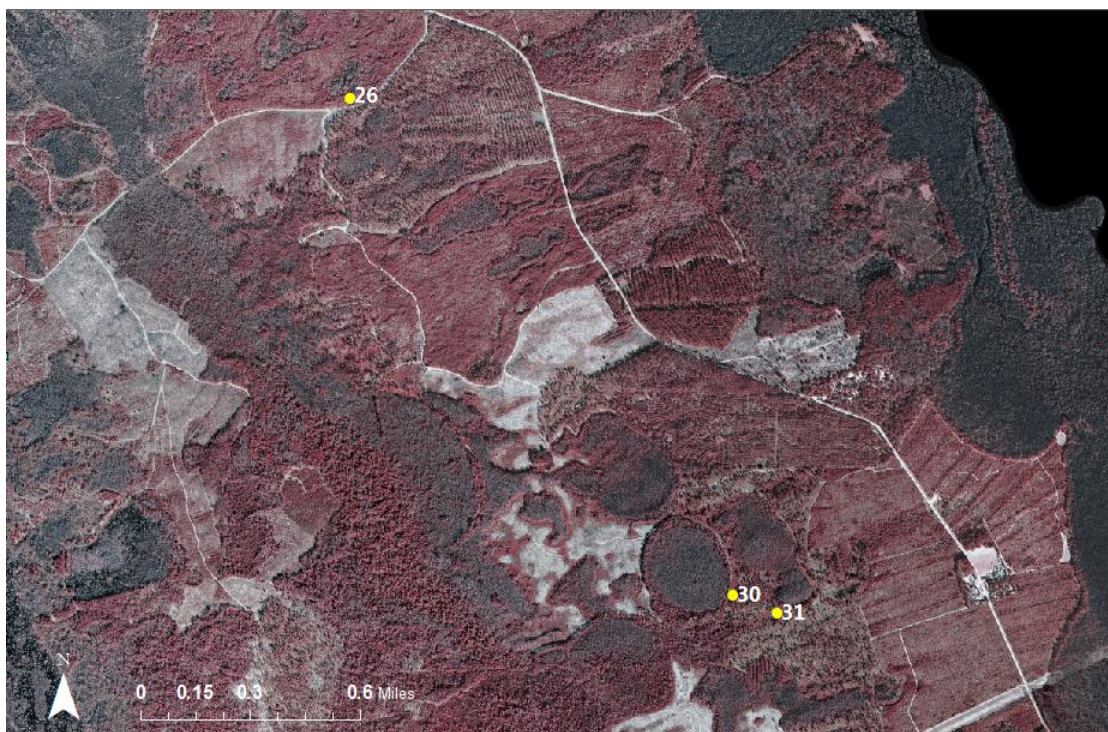


Figure 9a. *Lindera melissifolia* occurrences on Snow Island and Dongola 2006 digital orthophoto quadrangles.

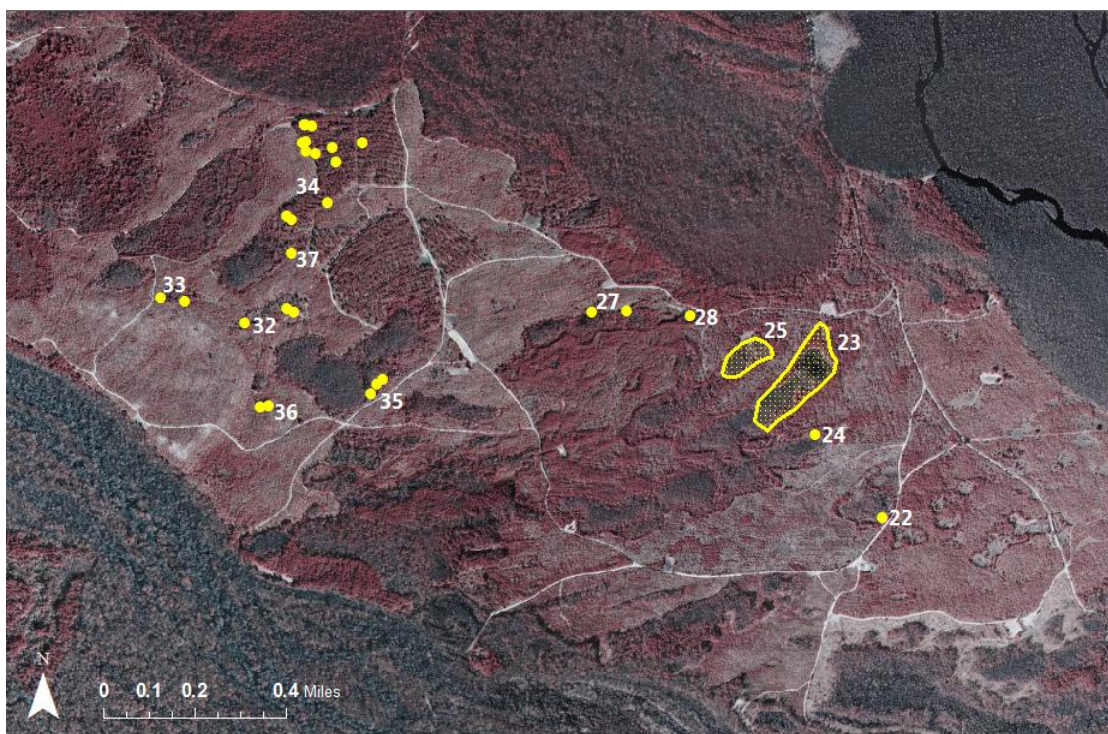


Figure 9b. *Lindera melissifolia* occurrences on Outland and Yauhannah 2006 digital orthophoto quadrangles.

Management Recommendations. During the 2010 growing season, the largest stands of *L. melissifolia* all exhibited significant areas of stem dieback, as been reported for many such populations throughout much of *L. melissifolia*'s geographic range (Deval and others, 2001). Stem specimens were collected for analysis by the research plant pathology laboratories of the Southern Research Station, USDA- Forest Service and the Plant Problem Clinic at Clemson University to determine if laurel wilt disease was the cause. Using agar plating techniques to amplify fungal growth derived from the tissue sample, pathologists observed no known disease. They hypothesize that the typical stem diameter of *L. melissifolia* may be so small that the species escapes predation by the disease's primary vector, Redbay Ambrosia Beetle (*Xyleborus glabratus*). The woody species with larger diameters in the Laurel family are more susceptible. Continued monitoring and sampling of *L. melissifolia* and sister genera is recommended (Clemson University, 2010).

Comparing the aerial photography of the 1940's to the present, the many Carolina Bays, shallow ponds, and pocosin lowlands along the spine of Britton's Neck are now more densely stocked with trees (Figure 6). Many of the small depressions and the rims of Carolina Bays have been impacted by the removal of the upland stands of Longleaf Pine and replanting to Loblolly monocultures. The resulting increase in Loblolly Pine seedlings and development of copses of Sweetgum suckers is displacing the more open woodlands and meadows typical of the largest populations of *L. melissifolia*. Concomitant with recent drought conditions over the last decade, the increase in evapotranspiration demand and woody species competition is degrading these habitats. Without active management to control Loblolly Pine and Sweetgum, these sites may lose the fluctuating water levels that are critical for both amphibian and vascular plant species diversity. Already a number of natural communities are undergoing visible structural change. Loblolly Pines, planted and established in some areas of the Woodbury tract before acquisition by SCDNR are now raining seed into and around adjacent wetlands (Figure 10). SCDNR land managers are using prescribed fire in some of the pocosin-dominated bays, depression meadows, and their associated ecotones to control the smaller diameter trees and woody understory. Consideration should be given to controlling the larger Loblolly Pines and Sweetgums that are resistant to fire.

Another threat to wetlands throughout the Woodbury tract is the activity of feral hogs (Figure 11). Given the importance of vegetative reproduction for *L. melissifolia*, it is not clear how rooting behavior affects its growth; such effects can be either positive or negative and are highly species specific (Engeman and others, 2007). However, hog rooting does generally promote the establishment and growth of invasive plants, both native and exotic, by promoting general soil and subsoil disturbance. Therefore, control of hogs at Woodbury is recommended, particularly as relates the establishment of Loblolly Pine.



Figure 10. Copses of Sweetgum and Loblolly Pine seedlings invading margins of *L. melissifolia* habitat in a Pond Cypress savanna.

In summary, as Loblolly Pine seedlings and sweet gum copses become established in and near the moist depressions and swales, increased rates of evapotranspiration may have the long-term effect of lowering the soil moisture content and perhaps groundwater levels to significantly alter

the temporary pond-like conditions critical for *L. melissifolia* habitat. These trends will be greatly exacerbated when these woody species begin to bear seeds in areas disturbed by feral hogs. Prescribed fire and feral hog management are recommended.



Figure 11. Left: Altered depression meadow damaged by feral hogs in 2005. Right: Recovery of native grass layer in 2011.

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Canby's Dropwort (*Oxypolis canbyi*), LE: Crosby Oxypolis Heritage Preserve and Longleaf Pine Heritage Preserve

Oxypolis canbyi is stoloniferous, perennial herb (Apiaceae) that inhabits a variety of wetlands along the Atlantic Seaboard from Maryland to Georgia (USFWS, 2012). In South Carolina *O. canbyi* occurs in Pond Cypress savannas in wet meadows, Carolina Bays, and other depressional wetlands with loam or clay soils (Gaddy, 2006).

Surveys for *O. canbyi* were conducted across Crosby Oxypolis, Longleaf Pine, and Lynchburg Savanna Heritage Preserves to confirm and update known data points and search for additional populations. Black and white archival photographs, produced and printed by the Agricultural Stabilization and Conservation Service (ASCS), from the 1930's - 70's were scanned as an aid in evaluating sites for *O. canbyi* habitat. The historic landscape, when compared with recent digital orthophotos and high-resolution true-color imagery, provided a backdrop of land use change over a 70-year period (Figure 12). Areas that had been ditched and cultivated – and were therefore less likely to provide suitable habitat – were readily identified. When combined with soils data, general vegetation patterns were delineated. Pond Cypress depressions with open canopies and herbaceous ground layers were identified and marked for survey. Red-cockaded Woodpecker location data was added to indicate site characteristics and additional potential locations for *O. canbyi*.

Field surveys confirmed that all *O. canbyi* at Longleaf Pine Heritage Preserve is in or near the utility right-of-way that bisects a low area with Pond Cypress. Intensive field searches along the length of the right-of-way and also in stands of Longleaf Pine woodland managed for Red-cockaded Woodpecker and *Schwalbea americana* were unsuccessful. No additional populations of *O. canbyi* were found along the sloughs and Pond Cypress depressions that cover much of the property.

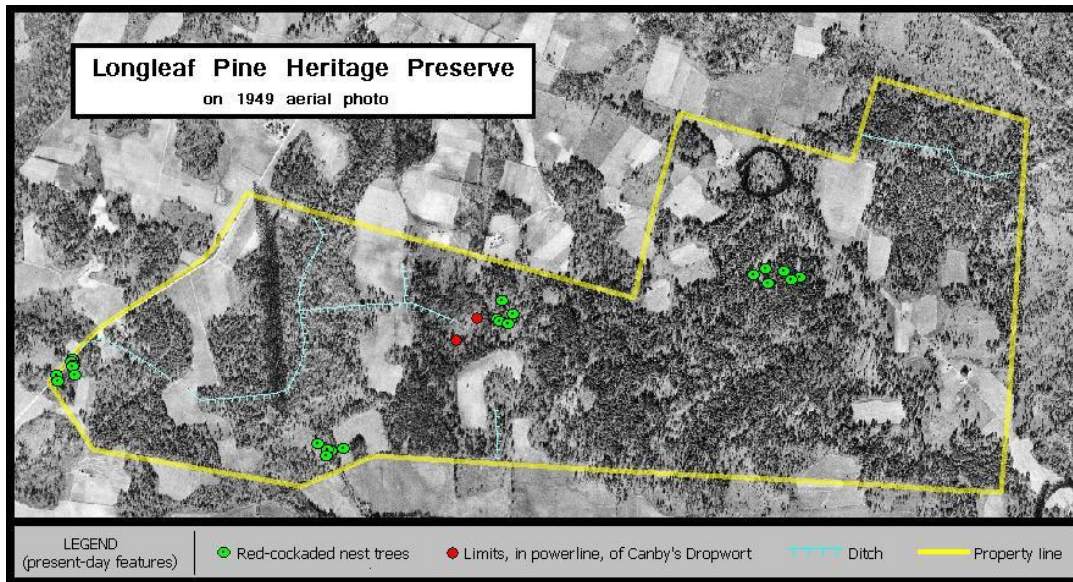


Figure 12a. Digital imagery of ASCS archival aerial photographic prints dated 1949 of the Longleaf Pine Heritage Preserve, Lee County, SC, with present day features added. (Note: black marks are artifacts on original prints).

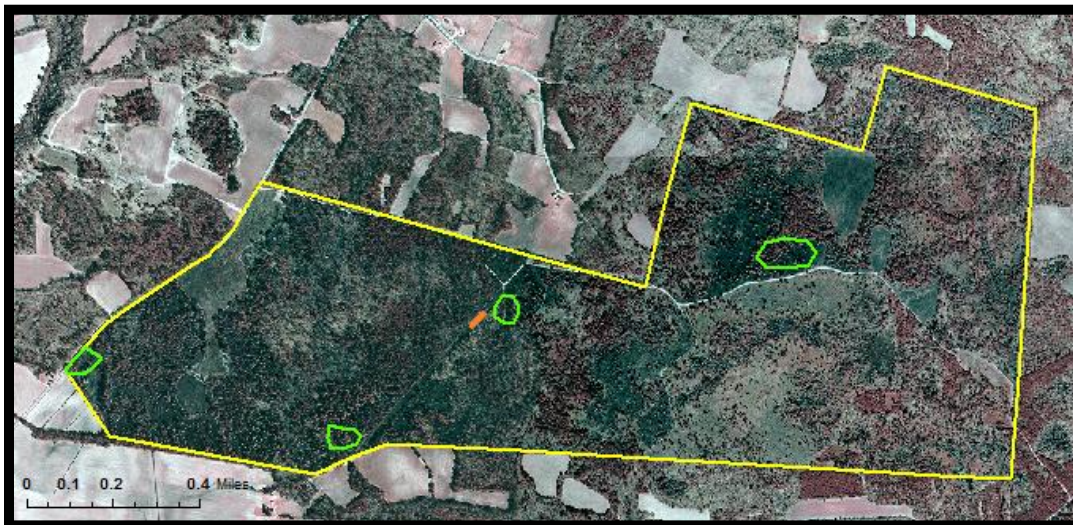


Figure 12b. Same features as above on Elliott, Lynchburg, Mayesville, and Turbeville 2006 digital orthophoto quadrangles.

Field surveys and image analysis of the Crosby Oxypolis Heritage Preserve were conducted in order to estimate the abundance of *O. canbyi* and to typify the dominant vegetation, past and present, along the SC-63 right-of-way and throughout the preserve. By comparing archival ASCS black and white prints (years 1939, 1957, 1963, 1968, and 1973) to 2006 digital

orthophoto quadrangles (Figure 13), we determined that the timber stands on the preserve and those to the north of SC 63 were impacted by road improvement and selective timber harvest, but not clear-cutting, prior to acquisition by the SCDNR. In addition, floristic observations and specimen collections of associate species include both significant long-lived, perennial heliophytes (*Sarracenia flava*) and an abundance of large, widely-spaced *T. ascendens* trees.

Slash and Loblolly Pine silviculture prior to acquisition by the SC Heritage Program, and subsequent fire suppression have led to a retrenchment of the natural wet savanna and open woodland habitat that supports *O. canbyi* still found along the roadside right-of-ways. Other woodland or savanna herbaceous species observed both north and south of the highway or as vegetative rosettes in the preserve interior include *Boltonia asteroides*, *Erigeron vernus*, *Eriocaulon decangulare*, *Eupatorium capillifolium*, *E. leucolepis*, *Lobelia nuttallii*, *Panicum hemitomon*, *Saccharum giganteum*, and *Xyris fimbriata*. Also growing along the edge of the preserve with *Oxypolis canbyi* is the congeneric species *O. filiformis*. The latter species is perennial by habit with thick fleshy roots and occupies a very similar niche in Pond Cypress savannas throughout much of its range in SC. Both possess distinctive phyllodial leaves and are easily misidentified in vegetative state. However, the distinctive white stolons of *O. canbyi* readily separate them. In the wetter, central portions of the site the presence of large, hollow *Nyssa biflora* and *Gordonia lasianthus* point to a Gum Pond community with a *Cyrilla racemiflora* understory.



Figure 13a. Crosby Oxypolis Heritage Preserve 2006 digital orthophoto quadrangle. Red dots indicate old growth Pond Cypress, Swamp Blackgum, and Loblolly Bay; yellow dots are *Oxypolis canbyi*. Note how SC Highway 63 bisects the northern end of the wetland, with Longleaf Pine / Pond Cypress savanna vegetation still intact northeast of the preserve and south of the church cemetery.

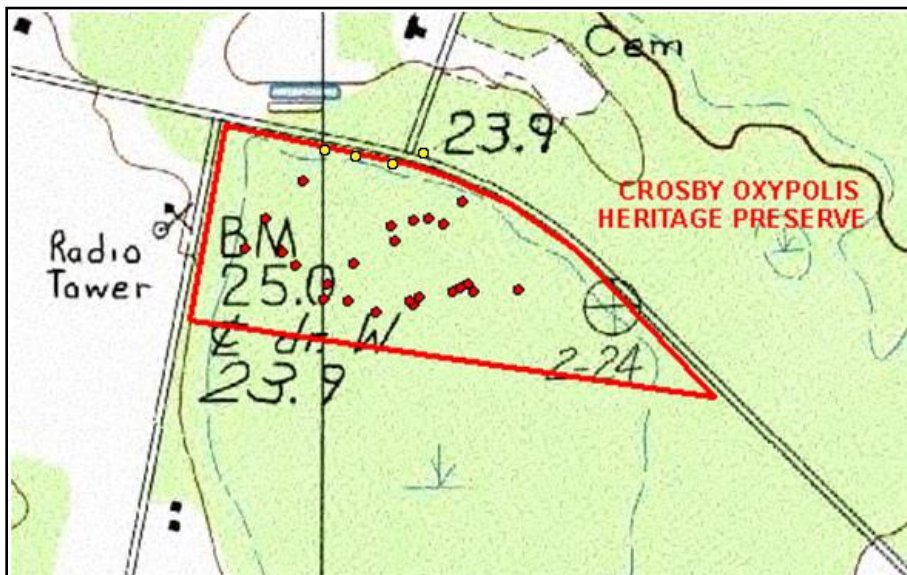


Figure 13b. Locations of large individual trees (~20-50 cm DBH) of Pond Cypress, Swamp Blackgum, and Loblolly Bay in the Crosby Oxypolis Heritage Preserve. Yellow dots indicate populations of *Oxypolis canbyi* on both sides of SC 63.

Management Recommendations. Restoration of Pond Cypress slough and savanna vegetation is recommended. Plants that inhabit Carolina Bays can survive multiple disturbances including tillage and drought (Kirkman and Sharitz, 1994). Critical to their persistence is the presence of seed banks and perennating organs such as rhizomes and stolons. Removing aggressive trees (Loblolly Pine) and shrubs (*Ilex glabra*, *Cyrilla racemiflora*, and *Myrica cerifera*) may allow recruitment of less common species including *O. canbyi*, *Sarracenia flava*, and *S. purpurea*.

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Harperella (*Ptilimnium nodosum*), LE: Janet Harrison High Pond Heritage Preserve

In South Carolina, *Ptilimnium nodosum* is limited to small natural ponds colloquially known as "High Ponds." Of the six known sites in the state, only the Janet Harrison High Pond population is still extant (Aulbach, 2011). The preserve is in the northwest corner of the Inner Coastal Plain, in a region known as the Aiken Plateau (Cooke, 1936). Other areas along the Fall Line that were named by Cooke include the Richland Red Hills, the High Hills of Santee, and the Congaree Sandhills. High Ponds are small, shallow, temporarily flooded depressions scattered across the Inner Coastal Plain Province. Eolian in origin and elliptical in shape, they are classified as Carolina Bays by geologists (Nystrom and others, 1991). However, High Ponds are unusual in that they often support graminoid-dominated vegetation, with emergent or floating aquatic plants in deeper water (Rayner, 1982). Arborescent vegetation is often sparse compared to many of the Carolina Bays of the Outer Coastal Plain, which typically become well stocked with *Taxodium ascendens*, *Nyssa biflora*, *Acer rubrum*, and broad-leaved, evergreen sclerophyllous vegetation to form "pocosins." Furthermore, the soils of High Ponds usually lack significant accumulations of organic matter or peat (Bennett and Nelson, 1991). Drainage may flow into or out of these small localized basins, but the major source of water is probably rainfall (Johnson, 1942). As with Carolina Bays, fire is thought to be a natural check on woody plant succession (Sharitz, R. R., 2003).

Prior to acquisition by SCDNR, Janet Harrison High Pond had been ditched and the uplands planted in Loblolly Pine. The *P. nodosum* population, estimated by stem counts during peak flowering, has varied greatly from 1985 to 2011 with a range of 66 to more than 10,000 stems (Aulbach, 2011). The effects of different sampling methods and the prolonged periods of drought in the Aiken Plateau upon these counts are not known. Concurrent with these droughts have been efforts by SCDNR preserve managers to restore the site's pond-like hydrology, natural contours, and vegetation patterns. *P. nodosum* is not evenly spread across the depression; stems were most concentrated along its western margin (Aulbach, 2011). If normal pool levels return, stem counts should increase with plants eventually spreading across much of the pond (Figure 14).

High Ponds provide habitat for a number of state and federal species of concern (Rayner, 1982). These include *Lobelia boykinii*, *Ludwigia spathulata*, *Rhexia aristosa*, *Rhynchospora tracyi*, and *Sclerolepis uniflora*, in addition to *P. nodosum*. A complete compilation of all vascular plants collected at Janet Harrison High Pond and curated at USCH and CLEMS is included in the Appendix.

Management Recommendations. The restoration of the natural contours has exposed areas of bare mineral soil, particularly on the pond's eastern margins. Here, seedlings of *Pinus taeda* and *Typha* spp. can become established in times of pool drawdown. Population estimates of *Ptilimnium nodosum* should continue with standardized methods, and colonization by invasive species monitored.



Figure 14. *Ptilimnium nodosum* occurrence on Monetta 2006 digital orthophoto quadrangle. At present the west side of the pond has developed more favorable conditions for *P. nodosum* than the east side.

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Miccosukee Gooseberry (*Ribes echinellum*), FT: Stevens Creek Heritage Preserve

Ribes echinellum (Saxifragaceae) is a shrub with ascending or reclining stems known to inhabit two far disjunct locations along Miccosukee Lake near Monticello Florida and Stevens Creek in McCormick County, South Carolina (USFWS, 1985). Originally discovered and described along the north-facing bluffs overlooking Stevens Creek, *R. echinellum* inhabits a unique basic-mesic forest (Radford, 1959). To protect *R. echinellum* and other rare plants, Stevens Creek Heritage Preserve was established in 1978. The bluff area has an unparalleled diversity of deciduous tree and shrub species, as well as a variety of spring wildflowers and other herbs not typical for the Southern Piedmont. Many of these herbaceous plants are associated with circum-neutral soils and are more typical of the marl forests of the Low Country and the deep rich coves of the mountains. Topography at Stevens Creek is steep, with slopes of 50-75 degrees as the stream rapidly cuts down towards the Fall Line. The underlying rock is syenite, a coarse-grained intrusive igneous rock of the same general composition as granite, which it often grades into. Here the syenite is often alkaline in nature and can erode to form soils approaching neutrality in reaction. Radford (1959) reported a soil reaction range of 4 to 7.5, and Jones (1986) later corroborated the atypical soil characteristics, finding slightly acidic and alkaline soil reactions (pH 6.7 to 7.4) and high calcium levels. Gaddy (2008) focused on sampling and mapping its abundance and the associated canopy trees.

A survey to map the range and extent of *Ribes echinellum* was completed at Stevens Creek Heritage Preserve. All steep north-facing bluffs with mesic hardwoods, particularly syenite outcrops were targeted. Upslope of the bluffs, the drier draws dominated by more xeric pine-oak-hickory assemblages were also surveyed. While the bulk of the *R. echinellum* stems were found to be along the well-known and much-frequented bluffs overlooking Stevens Creek, the outline of the stand mapped by Gaddy (2008) was extended ~0.2 mile to the west and ~0.2 mile upslope -- field checked by global positioning to plus/minus 10-meter accuracy. Unlike the more typical sites with plot densities of 500 stems/ 0.1 acre reported by Gaddy, these stands are sparsely populated and may not flower or set seed. Vegetative reproduction of the reclining shoots or canes is thought to be common. These upslope, sporadically occurring "waifs" are often upright in habit, with canes generally not exceeding 50 dm, sterile, and often appearing "haw-like."

Sterile and depauperate stems of parsley hawthorn (*Crataegus marshallii*) may be confused with *R. echinellum*, but are readily distinguished by the armature of the twigs. The spines of the latter vary in number from 1-3 and are decurrent along the side of the leaf scars, being morphologically derived from the stipules (Figure 15). In contrast, the spines (sometimes called "thorns") of *C. marshallii* are simple determinate branches.

Additional surveys were made on the north side of Stevens Creek on parcels acquired by SCDNR subsequent to the original acquisition of the preserve. Here, in contrast to the more sheltered topographic position of north-facing bluffs, are generally south-facing slopes that are less steep, much drier, and noticeably less floristically diverse. The area is also more disturbed and fragmented by Loblolly Pine plantation silviculture. Yet, two additional stands of *R. echinellum* were found, a small one on the east side of the tributary Gundy Creek, and a somewhat larger one on the west side (Figure 16).



Figure 15. *Ribes echinellum* near Gundy Creek, Stevens Creek Heritage Preserve.

Management Recommendations. The upland forests in the Stevens Creek watershed have been greatly disturbed and, as is the case throughout much of the Piedmont, are now dominated by vast acreages of Loblolly Pine monoculture, both planted and volunteered through old field succession. Historical evidence points to a piedmont landscape marked by periodic fire supporting a more mixed oak-hickory-pine woodland natural community, particularly along the drier and steeper south-facing slopes and in areas where soils are thin over bedrock (Jones, 1988). Upland sites along Stevens Creek are dominated by *Pinus echinata*, *P. virginiana*, *Quercus prinus*, *Q. marilandica*, *Q. stellata*, and *Carya glabra* with an abundance of drought tolerant grasses that are capable of carrying low intensity fires, namely *Schizachyrium scoparium*, *Danthonia spicata*, *Piptochaetium avenaceum*, *Andropogon gerardii*, *A. ternarius*, *A. gyrans*, and *Sorghastrum nutans*. Particularly relevant to this discussion is that the herbaceous layer of these uplands includes *Tephrosia virginiana*, *Pityopsis graminifolia*, *Parthenium integrifolium*, *Cunila origanoides*, and *Coreopsis verticillata* -- all potential sources of nectar and pollen for a variety of insect pollinators. In addition, flowering shrubs are common in understory: *Diospyros virginiana*, *Vitis rotundifolia*, *Cercis canadensis*, *Fraxinus americana*, *Vaccinium arboreum*, *V. pallidum* and *Chionanthus virginicus*. See White and Lloyd (1998) for a more complete discussion of the floristics of xeric Piedmont forests which includes the John de la Howe tract, a mixed oak-shortleaf-loblolly forest near McCormick, SC.

Catling and others (1998) studied pollinators and determined the pollination mechanism for *R. echinellum*. The primary pollinators were identified as large bees in the genus *Bombus* and *Habropoda laboriosa*. However, neither pollinator specificity nor rarity was thought to be adequate explanation for the isolated and limited distribution of *R. echinellum* in Florida or South Carolina. Although breeding studies were not conducted, pollinators were observed to effectively transport pollen from protandrous plants to those with emergent styles, presumably receptive to effective fertilization. They conclude that factors such as overall landscape biodiversity, ensuring a large pollinator pool, may be important to successful fertilization and fruit production in *R. echinellum*. Moller and others (2012) demonstrated a causal relationship between the decline of pollinators and decline of fruit set, frugivory, and seed dispersal for a wide diversity of plants at a landscape level. In addition, small isolated populations may not

attract pollinators and therefore would be less successful than the typically conspicuous plants in large patches.

Based upon these pollinator studies, silvicultural practices that promote a diversity of "showy" or entomophilous wildflowers are recommended. The pine plantations upslope or adjacent to the *R. echinellum* sites, particularly those northeast of the main tract of Stevens Creek Heritage Preserve, should be managed for Shortleaf Pine, with an open woodland vegetation structure conducive to high floristic diversity as described by White and Lloyd (1998). Such management would help maintain a large bee population necessary for successful cross-pollination of *R. echinellum* (Catling and others, 1998). Isolated colonies of *R. echinellum* should be monitored for flowering and fruit production.

The steeper hardwood bluffs and south-facing slopes over exposed syenite rock may yet harbor additional significant natural areas with small but important stands of *R. echinellum*. Both the steeper bluffs with basic mesic forests and the drier sites near Red Cedar glades along the Stevens/Turkey Creek drainage should be surveyed throughout the adjoining Sumter National Forest. Breeding, fecundity, and seed dispersal studies to include small isolated populations would be useful in ascertaining the role of asexual and sexual reproduction in establishment and recruitment.

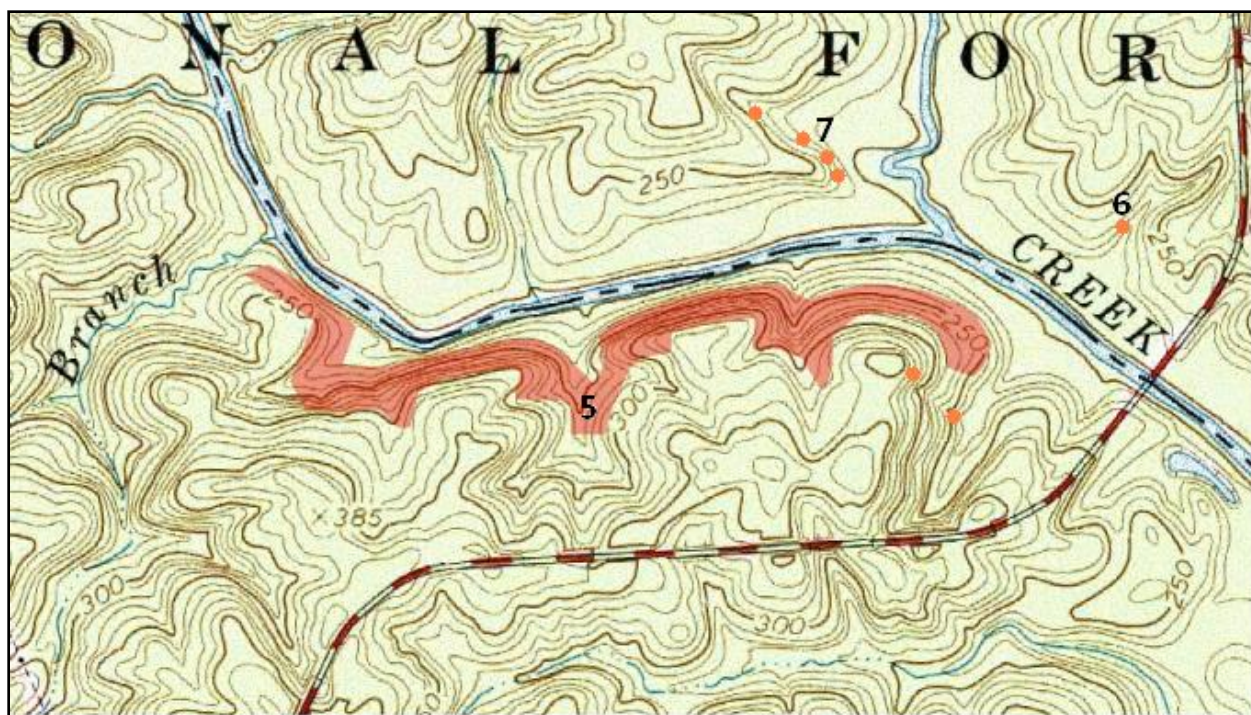


Figure 16a. *Ribes echinellum* occurrences 5, 6, and 7 on 7.5-minute topographic map (Clarks Hill SC, 1986).



Figure 16b. *Ribes echinellum* occurrences in yellow on Clarks Hill 2006 digital orthophoto quadrangle.

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Mountain Sweet Pitcher-Plant (*Sarracenia rubra* ssp. *jonesii*), LE: Ashmore and Chandler Heritage Preserves

Sarracenia rubra ssp. *jonesii* (Sarraceniaceae) is an herbaceous, rhizomatous, carnivorous plant living along streams on or in high elevation bogs and along south-facing slopes in North and South Carolina. Most of the documented occurrences of this southern Appalachian endemic in South Carolina inhabit extremely steep, wet rockslides known as "cataract seeps" (Porcher and Rayner, 2001).

South Carolina's cataract seeps or fens are some of the most distinctive natural communities in the mountains of the Carolinas. Botanically they are a combination of low granite or gneiss dome species and Peat Moss seepage-wetland species, sharing floristic assemblages of both mountain streams and sandhill streamside pocosins. Commonly associated with the sandhills are species such as *Woodwardia virginica*, *W. areolata*, *Osmunda cinnamomea*, *O. regalis*, *Andropogon glomeratus*, *Dulichium arundinaceum*, *Fuirena squarrosa*, *Scleria triglomerata*, *S. muehlenbergii*, *Smilax laurifolia*, *S. smallii*, *Eubotrys racemosa*, *Viburnum nudum*, *Rhododendron viscosum*, *Eryngium integrifolium*, *Lobelia amoena*, *Gratiola pilosa*, and *Polygala cruciata*, often in dense assemblages. The canopy and shrub layers however may consist of distinctly montane species. *Pinus rigida*, *P. strobus*, *P. virginiana*, and *Tsuga canadensis* are often perched along the steep slopes in the canopy, while the stream banks are dense with *Kalmia latifolia*, *Rhododendron maximum*, and *R. arborescens*. In some stands the vegetation is bi-layered, with an evergreen shrub layer overtopped by *Acer rubrum*, *Ilex opaca*, and *Liriodendron tulipifera*. Only along the streambed edges or on small "islands" in the channel is there enough sun and moisture to support Peat Moss hummocks 1-2 meters in area. Other carnivorous species typical of the acidic, nutrient poor habitats of the sandhills of the Inner Coastal Plain are found as well: *Utricularia cornuta*, *Drosera rotundifolia*, and *S. purpurea*.

Some of the earliest known collections of *S. rubra* ssp. *jonesii* (C.R. Bell, NCU, 1948) were made in northern Greenville County in the region now known as the Mountain Bridge Wilderness Area. In this area are well documented examples of hard-rock exposures of Table Rock biotite-microcline augen gneiss (SC Geological Survey, 2005). Numerous intermittent,

high elevation streams flow locally south over massive granitoid gneiss outcrops into the deeply incised South Saluda River Valley below. *S. rubra* ssp. *jonesii* occurs on both sides of Persimmon Ridge, on both the Ashmore and Chandler Heritage Preserves. Numbers of observed occurrences, east-to-west by drainage, were as follows: Wattacoo Creek – 2, upper Wildcat Creek – 2, and Slickum Creek – 2 (“Wildcat” and “Slickum” do not appear on topographic maps but are the locally accepted drainage names). Most of the *S. rubra* ssp. *jonesii* occurrences appear stable, with robust colonies of trap leaves reproducing as ramets from rhizomes. Each can produce over a dozen trap leaves per ramet. Many sites are along very steep gradients over thin soils close to bedrock, where tree growth is limited and moisture is adequate. At a few sites -- in particular, the upstream portion of occurrence 1 on Slickum Creek -- some colonies failed to flower or set seed and trap leaves were etiolated and did not expand. This area is along a nearly level stream stretch with very dense shrub layers over dry sandy washes (Figure 17).

Management Recommendations. In a quantitative study of montane wetlands in North Carolina, Warren and others (2007) determined that herbaceous species coverage and rare species presence are negatively correlated with woody species encroachment. In such areas, control of the overtopping woody vegetation may induce flowering and positively affect moisture levels. However, Porcher and Rayner (2001) speculate that the unique cataract seeps may slow otherwise natural hydrarch succession. Thin soils discourage the growth of woody competition while sunny and wet conditions promote herbaceous species diversity, making the cataract bog a rare but ideal environment for plants like *S. rubra* ssp. *Jonesii*.

In contrast to South Carolina's pocosin-like seeps, the *S. rubra* ssp. *jonesii* sites in North Carolina occupy non-forested "bogs" near flat stream bottoms or gentle slopes with wet organic or mucky mineral soils (Schafale, 2013). One South Carolina site, occurrence 13 on the northern shore of Wattacoo Lake in the Ashmore tract, may fit these criteria. However, the site was impacted by an impoundment built in the 1960's, and therefore, the exact nature of the stand may not be possible to determine. A comparative study of the vegetation patterns and dynamics across the two states is recommended to augment the demographic studies by Sutter and others (1996) and Rudd and Sutter (1997).

Since most populations of *S. rubra* ssp. *jonesii* seem to be stable given sufficient rainfall, perhaps the most immediate threat is disturbance by feral hogs. Two populations on the Ashmore Heritage Preserve Tract were reported by to have been impacted by hog rooting (Bunch, 2013). If large numbers of rhizomes were to be excavated, dislodged, and desiccated, the effect upon the colonies would be severe; therefore hog population monitoring and control should continue. Efforts to relocate two historic populations along the lower reaches of Wildcat Creek on property owned by SC State Parks were unsuccessful.

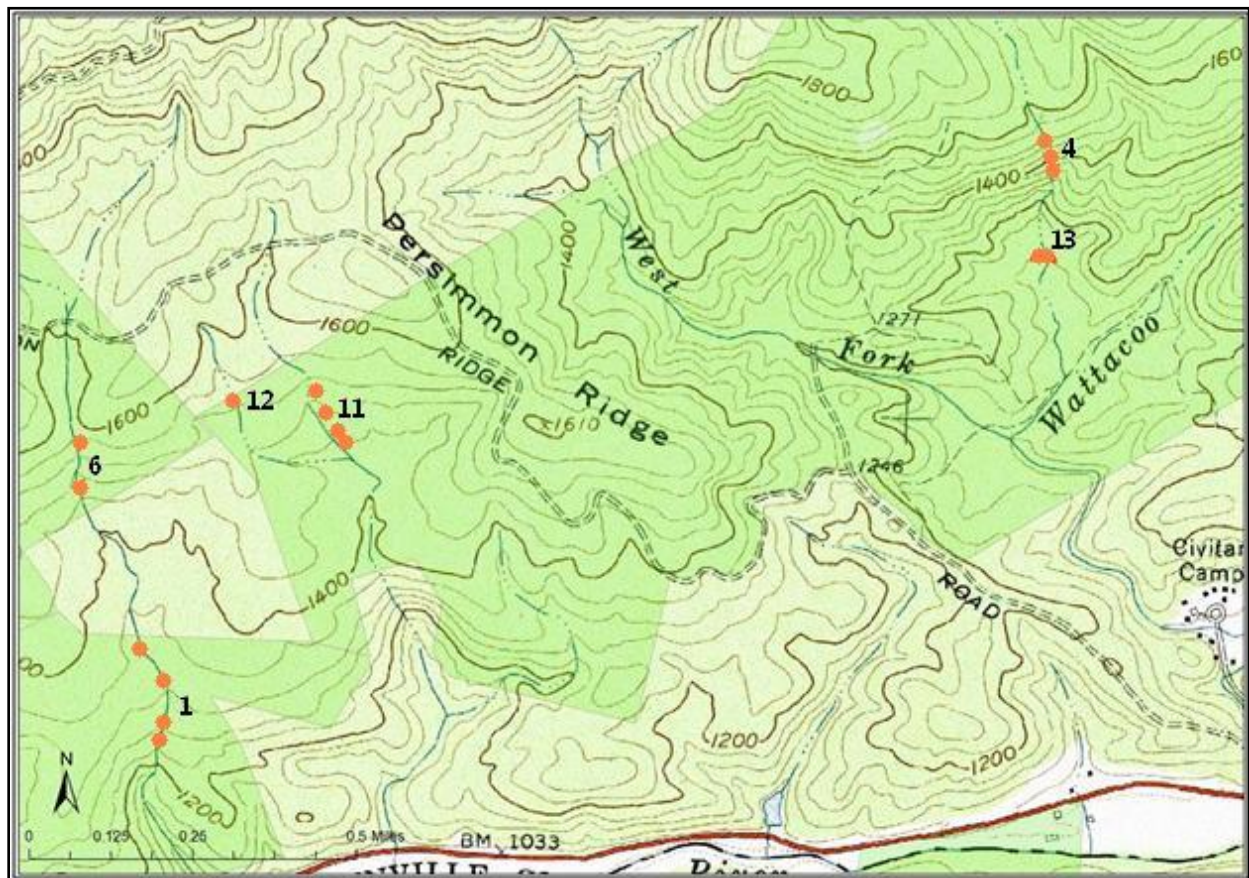


Figure 17. *Sarracenia jonesii* occurrences 1, 4, 6, 11, 12, and 13 on 7.5-minute topographic map (Cleveland SC, 1961).

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Persistent Trillium (*Trillium persistens*), LE: Battle Creek Registration Site and Brasstown Creek Heritage Preserve

Trillium persistens (Liliaceae) is a short-lived, herbaceous perennial narrowly endemic to northwest South Carolina and northeast Georgia along the Tallulah-Tugaloo River drainage. It inhabits acidic cove forests, sometimes extending to the edges of xeric slopes just above the coves. In South Carolina *T. persistens* appears to be restricted to the lower reaches of Battle Creek (USFWS, 2011).

The southernmost known population is in Georgia along Panther Creek, near the confluence with the Tugaloo River. Here *T. persistens* inhabits a north-facing evergreen acidic forest, which Plank describes in a full floristic analysis (2010). Less than a mile to the northeast, across the river in South Carolina, is the floristically rich Brasstown Creek which drains the Brevard Fault Zone (Boufford and Wood, 1977). Much of the drainage is protected by the Brasstown Creek Heritage Preserve and the adjacent Andrew Pickens Ranger District of the Sumter National Forest. With particular attention to habitats similar to those at Panther Creek, searches were conducted for *T. persistens* from the vicinity of Brasstown Creek north to the known occurrence at Battle Creek. No new occurrences were found, but at the Battle Creek site the presence of at least 100 plants, with ~10 percent in flower, was confirmed (Figure 18).

Plank (2010) suggests that *T. persistens* may be in decline at Battle Creek. Of concern is that in 2009 no fruit set was observed. The largest groups sampled and scored in 2010 were in the juvenile and sub-adult stages. By adding a dormant stage to her matrix growth model Plank concluded that a more realistic projection of population stability may emerge; seedling dormancy is an important factor in estimating population size and growth of *T. persistens*. If these empirical data foretell greater recruitment into the adult reproductive stage, then seed set should replenish the seed bank. Conversely, any loss of these reproductive adults may portend a significant decline in population over time.

Management Recommendations. With the loss of reproductive adults deemed a major threat to the long-term sustainability of *T. persistens* populations, concerns about feral hogs in the region are only heightened. Feral hog rooting is common throughout the mountains of South Carolina, particularly along the streams and moist coves as found along Brasstown Creek (Bunch, 2013). State and federal agencies should coordinate efforts to control these destructive animals.

Another and perhaps more intractable problem is Woolly Adelgid infestation leading to the loss of *Tsuga canadensis*, the canopy dominant of many mountain streams. Plank (2010) measured Importance Values (IV) in the tree layers at Battle Creek and three nearby sites in Georgia, assessing relative frequency, density, and dominance. Of all tree species (n=21), *T. canadensis* scored the highest IV at all four sites. Clearly its loss would have an immediate effect by changing forest composition and increasing the light gap index. However, with the evergreen heath species *Kalmia latifolia*, *Rhododendron maximum*, and *R. minus* extremely abundant in the understory, any effects of increased solar radiation on *T. persistens* are likely to be short-lived as the evergreens expand coverage (Krapfl and others, 2012). In our survey almost all hemlocks appeared to be infected and the canopies partially or completely denuded; many trees are apparently dead. Continued monitoring of the long-term effects of the loss of *T. canadensis* upon growth and fecundity of *T. persistens* is recommended.

Finally, most of the plants sampled by Plank (2010) and seen in this study are very close to the margins of Lake Yonah. These plants may be vulnerable to excessive soil moisture or even inundation during flood events; therefore assessment and mapping of the upstream extent of the population is particularly important. When *T. persistens* was first collected at Battle Creek in 1970 by John Garst (specimen at the University of Georgia Herbarium), the collection site was described as "under *R. maximum* on wooded terrace in steep ravine; Battle Creek 1/3 mile from Lake Yonah, elev. about 850 ft." Thus, Garst seemingly points to additional plants upstream from the well-studied site near the lake shore. However, the exact location is not clear. Gaddy and Rayner (1989) conducted a demographic study of populations along Battle Creek but again precise location coordinates were not reported.

US Fish and Wildlife (2011) concluded that additional searches for *T. persistens* were not warranted "since repeated surveys since 1983 have not significantly expanded the range of the species." Given the disturbance and change occurring in the moist cove habitats throughout the region, a thorough reconnaissance using global positioning technology should be considered to include the Battle Creek Registration Site extending into the Sumter National Forest. Our reconnaissance of Boatwright Creek, a major tributary of Brasstown Creek, revealed a particularly undisturbed stretch of steep north-facing slopes less than 2 mile northeast of the Panther Creek, Georgia population. A cooperative survey effort with SCDNR, the US Forest Service, and the Georgia Power Company is also recommended.

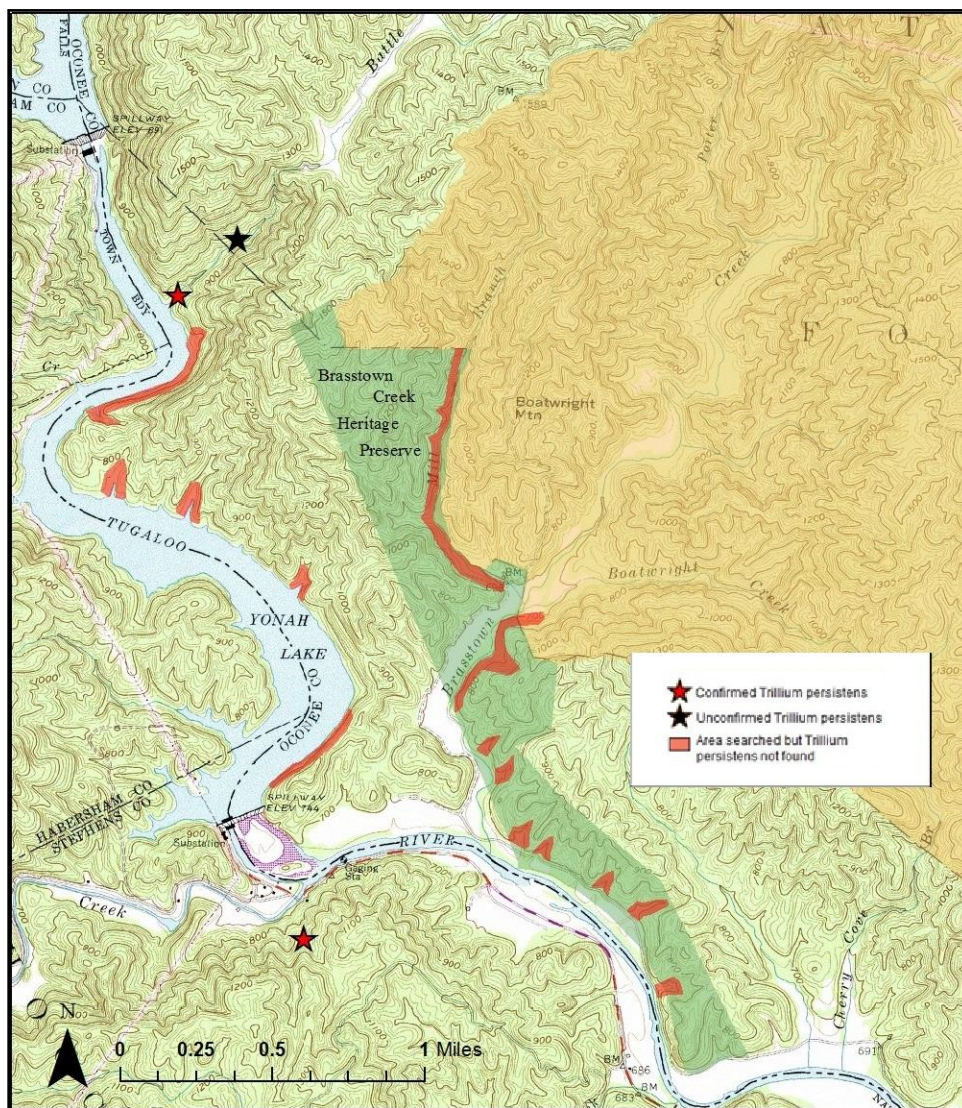


Figure 18. *Trillium persistens* occurrences, on 7.5-minute topographic quadrangle (Tugaloo Lake SC/GA, 1972).

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Appendix 1. Number of Federally listed species vouchers at each herbarium: Clemson University (CLEMS), University of South Carolina (USCH), and University of North Carolina (NCU).

Scientific Name	Common Name	USESA Status	CLEMS	USCH	NCU	Total Number of Vouchers
<i>Amaranthus pumilus</i>	Seabeach Amaranth	LT: Threatened	1	7	0	8
<i>Amphianthus pusillus</i>	Little Amphianthus	LT: Threatened	0	5	1	6
<i>Echinacea laevigata</i>	Smooth Purple Coneflower	LE: Endangered	8	8	3	21
<i>Gymnoderma lineare</i>	Rock Gnome Lichen	LE: Endangered	0	1	0	1
<i>Helianthus schweinitzii</i>	Schweinitz's Sunflower	LE: Endangered	2	8	0	10
<i>Helonias bullata</i>	Swamp-pink	LT: Threatened	0	2	1	3
<i>Hexastylis naniflora</i>	Dwarf-flower Heartleaf	LT: Threatened	2	7	1	10
<i>Isoetes melanospora</i>	Black-spored Quillwort	LE: Endangered	0	0	0	0
<i>Isotria medeoloides</i>	Small Whorled Pogonia	LT: Threatened	0	0	0	0
<i>Lindera melissifolia</i>	Pondberry	LE: Endangered	5	5	5	15
<i>Lysimachia asperulifolia</i>	Roughleaf Loosestrife	LE: Endangered	0	5	0	5
<i>Narthecium americanum</i> *	Bog Asphodel	C: Candidate	0	0	0	0
<i>Oxypolis canbyi</i> **	Canby's Dropwort	LE: Endangered	11	0	11	22
<i>Platanthera integrilabia</i>	White Fringeless Orchid	C: Candidate	0	0	0	0
<i>Ptilimnium nodosum</i> **	Harperella	LE: Endangered	3	0	2	5
<i>Rhus michauxii</i>	Michaux's Sumac	LE: Endangered	0	0	1	1
<i>Ribes echinellum</i>	Miccosukee Gooseberry	LT: Threatened	0	5	7	12
<i>Sagittaria fasciculata</i>	Bunched Arrowhead	LE: Endangered	5	1	4	10
<i>Sarracenia rubra</i> ssp. <i>jonesii</i>	Mountain Sweet Pitcherplant	LE: Endangered	0	7	4	11
<i>Schwalbea americana</i>	Chaffseed	LE: Endangered	33	10	5	48
<i>Sisyrinchium dichotomum</i>	Reflexed Blue-eyed-grass	LE: Endangered	1	7	0	8
<i>Symphyotrichum georgianum</i>	Georgia Aster	C: Candidate	3	16	0	19
<i>Trillium persistens</i>	Persistent Trillium	LE: Endangered	0	1	0	1
<i>Trillium reliquum</i>	Relict Trillium	LE: Endangered	0	13	2	15

* *Narthecium americanum* removed from Candidate Status since "the species is less imperiled than previously believed and therefore does not warrant listing as threatened or endangered." (see 2012 Candidate Notice of Review Federal Register / Vol. 77, No. 225 / Wednesday, November 21, 2012 / Proposed Rules)

** A recent revision by Feist et al., 2012 provided new combinations for several taxa including *Ptilimnium nodosum* (Rose) Mathias (now *Harperella nodosa* Rose) and *Oxypolis canbyi* (J.M. Coult. & Rose) Fernald (now *Tiedemannia canbyi* (J.M. Coult. & Rose) Feist & S.R. Downie). Since herbarium specimens were consulted as part of this taxonomic review process, the current determination on these specimens reflects this more recent nomenclature.

Appendix 2. Federally listed species vouchers at USCH (108 specimens total).

EO ID	Accession Number	Species Name	Collector(s)	Collector's Number	Collection Date	County
4715	15697	<i>Amaranthus pumilus</i>	Pinson, Jr., Joseph	222	29-Jul-1970	Charleston
565	15696	<i>Amaranthus pumilus</i>	Pinson, Jr., Joseph	342	28-Jul-1971	Charleston
5495	15698	<i>Amaranthus pumilus</i>	Pinson, Jr., Joseph	425	18-Oct-1971	Georgetown
4741	20699	<i>Amaranthus pumilus</i>	Rayner, Douglas		26-Aug-1977	Georgetown
3683	88053	<i>Amaranthus pumilus</i>	Suiter, Dale	203	2-Aug-1993	Georgetown
under review	70793	<i>Amaranthus pumilus</i>	Seckinger, Jr., George	317	3-Aug-1996	Georgetown
under review	76615	<i>Amaranthus pumilus</i>	Seckinger, Billy	399	12-Sep-1996	Georgetown
12998	39196	<i>Amphianthus pusillus</i>	Sawyer, Jr., George	854	19-Apr-1964	Lancaster
12998	39197	<i>Amphianthus pusillus</i>	Chen, D.	326	25-Apr-1965	Lancaster
12998	12982	<i>Amphianthus pusillus</i>	Leonard, Steven; Cooper, Jim	3024	16-Apr-1969	Lancaster
12998	12983	<i>Amphianthus pusillus</i>	O'Neal, Peggy		20-Apr-1974	Kershaw
8167	21112	<i>Amphianthus pusillus</i>	Rayner, Douglas	1190	25-Apr-1980	York
5533	51888	<i>Echinacea laevigata</i>	Angerman, Jeannine		7-Jun-1979	Aiken
2094	15060	<i>Echinacea laevigata</i>	Kirkman, L.; Ellis, J.; Ware, D.	1229	13-Jun-1979	Oconee
8581	10773	<i>Echinacea laevigata</i>	Charles, Tommy		28-May-1987	Allendale
under review	57158	<i>Echinacea laevigata</i>	Gaddy, L.		12-Jul-1991	Oconee
1523	58366	<i>Echinacea laevigata</i>	Nelson, John	12916	17-Jun-1992	Richland
6557	65726	<i>Echinacea laevigata</i>	Hyatt, Philip	6069	16-Jun-1994	Barnwell
584	75748	<i>Echinacea laevigata</i>	Pittman, Albert	5289810	28-May-1998	Allendale
584	75747	<i>Echinacea laevigata</i>	Pittman, Albert	5289810	28-May-1998	Allendale
3680	97723	<i>Gymnoderma lineare</i>	Pittman, Albert; Harris, Richard; Buck, William	4149701	14-Apr-1997	Greenville
3899	33541	<i>Helianthus schweinitzii</i>	Nelson, John; Rayner, Douglas	5037	30-Sep-1986	York
7542	47656	<i>Helianthus schweinitzii</i>	Rayner, Douglas; Nelson, John	2660	30-Sep-1986	York
3899	33542	<i>Helianthus schweinitzii</i>	Nelson, John; Rayner, Douglas	5037	30-Sep-1986	York
471	33826	<i>Helianthus schweinitzii</i>	Nelson, John	5068	23-Oct-1986	York
471	33828	<i>Helianthus schweinitzii</i>	Nelson, John	5068	23-Oct-1986	York
471	33827	<i>Helianthus schweinitzii</i>	Nelson, John	5068	23-Oct-1986	York
471	33830	<i>Helianthus schweinitzii</i>	Nelson, John	5098	23-Oct-1986	York
471	33831	<i>Helianthus schweinitzii</i>	Nelson, John	5098	23-Oct-1986	York
8119	17833	<i>Helonias bullata</i>	McDowell, G.; Pattillo, J.	GVSC 3 McD	13-May-1972	Greenville
8119	55131	<i>Helonias bullata</i>	Strayer, Mary		13-Apr-1990	Greenville
3852	7361	<i>Hexastylis naniflora</i>	Vernon, E.		10-May-1964	Greenville
under review	9110	<i>Hexastylis naniflora</i>	Crandell, Allan	152	9-Apr-1977	Greenville
7399	20729	<i>Hexastylis naniflora</i>	Rayner, Douglas	1039	21-Apr-1977	Greenville
1160	21514	<i>Hexastylis naniflora</i>	Rayner, Douglas	1250	19-May-1981	Greenville
7689	21511	<i>Hexastylis naniflora</i>	Rayner, Douglas	1253	21-May-1981	Greenville
1160	21516	<i>Hexastylis naniflora</i>	Rayner, Douglas	1258	1-Jun-1981	Greenville

under review	47824	<i>Hexastylis naniflora</i>	Rayner, Douglas	2250	21-May-1985	Spartanburg
under review	78941	<i>Lindera melissifolia</i>	Williamson, Ben; Ahles, Harry	1557	23-Jul-1961	Berkeley
under review	78708	<i>Lindera melissifolia</i>	Williamson, Ben; Ahles, Harry	1558	23-Jul-1961	Berkeley
under review	78940	<i>Lindera melissifolia</i>	Williamson, Ben; Ahles, Harry	1556	23-Jul-1961	Berkeley
under review	48786	<i>Lindera melissifolia</i>	Rayner, D.	2851	26-May-1988	Berkeley
under review	46678	<i>Lindera melissifolia</i>	Nelson, John	6679	15-Jun-1988	Berkeley
7946	55558	<i>Lysimachia asperulifolia</i>	Nelson, John	10626	5-Jul-1991	Richland
7946	58179	<i>Lysimachia asperulifolia</i>	Nelson, John; Boyle, Kathy; Long, Brent; Pittman, Albert	12668	31-May-1992	Richland
146	72222	<i>Lysimachia asperulifolia</i>	Pittman, Albert; Boyle, Kathy; Nelson, John	5319201	31-May-1992	Richland
7946	60626	<i>Lysimachia asperulifolia</i>	Nelson, John; Rembert, Jr., David; Maitland, John	14725	31-May-1993	Richland
7946	66606	<i>Lysimachia asperulifolia</i>	Kelly, Jr., K.	128	2-Jun-1995	Richland
under review	14036	<i>Ribes echinellum</i>	Batson, Jr., Wade		16-Apr-1961	McCormick
13029	14035	<i>Ribes echinellum</i>	Radford, A.	43538	16-Apr-1961	McCormick
under review	14037	<i>Ribes echinellum</i>	Batson, Jr., Wade		30-Apr-1963	McCormick
13029	39202	<i>Ribes echinellum</i>	Sawyer, Jr., George	745	18-Apr-1964	McCormick
3050	53655	<i>Ribes echinellum</i>	Pittman, Albert; Soblo, Dale	2199101	19-Feb-1991	McCormick
3639	26678	<i>Sagittaria fasciculata</i>	Rodgers, C.; Mullens, Nora	73286	26-Jun-1973	Greenville
4798	13906	<i>Sarracenia rubra ssp. jonesii</i>	Cook, ; Lance,		29-Jun-1938	Greenville
under review	10047	<i>Sarracenia rubra ssp. jonesii</i>	Rayner, Douglas	1121	15-Aug-1979	Greenville
2985	10096	<i>Sarracenia rubra ssp. jonesii</i>	Rayner, Douglas	1149	3-Oct-1979	Greenville
6295	10087	<i>Sarracenia rubra ssp. jonesii</i>	Rayner, Douglas	1149	26-Oct-1979	Greenville
6295	10086	<i>Sarracenia rubra ssp. jonesii</i>	Rayner, Douglas	1150	26-Oct-1979	Greenville
under review	50014	<i>Sarracenia rubra ssp. jonesii</i>	Nelson, John	7763	23-May-1989	Greenville
under review	50674	<i>Sarracenia rubra ssp. jonesii</i>	Nelson, John	9104	5-Jun-1990	Greenville
220	13164	<i>Schwalbea americana</i>	Porcher, Jr., Richard		27-May-1972	Berkeley
292	20738	<i>Schwalbea americana</i>	Rayner, Douglas	1066	25-May-1978	Williamsburg
2024	54475	<i>Schwalbea americana</i>	Rayner, Douglas		6-Jun-1979	Sumter
under review	25280	<i>Schwalbea americana</i>	Aulbach-Smith, Cynthia	2240	22-May-1982	Jasper
8543	29570	<i>Schwalbea americana</i>	Aulbach-Smith, Cynthia	3055	8-May-1984	Jasper
9322	29582	<i>Schwalbea americana</i>	Nelson, John	3741	17-Oct-1984	Jasper
292	47706	<i>Schwalbea americana</i>	Rayner, Douglas	2258	4-Jun-1985	Williamsburg
under review	50069	<i>Schwalbea americana</i>	Nelson, John	8110	12-Jul-1989	Williamsburg
under review	73200	<i>Schwalbea americana</i>	Sorrie, Bruce	8018	8-Jun-1994	Horry
4594	70232	<i>Schwalbea americana</i>	Nelson, John	17307	7-Jun-1996	Williamsburg
under review	67240	<i>Sisyrinchium dichotomum</i>	Horn, Charles; Pittman, Albert	5288	25-Jun-1992	Greenville
3545	58305	<i>Sisyrinchium dichotomum</i>	Pittman, Albert; Brown, Herrick	6269201	26-Jun-1992	Greenville
9483	99307	<i>Sisyrinchium dichotomum</i>	Pittman, Albert; Darr, Ann	06220513	22-Jun-2005	Greenville
under review	99283	<i>Sisyrinchium dichotomum</i>	Pittman, Albert; Darr, Ann	06220523	22-Jun-2005	Greenville
under review	10775	<i>Sisyrinchium dichotomum</i>	Pittman, Albert; Darr, Ann	7060512	6-Jul-2005	Greenville
9481	16496	<i>Sisyrinchium dichotomum</i>	Pittman, Albert	7210505	21-Jul-2005	Greenville

9497	99156	<i>Sisyrinchium dichotomum</i>	Pittman, Albert; Darr, Ann	08170515	17-Aug-2005	Greenville
under review	19640	<i>Symphyotrichum georgianum</i>	Philson, P.		19-Oct-1935	Richland
under review	19638	<i>Symphyotrichum georgianum</i>	Philson, P.		19-Oct-1935	Richland
under review	45853	<i>Symphyotrichum georgianum</i>	Credle, Walter	2675	18-Oct-1979	Abbeville
7024	33654	<i>Symphyotrichum georgianum</i>	Nelson, John	5056	15-Oct-1986	York
7024	33712	<i>Symphyotrichum georgianum</i>	Nelson, John	5071	23-Oct-1986	York
2295	47312	<i>Symphyotrichum georgianum</i>	Nelson, John	7171	27-Oct-1988	Fairfield
7812	51460	<i>Symphyotrichum georgianum</i>	Nelson, John	8576	24-Oct-1989	York
7698	1111	<i>Symphyotrichum georgianum</i>	Kenmore, Jr., Douglas	8153	11-Oct-1993	Cherokee
4053	70494	<i>Symphyotrichum georgianum</i>	Kenmore, Jr., Douglas	1188	12-Oct-1993	York
under review	67185	<i>Symphyotrichum georgianum</i>	Kenmore, Jr., Douglas	1712	5-Oct-1994	York
under review	70566	<i>Symphyotrichum georgianum</i>	Kenmore, Jr., Douglas	808	12-Oct-1994	York
3578	75115	<i>Symphyotrichum georgianum</i>	Horn, Charles	10231	23-Oct-1995	Union
under review	75282	<i>Symphyotrichum georgianum</i>	Nelson, John	18891	24-Oct-1997	Edgefield
NEW	88381	<i>Symphyotrichum georgianum</i>	Nelson, John	23401	29-Sep-2002	Richland
under review	108758	<i>Symphyotrichum georgianum</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10200910	20-Oct-2009	Oconee
under review	111047	<i>Symphyotrichum georgianum</i>	Proctor, Tom		16-Oct-2011	Edgefield
under review	33299	<i>Trillium persistens</i>	Rayner, Douglas	2109	26-Mar-1985	Oconee
under review	8284	<i>Trillium reliquum</i>	Arnett, James		4-Apr-1964	Aiken
3323	36053	<i>Trillium reliquum</i>	Sawyer, Jr., George; Ahles, Harry	814	18-Apr-1964	Aiken
under review	68180	<i>Trillium reliquum</i>	Gordon, J.		30-Mar-1978	Aiken
2438	47622	<i>Trillium reliquum</i>	Rayner, Douglas	1400	7-May-1982	Aiken
under review	53353	<i>Trillium reliquum</i>	Angerman, Jeannine		22-Mar-1983	Aiken
6455	31543	<i>Trillium reliquum</i>	Nelson, John; Greeter, S.	3816	27-Mar-1985	Aiken
under review	46934	<i>Trillium reliquum</i>	Rayner, Douglas	2767	17-Mar-1988	Edgefield
2438	50510	<i>Trillium reliquum</i>	Soblo, Dale	1855	14-Mar-1990	Aiken
1059	56652	<i>Trillium reliquum</i>	Dutton, Mark		13-Apr-1991	Aiken
1059	56653	<i>Trillium reliquum</i>	Dutton, Mark		13-Apr-1991	Aiken
3323	57657	<i>Trillium reliquum</i>	Nelson, John; Fairey, III, John; Pittman, Albert	12248	11-Apr-1992	Edgefield
373	89106	<i>Trillium reliquum</i>	Gordon, J.		1-Apr-2003	Aiken
3323	89108	<i>Trillium reliquum</i>	Gordon, J.		1-Apr-2003	Edgefield

Appendix 3. Federally listed species vouchers at CLEMS (74 specimens total).

EO ID	Accession Number	Species Name	Collector(s)	Collector's Number	Collection Date	County
under review	59236	<i>Amaranthus pumilus</i>	J. Carney	666	6-Aug-1984	Charleston
1791	3176	<i>Echinacea laevigata</i>	John E. Fairey, III	466	2-Jul-1969	Pickens
3998	15487	<i>Echinacea laevigata</i>	Robert W. Gettman	315	22-Jun-1973	Oconee
7218	3175	<i>Echinacea laevigata</i>	Robert W. Gettman	326	29-Jun-1973	Oconee
1361	3173	<i>Echinacea laevigata</i>	Alston E. Hodge	347	10-Aug-1982	Oconee
4257	3174	<i>Echinacea laevigata</i>	Alston E. Hodge	350	10-Aug-1982	Oconee
6797	26162	<i>Echinacea laevigata</i>	John D. Tobe	1098	7-Aug-1986	Oconee
7464	36169	<i>Echinacea laevigata</i>	Steven R. Hill	20646	4-Jun-1989	Oconee
584	54428	<i>Echinacea laevigata</i>	Albert B. Pittman	5289810	28-May-1998	Allendale
4454	45551	<i>Helianthus schweinitzii</i>	Steven R. Hill	24440	26-Sep-1992	York
4454	45552	<i>Helianthus schweinitzii</i>	Steven R. Hill	24441	26-Sep-1992	York
3124	35979	<i>Hexastylis naniflora</i>	Steven R. Hill	20406	6-Apr-1989	Cherokee
5554	35980	<i>Hexastylis naniflora</i>	Steven R. Hill	20405	6-Apr-1989	Cherokee
under review	59410	<i>Lindera melissifolia</i>	Richard D. Porcher, Jr.	59410	8-Jan-1990	Beaufort
under review	52723	<i>Lindera melissifolia</i>	John F. Townsend		8-Apr-1996	Charleston
NEW	76968	<i>Lindera melissifolia</i>	Patrick D. McMillan	6594	24-Jun-2002	Barnwell
under review	81811	<i>Lindera melissifolia</i>	Daniel C. Payne	2192	19-Jun-2005	Beaufort
under review	80082	<i>Lindera melissifolia</i>	Daniel C. Payne, Randy Moring, Jose Luis Lopez-Ramirez	4271	6-Jan-2006	Beaufort
5329	1767	<i>Oxypolis canbyi</i>	A. E. Radford	11439	8-Sep-1967	Colleton
7385	1766	<i>Oxypolis canbyi</i>	John B. Nelson	3702	11-Sep-1984	Barnwell
977	27024	<i>Oxypolis canbyi</i>	John B. Nelson	4301	13-Sep-1985	Orangeburg
1263	48416	<i>Oxypolis canbyi</i>	John F. Townsend	207	3-Sep-1993	Clarendon
41	48417	<i>Oxypolis canbyi</i>	John F. Townsend	208	17-Sep-1993	Clarendon
1593	48418	<i>Oxypolis canbyi</i>	John F. Townsend	209	17-Sep-1993	Clarendon
9039	48419	<i>Oxypolis canbyi</i>	John F. Townsend	210	17-Sep-1993	Williamsburg
1820	48138	<i>Oxypolis canbyi</i>	John F. Townsend	420	24-Jun-1994	Clarendon
6007	48166	<i>Oxypolis canbyi</i>	John F. Townsend	438	12-Jul-1994	Clarendon
1962	54204	<i>Oxypolis canbyi</i>	John F. Townsend	1736	21-Aug-1998	Florence
NEW	78460	<i>Oxypolis canbyi</i>	Patrick D. McMillan, Richard D. Porcher, Jr.	8555	1-Oct-2004	Berkeley
8685	7011	<i>Ptilimnium nodosum</i>	Alston E. Hodge	925	22-May-1984	Barnwell
7086	49168	<i>Ptilimnium nodosum</i>	Steven R. Hill	23659	3-Jul-1992	Saluda
5112	44988	<i>Ptilimnium nodosum</i>	Steven R. Hill	23921	20-Jul-1992	Aiken
3639	1297	<i>Sagittaria fasciculata</i>	Rodgers, C. Leland, Mullens, N. E.	73286	26-Jun-1973	Greenville
2226	1298	<i>Sagittaria fasciculata</i>	Mary G. Douglass	348	4-Jun-1979	Greenville
2226	1300	<i>Sagittaria fasciculata</i>	Mary G. Douglass	347	4-Jun-1979	Greenville
2226	1296	<i>Sagittaria fasciculata</i>	Mary G. Douglass	370	20-Jun-1979	Greenville
2226	1299	<i>Sagittaria fasciculata</i>	Mary G. Douglass	397	5-Aug-1979	Greenville

9322	24519	<i>Schwalbea americana</i>	Cynthia A. Aulbach-Smith	3055	8-May-1984	Jasper
1234	48320	<i>Schwalbea americana</i>	John F. Townsend	160	13-May-1993	Williamsburg
3254	48327	<i>Schwalbea americana</i>	John F. Townsend	167	27-May-1993	Williamsburg
3254	48328	<i>Schwalbea americana</i>	John F. Townsend	167	27-May-1993	Williamsburg
4142	48329	<i>Schwalbea americana</i>	John F. Townsend	168	27-May-1993	Williamsburg
5293	48330	<i>Schwalbea americana</i>	John F. Townsend	169	27-May-1993	Williamsburg
5293	48331	<i>Schwalbea americana</i>	John F. Townsend	170	27-May-1993	Williamsburg
5293	48332	<i>Schwalbea americana</i>	John F. Townsend	171	27-May-1993	Williamsburg
2378	48333	<i>Schwalbea americana</i>	John F. Townsend	172	27-May-1993	Williamsburg
4972	48334	<i>Schwalbea americana</i>	John F. Townsend	173	27-May-1993	Williamsburg
6746	48335	<i>Schwalbea americana</i>	John F. Townsend	174	27-May-1993	Williamsburg
5361	48336	<i>Schwalbea americana</i>	John F. Townsend	175	27-May-1993	Williamsburg
5862	48337	<i>Schwalbea americana</i>	John F. Townsend	176	27-May-1993	Williamsburg
1234	48342	<i>Schwalbea americana</i>	John F. Townsend	181	9-Jun-1993	Williamsburg
4594	48343	<i>Schwalbea americana</i>	John F. Townsend	182	10-Jun-1993	Williamsburg
703	52345	<i>Schwalbea americana</i>	John F. Townsend	334	11-May-1994	Williamsburg
4020	48348	<i>Schwalbea americana</i>	John F. Townsend	339	12-May-1994	Williamsburg
6484	48269	<i>Schwalbea americana</i>	John F. Townsend	357	31-May-1994	Williamsburg
3682	48277	<i>Schwalbea americana</i>	John F. Townsend	348	31-May-1994	Williamsburg
7276	48264	<i>Schwalbea americana</i>	John F. Townsend	362	1-Jun-1994	Williamsburg
7161	48267	<i>Schwalbea americana</i>	John F. Townsend	359	1-Jun-1994	Williamsburg
9021	48261	<i>Schwalbea americana</i>	John F. Townsend	366	2-Jun-1994	Williamsburg
780	48262	<i>Schwalbea americana</i>	John F. Townsend	365	2-Jun-1994	Clarendon
1754	48258	<i>Schwalbea americana</i>	John F. Townsend	369	7-Jun-1994	Williamsburg
9289	48193	<i>Schwalbea americana</i>	John F. Townsend	388	10-Jun-1994	Williamsburg
3571	48144	<i>Schwalbea americana</i>	John F. Townsend	412	21-Jun-1994	Williamsburg
under review	48142	<i>Schwalbea americana</i>	John F. Townsend	416	23-Jun-1994	Williamsburg
5113	48132	<i>Schwalbea americana</i>	John F. Townsend	454	2-Aug-1994	Williamsburg
5378	48116	<i>Schwalbea americana</i>	John F. Townsend	470	21-Aug-1994	Williamsburg
under review	52158	<i>Schwalbea americana</i>	John F. Townsend	924	24-May-1996	Jasper
under review	83827	<i>Schwalbea americana</i>	Patrick D. McMillan	1468	24-May-1996	Jasper
under review	55431	<i>Schwalbea americana</i>	John F. Townsend	2045	26-Apr-2000	Lee
under review	75049	<i>Schwalbea americana</i>	Richard D. Porcher, Jr., Patrick D. McMillan	7467	29-May-2004	Williamsburg
9462	83963	<i>Sisyrinchium dichotomum</i>	Ann R. Darr	3017	26-May-2005	Greenville
1119	27984	<i>Symphyotrichum georgianum</i>	Steven R. Hill	19052	9-Nov-1987	Pickens
3578	72326	<i>Symphyotrichum georgianum</i>	Horn, Charles N.	10231	23-Oct-1995	Union
NEW	79423	<i>Symphyotrichum georgianum</i>	Patrick D. McMillan, McLaughlin, S., Tucsan, A.	8927	18-Oct-2005	Anderson

Appendix 4. Federally listed species vouchers at NCU (53 specimens total).

EO ID	Accession Number	Species Name	Collector(s)	Collector's Number	Collection Date	County
12998	131481	<i>Amphianthus pusillus</i>	Harry E. Ahles	23100	15-Apr-1957	Lancaster
5932	251430	<i>Echinacea laevigata</i>	Stan Beard	s.n.	1-May-1963	Aiken
1361	366632	<i>Echinacea laevigata</i>	S.W. Leonard	3297	23-Jun-1970	Oconee
2228	439506	<i>Echinacea laevigata</i>	D.E. Boufford	9801	1-Jun-1973	Lancaster
8119	419801	<i>Helonias bullata</i>	Gladstone "Mac" W. [Wadley] McDowell	s.n.	13-May-1972	Greenville
7399	86894	<i>Hexastylis naniflora</i>	O. [Oliver] M. [Myles] Freeman	5608	17-Mar-1956	Greenville
8629	162484	<i>Lindera melissifolia</i>	Harry E. Ahles	22507	8-Apr-1957	Berkeley
8629	162420	<i>Lindera melissifolia</i>	Harry E. Ahles	26678	28-May-1957	Berkeley
8629	162421	<i>Lindera melissifolia</i>	Harry E. Ahles	26677	28-May-1957	Berkeley
8629	249384	<i>Lindera melissifolia</i>	Harry E. Ahles	35576	28-Sep-1957	Berkeley
8629	441900	<i>Lindera melissifolia</i>	J. [James] "Jimmy" R. Massey	3412	6-Oct-1972	Berkeley
623	244548	<i>Oxypolis canbyi</i>	HE Ahles and Baird	54905	13-Aug-1961	Berkeley
5329	316578	<i>Oxypolis canbyi</i>	AE Radford, Bozeman, John Radford	11439 (Bozeman #)	8-Sep-1967	Colleton
under review	522257	<i>Oxypolis canbyi</i>	FW Kinard	255	16-Sep-1983	Bamberg
under review	538042	<i>Oxypolis canbyi</i>	JB Nelson, SH Bennett	3620	17-Aug-1984	Barnwell
8311	537890	<i>Oxypolis canbyi</i>	Nelson, Bennett	3687	7-Sep-1984	Richland
7385	537893	<i>Oxypolis canbyi</i>	JB Nelson, SH Bennett	3702	11-Sep-1984	Barnwell
7533	537912	<i>Oxypolis canbyi</i>	JB Nelson, SH Bennett, R. Jones	4271	10-Sep-1985	Lee
977	538037	<i>Oxypolis canbyi</i>	Nelson & Bennett	4301	13-Sep-1985	Orangeburg
7533	565136	<i>Oxypolis canbyi</i>	Nifong	513	21-Aug-1994	Lee
under review	564809	<i>Oxypolis canbyi</i>	TD Nifong	614	14-Sep-1994	Allendale
977	565062	<i>Oxypolis canbyi</i>	Nifong	538	14-Sep-1994	Orangeburg
8377	557110	<i>Ptilimnium nodosum</i>	J. [Jeanine] S. Angerman	s.n.	11-Jun-1979	Aiken
5112	559536	<i>Ptilimnium nodosum</i>	John B. Nelson	9321	13-Jul-1990	Aiken
4078	232451	<i>Rhus michauxii</i>	Harry E. Ahles	54887	13-Aug-1961	Kershaw
13029	148316	<i>Ribes echinellum</i>	A.E. Radford	31713	11-Apr-1957	McCormick
13029	148315	<i>Ribes echinellum</i>	A.E. Radford	22456	11-May-1957	McCormick
13029	187248	<i>Ribes echinellum</i>	A.E. Radford	24776	8-Jun-1958	McCormick
13029	273727	<i>Ribes echinellum</i>	A.E. Radford	44800	19-Jun-1966	McCormick
13029	340951	<i>Ribes echinellum</i>	S.W. Leonard & A.E. Radford	2328	8-Apr-1969	McCormick
13029	454297	<i>Ribes echinellum</i>	J.R. Massey	4559	6-Apr-1975	McCormick
13029	502981	<i>Ribes echinellum</i>	Miklos Treiber & Guy Nesom	1513	6-May-1978	McCormick
3639	456809	<i>Sagittaria fasciculata</i>	C. [Charles] Leland Rodgers	73286	26-Jun-1973	Greenville
3639	527641	<i>Sagittaria fasciculata</i>	C. [Charles] Leland Rodgers	73286	26-Jun-1973	Greenville
3639	456808	<i>Sagittaria fasciculata</i>	C. [Charles] Leland Rodgers	73286	26-Jun-1973	Greenville
3639	527252	<i>Sagittaria fasciculata</i>	C. [Charles] Leland Rodgers	73286	26-Jun-1973	Greenville
843	71209	<i>Sarracenia rubra ssp. jonesii</i>	Clyde Ritchie Bell	572	7-Jun-1948	Pickens

843	247574	<i>Sarracenia rubra ssp. jonesii</i>	Clyde Ritchie Bell	574	7-Jun-1948	Greenville
843	71207	<i>Sarracenia rubra ssp. jonesii</i>	Clyde Ritchie Bell	573	7-Jun-1948	Greenville
843	71208	<i>Sarracenia rubra ssp. jonesii</i>	Clyde Ritchie Bell	571	7-Jun-1948	Greenville
8626	269571	<i>Schwalbea americana</i>	HE Ahles and Haesloop	25684	20-May-1957	Charleston
2977	418001	<i>Schwalbea americana</i>	Musselman & WW Thomas	4581	11-May-1972	Horry
2977	495012	<i>Schwalbea americana</i>	LJ Musselman	4658	1-Jun-1973	Horry
9322	538003	<i>Schwalbea americana</i>	Aulbach-Smith & JB Nelson	3055	8-May-1984	Jasper
3921	566552	<i>Schwalbea americana</i>	Sorrie	8018	8-Jun-1994	Horry
2438	35200	<i>Trillium reliquum</i>	A. [Albert] E. Radford	1404	24-Mar-1946	Aiken
2438	367451	<i>Trillium reliquum</i>	John D. Freeman	623	30-Mar-1968	Aiken

Appendix 5. G1-G3 priority species vouchers at USCH (182 specimens total).

Global Rank	Accession Number	Species Name	Collector(s)	Collector's Number	Collection Date	County
G3T2	32181	<i>Amorpha georgiana</i> var. <i>georgiana</i>	Swails, Larry; Howe, K.	84/226	2-Jul-1984	Darlington
G3T2	73199	<i>Amorpha georgiana</i> var. <i>georgiana</i>	Sorrie, Bruce	7891	29-Apr-1994	Florence
G3T2	73202	<i>Amorpha georgiana</i> var. <i>georgiana</i>	Sorrie, Bruce	7885	27-Apr-1994	Florence
G3T2	73203	<i>Amorpha georgiana</i> var. <i>georgiana</i>	Sorrie, Bruce	7888	29-Apr-1994	Florence
G3T2	73204	<i>Amorpha georgiana</i> var. <i>georgiana</i>	Sorrie, Bruce	7889	27-Apr-1994	Florence
G3T2	95911	<i>Amorpha georgiana</i> var. <i>georgiana</i>	McMillan, Patrick; McMillan, Nora; McMillan, Nic	7860	26-Jun-2004	Darlington
G2	1496	<i>Balduina atropurpurea</i>	Norton, J.		15-Jan-1921	Darlington
G2	66942	<i>Balduina atropurpurea</i>	Kelly, Jr., K.	343	11-Aug-1995	Richland
G1G2	19949	<i>Coreopsis integrifolia</i>	Bradley, Ted	3528	23-Sep-1966	Berkeley
G1G2	33083	<i>Coreopsis integrifolia</i>	Rayner, Douglas	2248b	10-Oct-1985	Horry
G1G2	61255	<i>Coreopsis integrifolia</i>	Nelson, John	15012	16-Oct-1993	Richland
G1G2	73296	<i>Coreopsis integrifolia</i>	McMillan, Patrick	2712	19-Oct-1997	Berkeley
G1G2	77883	<i>Coreopsis integrifolia</i>	Tran, Michelle	228	8-Oct-1999	Lexington
G1G2	93393	<i>Coreopsis integrifolia</i>	Nelson, John; DeGarady, Colette; Kruger, Eric	25076	22-Sep-2004	Charleston
G1G2	112075	<i>Coreopsis integrifolia</i>	Kauffman, Ethan		1-May-2012	Jasper
G1G2	112083	<i>Coreopsis integrifolia</i>	Nelson, John	30771	15-Jun-2012	Charleston
G2G3	8112	<i>Croton elliotii</i>	Angerman, Jeannine		4-Sep-1987	Barnwell
G2G3	30642	<i>Croton elliotii</i>	Rayner, D; Hodge, Alston	1998	25-Jul-1984	Barnwell
G2G3	31924	<i>Croton elliotii</i>	Nelson, John; Bennett, S.	4207	21-Aug-1985	Clarendon
G2G3	40744	<i>Croton elliotii</i>	Nelson, John; Bennett, S.	6030	6-Aug-1987	Barnwell
G2G3	43332	<i>Croton elliotii</i>	Knox, John		27-Aug-1986	Barnwell
G2G3	43333	<i>Croton elliotii</i>	Angerman, Jeannine		4-Sep-1987	Barnwell
G2G3	48784	<i>Croton elliotii</i>	Rayner, D	2888	5-Oct-1988	Barnwell
G2G3	72047	<i>Croton elliotii</i>	Gaddy, L.		14-Jul-1995	Barnwell
G2G3	72048	<i>Croton elliotii</i>	Gaddy, L.		15-Jul-1995	Barnwell
G2G3	72049	<i>Croton elliotii</i>	Gaddy, L.		14-Jul-1995	Barnwell
G2G3	72077	<i>Croton elliotii</i>	Rabolli, C.	119	8-Aug-1996	Barnwell
G2G3	72078	<i>Croton elliotii</i>	Rabolli, C.	120	8-Aug-1996	Barnwell
G2G3	72079	<i>Croton elliotii</i>	Rabolli, C.	121	8-Aug-1996	Barnwell
G2G3	72080	<i>Croton elliotii</i>	Rabolli, C.	122	7-Aug-1996	Barnwell
G2G3	72081	<i>Croton elliotii</i>	Rabolli, C.	123	8-Aug-1996	Barnwell

G2G3	72082	<i>Croton elliotii</i>	Rabolli, C.	124	8-Aug-1996	Barnwell
G2G3	72083	<i>Croton elliotii</i>	Rabolli, C.	129	8-Aug-1996	Barnwell
G2G3	72084	<i>Croton elliotii</i>	Rabolli, C.	128	8-Aug-1996	Barnwell
G2G3	72085	<i>Croton elliotii</i>	Rabolli, C.	127	8-Aug-1996	Barnwell
G2G3	72086	<i>Croton elliotii</i>	Rabolli, C.	126	8-Aug-1996	Barnwell
G2G3	72087	<i>Croton elliotii</i>	Rabolli, C.	125	8-Aug-1996	Barnwell
G2G3	75404	<i>Croton elliotii</i>	Garris, Amanda; Toner, Maureen		21-Aug-1996	Barnwell
G2	76937	<i>Eupatorium paludicola</i>	Pittman, A; Porcher, Jr., Richard	08219805	21-Aug-1998	Florence
G2	79686	<i>Eupatorium paludicola</i>	Townsend, John	1735	21-Aug-1998	Florence
G2	80200	<i>Eupatorium paludicola</i>	McMillan, Patrick; Porcher, Jr., Richard		2-Aug-1999	Florence
G2	33067	<i>Fimbristylis perpusilla</i>	Rayner, Douglas	2278	21-Jun-1985	Horry
G2	17576	<i>Forestiera godfreyi</i>	Townsend, John; Porcher, Jr., Richard; McMillan, Patrick	751	7-Apr-1996	Charleston
G2	73263	<i>Forestiera godfreyi</i>	McMillan, Patrick; Porcher, Jr., Richard	2301	12-May-1997	Beaufort
G2	73266	<i>Forestiera godfreyi</i>	McMillan, Patrick; Porcher, Jr., Richard	1267	5-Apr-1996	Charleston
G2	77168	<i>Forestiera godfreyi</i>	Pittman, Albert; Judge, Chris	4279908	27-Jun-1999	Charleston
G2	80688	<i>Forestiera godfreyi</i>	Pittman, Albert	2110001	11-Nov-2000	Colleton
G2	88216	<i>Forestiera godfreyi</i>	McMillan, Patrick; McMillan, Nora; Porcher, Jr., Richard	5619	4-Aug-2001	Colleton
G2G3	99048	<i>Isoetes hyemalis</i>	Nelson, John	27028	24-Apr-2008	Florence
G2G3	8127	<i>Lindera subcoriacea</i>	Angerman, Jeannine		28-Aug-1987	Barnwell
G2G3	17976	<i>Lindera subcoriacea</i>	Johnson, Deborah	374	27-Sep-1995	Aiken
G2G3	40881	<i>Lindera subcoriacea</i>	McCartney, Robert		11-Aug-1986	Aiken
G2G3	40882	<i>Lindera subcoriacea</i>	McCartney, Robert		30-Jul-1987	Barnwell
G2G3	41541	<i>Lindera subcoriacea</i>	Rayner, Douglas	2466	28-Mar-1986	Aiken
G2G3	43334	<i>Lindera subcoriacea</i>	Knox, John		17-Oct-1986	Barnwell
G2G3	50002	<i>Lindera subcoriacea</i>	McCartney, Robert		27-Mar-1986	Aiken
G2G3	50003	<i>Lindera subcoriacea</i>	McCartney, Robert		23-Jun-1986	Aiken
G2G3	50125	<i>Lindera subcoriacea</i>	McCartney, Robert		23-Mar-1986	Aiken
G2G3	60455	<i>Lindera subcoriacea</i>	Stanford, Priscilla	34	14-May-1993	Barnwell
G2G3	60456	<i>Lindera subcoriacea</i>	Stanford, Priscilla	32	30-Apr-1993	Aiken
G2G3	63764	<i>Lindera subcoriacea</i>	McCartney, Robert		29-Dec-1987	Richland
G2G3	66204	<i>Lindera subcoriacea</i>	Nelson, John	16415	17-Apr-1995	Aiken
G2G3	72090	<i>Lindera subcoriacea</i>	Roark, D.		17-Apr-1997	Jasper
G2G3	72091	<i>Lindera subcoriacea</i>	Roark, D.		17-Apr-1997	Jasper
G2G3	72092	<i>Lindera subcoriacea</i>	Roark, D.		17-Apr-1997	Jasper

G2G3	72093	<i>Lindera subcoriacea</i>	Roark, D.		17-Apr-1997	Jasper
G2G3	76871	<i>Lindera subcoriacea</i>	Pittman, Albert	7289820	28-Aug-1998	Aiken
G2G3	80457	<i>Lindera subcoriacea</i>	Nelson, John	21202	26-May-2000	Aiken
G2G3	3780	<i>Lobelia boykinii</i>	Kelley, W.; Batson, Jr., Wade		1-Aug-1956	Allendale
G2G3	9469	<i>Lobelia boykinii</i>	Kelley, W.; Batson, Jr., Wade		23-Jun-1953	Barnwell
G2G3	9470	<i>Lobelia boykinii</i>	Kelley, W.; Batson, Jr., Wade		24-Aug-1951	Barnwell
G2G3	9471	<i>Lobelia boykinii</i>	Kelley, W.; Batson, Jr., Wade		23-Jun-1953	Barnwell
G2G3	20739	<i>Lobelia boykinii</i>	Rayner, Douglas; Dumke, Judith; Dabbs, E.	1068	9-Jun-1978	Sumter
G2G3	26257	<i>Lobelia boykinii</i>	Hodge, Alston	374	15-Jun-1983	Orangeburg
G2G3	30776	<i>Lobelia boykinii</i>	Nelson, John; Bennett, Stephen	3530	5-Jul-1984	Bamberg
G2G3	39940	<i>Lobelia boykinii</i>	Nelson, John; Bennett, Stephen	5673	19-Jun-1987	Hampton
G2G3	40082	<i>Lobelia boykinii</i>	Nelson, John; Bennett, Stephen	5770	9-Jul-1987	Allendale
G2G3	40097	<i>Lobelia boykinii</i>	Nelson, John; Bennett, Stephen	5751	9-Jul-1987	Allendale
G2G3	40214	<i>Lobelia boykinii</i>	Nelson, John; Bennett, Stephen	5639	17-Jun-1987	Hampton
G2G3	40638	<i>Lobelia boykinii</i>	Nelson, John; Bennett, Stephen	5694	24-Jun-1987	Hampton
G2G3	45035	<i>Lobelia boykinii</i>	Hodge, Alston	955	23-May-1984	Barnwell
G2G3	45078	<i>Lobelia boykinii</i>	Hodge, Alston	928	23-May-1984	Barnwell
G2G3	47947	<i>Lobelia boykinii</i>	Rayner, Douglas	1938	7-Jun-1984	Colleton
G2G3	58332	<i>Lobelia boykinii</i>	Nelson, John; Ferral, Daniel	13286	21-Jul-1992	Clarendon
G2G3	59550	<i>Lobelia boykinii</i>	Kenmore, Jr., Douglas; Nelson, John	113	23-Oct-1992	Charleston
G2G3	60324	<i>Lobelia boykinii</i>	Govus, Thomas	589	14-Jun-1994	Bamberg
G2G3	61460	<i>Lobelia boykinii</i>	Garnett, Anglea		1-Jul-1993	Bamberg
G2G3	76929	<i>Lobelia boykinii</i>	Pittman, Albert; Porcher, Jr., Richard	8219814	21-Aug-1998	Florence
G2G3	80029	<i>Lobelia boykinii</i>	McMillan, Patrick; Porcher, Jr., Richard	3023	31-May-1998	Barnwell
G2G3	112649	<i>Lobelia boykinii</i>	Nelson, John	31530	28-Sep-2012	Berkeley
G2G3	30386	<i>Ludwigia brevipes</i>	Rayner, Douglas; Leonard, Steven	1670b	30-Jul-1983	Horry
G2G3	33212	<i>Ludwigia brevipes</i>	Rayner, Douglas; Tillett, Ellen	2271	21-Jun-1985	Horry
G2G3	34499	<i>Ludwigia brevipes</i>	Aulbach-Smith, Cynthia	4071	8-Aug-1986	Lee
G2G3	82631	<i>Ludwigia brevipes</i>	Nelson, John	21436	26-Jul-2000	Georgetown
G2G3	109093	<i>Ludwigia brevipes</i>	Brown, Herrick; Pittman, Albert; Boyle, Kathy	7151006	15-Jul-2010	Aiken
G2G3	109643	<i>Ludwigia brevipes</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011025	1-Oct-2010	Aiken
G2G3	109896	<i>Ludwigia brevipes</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011007	1-Jul-2010	Aiken
G2G3	110375	<i>Ludwigia brevipes</i>	Nelson, John; Carlisle, Will	29341	27-May-2011	Berkeley
G2	2709	<i>Ludwigia spathulata</i>	Leonard, Steven; Massey, J.; Radford, A.	4992	23-Aug-1971	Aiken

G2	41923	<i>Ludwigia spathulata</i>	Nelson, John	6067	3-Sep-1987	Aiken
G2	45515	<i>Ludwigia spathulata</i>	Rayner, Douglas	1293	11-Aug-1981	Saluda
G2	45874	<i>Ludwigia spathulata</i>	Hodge, Alston	1057	11-Aug-1984	Barnwell
G2	48714	<i>Ludwigia spathulata</i>	Nelson, John	8005	16-Jun-1989	Aiken
G2	60469	<i>Ludwigia spathulata</i>	Antieau, Clayton	48	25-May-1993	Barnwell
G2	65662	<i>Ludwigia spathulata</i>	Hyatt, Philip	6071	17-Jun-1994	Barnwell
G2	72054	<i>Ludwigia spathulata</i>	Gaddy, L.		15-Jul-1995	Barnwell
G2	103019	<i>Ludwigia spathulata</i>	Ravenel, H.			Aiken
G2	109365	<i>Ludwigia spathulata</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7301012	30-Jul-2010	Aiken
G2G3	10049	<i>Macbridea caroliniana</i>	Pittman, Albert			Aiken
G2G3	12799	<i>Macbridea caroliniana</i>	Batson, Jr., Wade		1-Aug-1967	Richland
G2G3	12800	<i>Macbridea caroliniana</i>	Batson, Jr., Wade; Kelley, W.		8-Aug-1952	Aiken
G2G3	23555	<i>Macbridea caroliniana</i>	Creel, Michael		15-Jul-1982	Williamsburg
G2G3	28604	<i>Macbridea caroliniana</i>	Gaddy, L.	62998	29-Jun-1998	Richland
G2G3	31338	<i>Macbridea caroliniana</i>	Nelson, John	3792	20-Mar-1985	Dillon
G2G3	32320	<i>Macbridea caroliniana</i>	Swails, Larry	85/223	23-Jul-1985	Florence
G2G3	38594	<i>Macbridea caroliniana</i>	Smith, Budd		3-Aug-1940	Darlington
G2G3	45212	<i>Macbridea caroliniana</i>	Horn, Charles	2363	28-Aug-1987	Aiken
G2G3	47173	<i>Macbridea caroliniana</i>	Batson, Jr., Wade		15-Nov-1988	Hampton
G2G3	51323	<i>Macbridea caroliniana</i>	Angerman, Jeannine		7-Oct-1987	Aiken
G2G3	52021	<i>Macbridea caroliniana</i>	Angerman, Jeannine		22-Nov-1978	Aiken
G2G3	56849	<i>Macbridea caroliniana</i>	Swails, Larry	83-862	10-Sep-1983	Dillon
G2G3	70147	<i>Macbridea caroliniana</i>	Gaddy, L.	s.n.	5-Jul-1994	Aiken
G2G3	72053	<i>Macbridea caroliniana</i>	Gaddy, L.		22-Jun-1995	Aiken
G2G3	77084	<i>Macbridea caroliniana</i>	Bourgeois, David		10-Sep-1998	Colleton
G2G3	82542	<i>Macbridea caroliniana</i>	Pittman, Albert	11160001	16-Nov-2000	Richland
G2G3	87664	<i>Macbridea caroliniana</i>	Nelson, John	23128	6-Aug-2002	Edgefield
G2G3	92353	<i>Macbridea caroliniana</i>	Nelson, John	24866	7-Aug-2004	Colleton
G2G3	92947	<i>Macbridea caroliniana</i>	DeGarady, Colette		21-Oct-2004	Jasper
G2G3	98212	<i>Macbridea caroliniana</i>	LeBlond, Richard	5531A	15-Aug-2001	Florence
G2G3	98213	<i>Macbridea caroliniana</i>	LeBlond, Richard	5518	16-Jul-2001	Richland
G2G3	98216	<i>Macbridea caroliniana</i>	Sorrie, Bruce	10805	15-Aug-2001	Florence
G2G3	98217	<i>Macbridea caroliniana</i>	Sorrie, Bruce	10805	15-Aug-2001	Florence
G2G3	98218	<i>Macbridea caroliniana</i>	Sorrie, Bruce	10804	15-Aug-2001	Georgetown

G2G3	98219	<i>Macbridea caroliniana</i>	Sorrie, Bruce	10781	23-Jul-2001	Aiken
G2G3	100001	<i>Macbridea caroliniana</i>	Ravenel, H.			Berkeley
G2G3	107172	<i>Macbridea caroliniana</i>	Nelson, John; Murphy, Gordon	27808	7-Aug-2009	Marion
G5T2	27940	<i>Nuphar lutea ssp. sagittifolia</i>	Seckinger, Jr., George	304	3-Aug-1996	Georgetown
G5T2	32938	<i>Nuphar lutea ssp. sagittifolia</i>	Aulbach-Smith, Cynthia	3690	25-Jun-1985	Georgetown
G5T2	32942	<i>Nuphar lutea ssp. sagittifolia</i>	Aulbach-Smith, Cynthia	3714	24-Jun-1985	Horry
G5T2	34003	<i>Nuphar lutea ssp. sagittifolia</i>	Nelson, John	4873	14-Aug-1986	Dillon
G5T2	39068	<i>Nuphar lutea ssp. sagittifolia</i>	Smith, Budd	1	3-Aug-1940	Darlington
G5T2	51366	<i>Nuphar lutea ssp. sagittifolia</i>	Hill, Steven	19601	15-Jun-1988	Georgetown
G5T2	55274	<i>Nuphar lutea ssp. sagittifolia</i>	Nelson, John	10968	6-Aug-1991	Marion
G5T2	62049	<i>Nuphar lutea ssp. sagittifolia</i>	Nelson, John	14611	12-Aug-1993	Georgetown
G5T2	62050	<i>Nuphar lutea ssp. sagittifolia</i>	Nelson, John	14611	12-Aug-1993	Georgetown
G5T2	70678	<i>Nuphar lutea ssp. sagittifolia</i>	Seckinger, Jr., George	304	3-Aug-1996	Georgetown
G5T2	72856	<i>Nuphar lutea ssp. sagittifolia</i>	Pittman, Albert; Darr, Ann	6269702	26-Jun-1997	Georgetown
G5T2	87372	<i>Nuphar lutea ssp. sagittifolia</i>	Nelson, John	22613	18-May-2002	Georgetown
G5T2	97809	<i>Nuphar lutea ssp. sagittifolia</i>	Nelson, John	26582	22-May-2007	Florence
G5T2	97818	<i>Nuphar lutea ssp. sagittifolia</i>	Nelson, John	26587	22-May-2007	Florence
G5T2	109203	<i>Nuphar lutea ssp. sagittifolia</i>	Nelson, John; Porcher, Richard	28599	12-Aug-2010	Georgetown
G1	99016	<i>Ptilimnium ahlesii</i>	Nelson, John; Richardson, Matt; Dewig, Rob	27198	14-Jun-2008	Colleton
G3	83154	<i>Rhynchospora thornei</i>	McMillan, Patrick	5343	21-Jun-2001	Georgetown
G3	92720	<i>Rhynchospora thornei</i>	McMillan, Patrick	7684	12-Jun-2004	Georgetown
G2	15045	<i>Rudbeckia heliopsidis</i>	Kirkman, L.	1242	13-Jun-1979	Oconee
G2	15541	<i>Rudbeckia heliopsidis</i>	Sorrie, Bruce	8233	25-Sep-1994	Oconee
G2	57159	<i>Rudbeckia heliopsidis</i>	Gaddy, L.		31-Jul-1991	Oconee
G2	64569	<i>Rudbeckia heliopsidis</i>	Hill, Steven; Betts, Dan	24475	17-Oct-1992	Oconee
G2	88997	<i>Scutellaria ocmulgee</i>	Pittman, Albert	4229807	22-Apr-1998	Aiken
G2	108490	<i>Scutellaria ocmulgee</i>	Nelson, John; Porcher, Richard	28196	22-Apr-2010	Jasper
G2	29259	<i>Sporobolus teretifolius</i>	Pittman, Albert; Darr, Ann	10279805	27-Oct-1998	Lexington
G2	73368	<i>Sporobolus teretifolius</i>	Sorrie, Bruce	8028	8-Jun-1994	Georgetown
G2	73387	<i>Sporobolus teretifolius</i>	Sorrie, Bruce	8265	24-Oct-1994	Horry
G2	76855	<i>Sporobolus teretifolius</i>	Pittman, Albert; Darr, Ann	08209809	20-Aug-1998	Lexington
G2	77958	<i>Sporobolus teretifolius</i>	Pittman, Albert; Darr, Ann	09139819	13-Sep-1998	Lexington
G2	99670	<i>Sporobolus teretifolius</i>	Nelson, John; Morris, Jim	17908	17-Jan-1997	Horry
G3	65374	<i>Tsuga caroliniana</i>	Hill, Steven; Douglass, Heyward; Blagden, Jr., T.	25243	13-Oct-1993	Greenville

G3	101878	<i>Tsuga caroliniana</i>	Ravenel, H.			
G2G3	10044	<i>Waldsteinia lobata</i>	Douglass, Caroline	581	19-Apr-1979	Ocone
G2G3	20758	<i>Waldsteinia lobata</i>	Rayner, Douglas		31-May-1977	Ocone
G2G3	20766	<i>Waldsteinia lobata</i>	Rayner, Douglas	1096	11-May-1978	Ocone
G2G3	21167	<i>Waldsteinia lobata</i>	Clark, Ross		27-Apr-1981	Ocone
G2G3	45885	<i>Waldsteinia lobata</i>	Hodge, Alston	537	20-Dec-1983	Ocone
G2G3	46125	<i>Waldsteinia lobata</i>	Douglass, Caroline	581	19-Apr-1979	Ocone
G2G3	52727	<i>Waldsteinia lobata</i>	Horn, Charles; Hill, Steven	3221	11-May-1989	Ocone
G2G3	55130	<i>Waldsteinia lobata</i>	Sorrow, James		17-Apr-1990	Ocone
G2G3	57165	<i>Waldsteinia lobata</i>	Gaddy, L.; Ye, Hu; Lin, Ye		25-Mar-1991	Ocone
G2G3	57166	<i>Waldsteinia lobata</i>	Gaddy, L.		3-Apr-1991	Ocone
G2G3	57178	<i>Waldsteinia lobata</i>	Gaddy, L.		1-Aug-1991	Ocone
G2G3	62305	<i>Waldsteinia lobata</i>	Hill, Steven; Blagden, Jr., T.	25306	2-Nov-1993	Ocone
G2G3	62753	<i>Waldsteinia lobata</i>	Hill, Steven	21977	5-Nov-1990	Ocone
G2G3	65581	<i>Waldsteinia lobata</i>	Hill, Steven; Dorsey, Brian	25060	27-May-1993	Ocone

Appendix 6. G1-G3 priority species vouchers at CLEMS (98 specimens total).

Global Rank	Accession Number	Species Name	Collector(s)	Collector's Number	Collection Date	County
G2	55034	<i>Carex impressinervia</i>	Noel, W. G.	990608	8-Jun-1999	Greenwood
G1G2	80325	<i>Coreopsis integrifolia</i>	John B. Nelson	25076	22-Sep-2004	Charleston
G2G3	6946	<i>Croton elliotii</i>	Alston E. Hodge	631	21-Feb-1984	Barnwell
G2	52660	<i>Forestiera godfreyi</i>	John F. Townsend	1485	13-May-1997	Beaufort
G2	52661	<i>Forestiera godfreyi</i>	John F. Townsend		13-May-1997	Beaufort
G2	54031	<i>Forestiera godfreyi</i>	John F. Townsend	1673	2-Jun-1998	Colleton
G2	54032	<i>Forestiera godfreyi</i>	John F. Townsend	1673	2-Jun-1998	Colleton
G2	54033	<i>Forestiera godfreyi</i>	John F. Townsend	1673	2-Jun-1998	Colleton
G2	54034	<i>Forestiera godfreyi</i>	John F. Townsend	1673	2-Jun-1998	Colleton
G2	56915	<i>Forestiera godfreyi</i>	Patrick D. McMillan	5667	5-Aug-2001	Charleston
G2	56927	<i>Forestiera godfreyi</i>	Patrick D. McMillan	5619	4-Aug-2001	Colleton
G2	56928	<i>Forestiera godfreyi</i>	Patrick D. McMillan	5619	4-Aug-2001	Colleton
G2	56933	<i>Forestiera godfreyi</i>	Patrick D. McMillan	5613	4-Aug-2001	Colleton
G2G3	57090	<i>Isoetes hyemalis</i>	Patrick D. McMillan	4434	18-Apr-2000	Kershaw
G2G3	53933	<i>Lindera subcoriacea</i>	John F. Townsend		25-Aug-1997	Barnwell
G2G3	53934	<i>Lindera subcoriacea</i>	John F. Townsend		25-Aug-1997	Barnwell
G2G3	77088	<i>Lindera subcoriacea</i>	Austin Jenkins		29-Sep-2001	Richland
G2G3	84066	<i>Lindera subcoriacea</i>	Austin Jenkins	340	4-Oct-2006	Richland
G2G3	5662	<i>Lobelia boykinii</i>	Alston E. Hodge	395	14-Jun-1983	Barnwell
G2G3	5663	<i>Lobelia boykinii</i>	Alston E. Hodge	432	2-Jun-1983	Barnwell
G2G3	5664	<i>Lobelia boykinii</i>	Alston E. Hodge	394	7-Jun-1983	Barnwell
G2G3	5665	<i>Lobelia boykinii</i>	Alston E. Hodge	376	15-Jun-1983	Orangeburg
G2G3	5666	<i>Lobelia boykinii</i>	Alston E. Hodge	374	15-Jun-1983	Orangeburg
G2G3	7013	<i>Lobelia boykinii</i>	Alston E. Hodge	928	23-May-1984	Barnwell
G2G3	7028	<i>Lobelia boykinii</i>	Alston E. Hodge	955	23-May-1984	Barnwell
G2G3	48145	<i>Lobelia boykinii</i>	John F. Townsend	411	21-Jun-1994	Williamsburg
G2G3	48195	<i>Lobelia boykinii</i>	John F. Townsend	386	9-Jun-1994	Clarendon
G2G3	48196	<i>Lobelia boykinii</i>	John F. Townsend	385	8-Jun-1994	Clarendon
G2G3	48200	<i>Lobelia boykinii</i>	John F. Townsend	381	8-Jun-1994	Clarendon
G2G3	48270	<i>Lobelia boykinii</i>	John F. Townsend	356	31-May-1994	Williamsburg
G2G3	48354	<i>Lobelia boykinii</i>	John F. Townsend	330	11-May-1994	Williamsburg

G2G3	52829	<i>Lobelia boykinii</i>	Patrick D. McMillan	1627	10-Jul-1996	Clarendon
G2G3	55884	<i>Lobelia boykinii</i>	Patrick D. McMillan	5523	8-Jul-2001	Charleston
G2G3	77391	<i>Lobelia boykinii</i>	Patrick D. McMillan	7925	8-Jul-2004	Hampton
G2G3	77392	<i>Lobelia boykinii</i>	Patrick D. McMillan	7602	11-Jun-2004	Florence
G2G3	81172	<i>Lobelia boykinii</i>	Patrick D. McMillan	4605	1-Jun-2000	Hampton
G1G2	77382	<i>Ludwigia ravenii</i>	Patrick D. McMillan	7895	8-Jul-2004	Hampton
G2	87451	<i>Ludwigia spathulata</i>	Albert B. Pittman	7301012	30-Jul-2010	Aiken
G3	55815	<i>Rhynchospora thornei</i>	Patrick D. McMillan	5343	24-Jun-2001	Georgetown
G3	75807	<i>Rhynchospora thornei</i>	Patrick D. McMillan	7684	12-Jun-2004	Georgetown
G3	78592	<i>Rhynchospora thornei</i>	Patrick D. McMillan	8029	10-Jul-2004	Georgetown
G2	4278	<i>Rudbeckia heliopsidis</i>	S. Jones		31-Aug-1978	Oconee
G2	28179	<i>Rudbeckia heliopsidis</i>	S. Jones		13-Sep-1978	Oconee
G2	45537	<i>Rudbeckia heliopsidis</i>	Steven R. Hill	24475	17-Oct-1992	Oconee
G2	47368	<i>Rudbeckia heliopsidis</i>	Steven R. Hill	24478	24-Oct-1992	Oconee
G2	49035	<i>Rudbeckia heliopsidis</i>	Steven R. Hill	24976	25-Apr-1993	Oconee
G2	57026	<i>Sporobolus teretifolius</i>	Patrick D. McMillan	4117	29-Aug-1999	Georgetown
G3	1038	<i>Tsuga caroliniana</i>	Prince, A. E.		11-Nov-1942	Pickens
G3	1041	<i>Tsuga caroliniana</i>	Hollar, Lawrence E.	H 82	5-Oct-1983	Pickens
G3	1043	<i>Tsuga caroliniana</i>	Prince, A. E.		11-Nov-1942	Pickens
G3	35406	<i>Tsuga caroliniana</i>	Soblo, Dale	976	3-Sep-1987	Oconee
G3	44661	<i>Tsuga caroliniana</i>	Steven R. Hill	23625	30-Jun-1992	Greenville
G3	44843	<i>Tsuga caroliniana</i>	Steven R. Hill	23693	10-Jul-1992	Pickens
G3	51699	<i>Tsuga caroliniana</i>	Steven R. Hill	25243	13-Oct-1993	Greenville
G3	76441	<i>Tsuga caroliniana</i>	Patrick D. McMillan	7419	18-May-2004	Pickens
G2G3	11116	<i>Waldsteinia lobata</i>	J. A. Alden	387	28-Mar-1984	Oconee
G2G3	14887	<i>Waldsteinia lobata</i>	Alston E. Hodge	713	27-Mar-1984	Oconee
G2G3	14888	<i>Waldsteinia lobata</i>	Caroline C. Douglass	581	19-Apr-1979	Oconee
G2G3	14889	<i>Waldsteinia lobata</i>	Caroline C. Douglass	1611	3-Jun-1983	Oconee
G2G3	14890	<i>Waldsteinia lobata</i>	Caroline C. Douglass	1683	3-Jun-1983	Oconee
G2G3	14891	<i>Waldsteinia lobata</i>	Alston E. Hodge	76	27-Mar-1982	Oconee
G2G3	14892	<i>Waldsteinia lobata</i>	Alston E. Hodge	541	21-Dec-1983	Oconee
G2G3	14893	<i>Waldsteinia lobata</i>	Alston E. Hodge	487	14-Oct-1983	Oconee
G2G3	14894	<i>Waldsteinia lobata</i>	Alston E. Hodge	22	4-Nov-1981	Oconee
G2G3	14895	<i>Waldsteinia lobata</i>	Alston E. Hodge	537	20-Dec-1983	Oconee

G2G3	14896	<i>Waldsteinia lobata</i>	Caroline C. Douglass	1724	1-Mar-1984	Oconee
G2G3	14897	<i>Waldsteinia lobata</i>	Caroline C. Douglass	1723	1-Mar-1984	Oconee
G2G3	14898	<i>Waldsteinia lobata</i>	John Hains	1029768	29-Oct-1976	Oconee
G2G3	14899	<i>Waldsteinia lobata</i>	Walter C. Credle	128	16-Oct-1979	Oconee
G2G3	14900	<i>Waldsteinia lobata</i>	Caroline C. Douglass	620	9-Oct-1979	Oconee
G2G3	14901	<i>Waldsteinia lobata</i>	Alston E. Hodge	171	17-Apr-1982	Oconee
G2G3	14902	<i>Waldsteinia lobata</i>	Caroline C. Douglass	1688	3-Jun-1983	Oconee
G2G3	18088	<i>Waldsteinia lobata</i>	D. C. Tremmel	278	14-Apr-1982	Oconee
G2G3	23285	<i>Waldsteinia lobata</i>	F. K. Mengak	30	28-Mar-1984	Oconee
G2G3	25631	<i>Waldsteinia lobata</i>	John D. Tobe	415	20-Mar-1986	Oconee
G2G3	25660	<i>Waldsteinia lobata</i>	John D. Tobe	453	1-Apr-1986	Oconee
G2G3	26541	<i>Waldsteinia lobata</i>	Mary M. Smith	283	28-Mar-1984	Oconee
G2G3	26626	<i>Waldsteinia lobata</i>	T. R. Murphy	172	28-Mar-1984	Oconee
G2G3	27481	<i>Waldsteinia lobata</i>	Alston E. Hodge	816	5-May-1984	Oconee
G2G3	27496	<i>Waldsteinia lobata</i>	Alston E. Hodge	816	5-May-1984	Oconee
G2G3	28719	<i>Waldsteinia lobata</i>	M. C. Weeks	77	17-Apr-1982	Oconee
G2G3	28771	<i>Waldsteinia lobata</i>	C. G. Eayre	99	14-Apr-1982	Oconee
G2G3	36204	<i>Waldsteinia lobata</i>	Steven R. Hill	20544	11-May-1989	Oconee
G2G3	40470	<i>Waldsteinia lobata</i>	Steven R. Hill	21977	5-Nov-1990	Oconee
G2G3	41146	<i>Waldsteinia lobata</i>	L. L. Gaddy		3-Apr-1991	Oconee
G2G3	41151	<i>Waldsteinia lobata</i>	L. L. Gaddy		23-Mar-1991	Oconee
G2G3	41156	<i>Waldsteinia lobata</i>	L. L. Gaddy		17-Sep-1991	Oconee
G2G3	41158	<i>Waldsteinia lobata</i>	L. L. Gaddy		1-Jul-1991	Oconee
G2G3	41181	<i>Waldsteinia lobata</i>	L. L. Gaddy		1-Aug-1991	Oconee
G2G3	43421	<i>Waldsteinia lobata</i>	Gradon C. Kingsland		18-Apr-1985	Oconee
G2G3	47466	<i>Waldsteinia lobata</i>	A. Black	117	27-Sep-1993	Oconee
G2G3	51301	<i>Waldsteinia lobata</i>	Steven R. Hill	25006	10-May-1993	Oconee
G2G3	51325	<i>Waldsteinia lobata</i>	Steven R. Hill	25060	27-May-1993	Oconee
G2G3	51772	<i>Waldsteinia lobata</i>	Steven R. Hill	25306	2-Nov-1993	Oconee
G2G3	52590	<i>Waldsteinia lobata</i>	John F. Townsend	726	30-Mar-1996	Oconee
G2G3	52923	<i>Waldsteinia lobata</i>	John F. Townsend	741	4-Apr-1996	Oconee
G2G3	53696	<i>Waldsteinia lobata</i>	John F. Townsend	1309	18-Mar-1997	Oconee
G2G3	53741	<i>Waldsteinia lobata</i>	John F. Townsend	1368	28-Mar-1997	Oconee

Appendix 7. G1-G3 priority species vouchers at NCU (42 specimens total).

Global Rank	Accession Number	Species Name	Collector(s)	Collector's Number	Collection Date	County
G3T2	102385	<i>Amorpha georgiana</i> var. <i>georgiana</i>	Clyde Ritchie Bell	7592	24-May-1957	Florence
G3T2	102386	<i>Amorpha georgiana</i> var. <i>georgiana</i>	Clyde Ritchie Bell	10845	18-Oct-1957	Florence
G3T2	102387	<i>Amorpha georgiana</i> var. <i>georgiana</i>	Clyde Ritchie Bell	6124	19-Apr-1957	Florence
G3T2	355961	<i>Amorpha georgiana</i> var. <i>georgiana</i>	B. [Bruce] A. Sorrie	7888	29-Apr-1994	Florence
G2	414811	<i>Balduina atropurpurea</i>	J B Norton	s.n.	15-Oct-1921	Darlington
G2	428924	<i>Balduina atropurpurea</i>	J B Norton	s.n.	15-Oct-1921	Darlington
G1G2	275511	<i>Coreopsis integrifolia</i>	Ted R. Bradley	3528	23-Sep-1966	Berkeley
G1G2	277483	<i>Coreopsis integrifolia</i>	Ted R. Bradley	3528	23-Sep-1966	Berkeley
G2G3	559506	<i>Croton elliotii</i>	J. [Jeanine] S. Angerman	s.n.	4-Sep-1987	Barnwell
G2	581354	<i>Eupatorium paludicola</i>	R. [Richard] J. LeBlond	5062	6-Oct-1998	Florence
G2	581369	<i>Eupatorium paludicola</i>	R. [Richard] J. LeBlond	5062	6-Oct-1998	Florence
G2	581379	<i>Eupatorium paludicola</i>	R. [Richard] J. LeBlond	5062	6-Oct-1998	Florence
G2	581380	<i>Eupatorium paludicola</i>	R. [Richard] J. LeBlond	5062	6-Oct-1998	Florence
G2	581381	<i>Eupatorium paludicola</i>	R. [Richard] J. LeBlond	5062	6-Oct-1998	Florence
G2	582411	<i>Eupatorium paludicola</i>	R. [Richard] J. LeBlond	5062	6-Oct-1998	Florence
G2	508374	<i>Fimbristylis perpusilla</i>	S. [Steven] W. [Worth] Leonard	7458	18-Oct-1980	Horry
G2	519841	<i>Fimbristylis perpusilla</i>	S. [Steven] W. [Worth] Leonard	8216	13-Sep-1983	Horry
G2	563483	<i>Forestiera godfreyi</i>	Patrick D. McMillan	1267	5-Apr-1996	Charleston
G2	563484	<i>Forestiera godfreyi</i>	Patrick D. McMillan	1441	26-May-1996	Charleston
G2	565587	<i>Forestiera godfreyi</i>	Patrick D. McMillan	2301	12-May-1997	Beaufort
G2	568046	<i>Forestiera godfreyi</i>	R. [Richard] D. Porcher	s.n.	5-Jun-1998	Colleton
G2	571944	<i>Forestiera godfreyi</i>	Patrick D. McMillan	2321	13-May-1997	Beaufort
G2	571945	<i>Forestiera godfreyi</i>	Patrick D. McMillan	2321	13-May-1997	Beaufort
G2G3	566432	<i>Lindera subcoriacea</i>	Patrick D. McMillan	2225	12-Apr-1997	Barnwell
G2G3	568882	<i>Lindera subcoriacea</i>	Patrick D. McMillan	2601	17-Jun-1997	Aiken
G1G2	118301	<i>Ludwigia ravenii</i>	Harry E. Ahles	35485	28-Sep-1957	Berkeley
G2	297940	<i>Ludwigia spathulata</i>	Harry E. Ahles	55060	16-Sep-1961	Aiken
G2	414618	<i>Ludwigia spathulata</i>	S. [Steven] W. [Worth] Leonard	4992	23-Aug-1971	Aiken
G2	418873	<i>Ludwigia spathulata</i>	J. [James] "Jimmy" R. Massey	2990	21-Sep-1971	Aiken
G2	419113	<i>Ludwigia spathulata</i>	J. [James] "Jimmy" R. Massey	2998	21-Sep-1971	Saluda
G2	419157	<i>Ludwigia spathulata</i>	J. [James] "Jimmy" R. Massey	2998	21-Sep-1971	Saluda

G5T2	174886	<i>Nuphar lutea ssp. sagittifolia</i>	Tom Daggy	s.n.	28-Apr-1956	Georgetown
G3	577553	<i>Rhynchospora thornei</i>	Patrick D. McMillan	7684	12-Jun-2004	Georgetown
G2	107054	<i>Rudbeckia heliopsidis</i>	A. [Albert] E. Radford	17789	2-Sep-1956	Oconee
G2	568534	<i>Rudbeckia heliopsidis</i>	B. [Bruce] A. Sorrie	8233	25-Sep-1994	Oconee
G2G3	211880	<i>Schoenoplectus hallii</i>	Frank McGilvrey	s.n.	31-Oct-1960	Orangeburg
G2	557705	<i>Sporobolus teretifolius</i>	J. [John] B. [Bryant] Taggart	62	5-Sep-1989	Georgetown
G2	566551	<i>Sporobolus teretifolius</i>	B. [Bruce] A. Sorrie	8028	8-Jun-1994	Georgetown
G2	568412	<i>Sporobolus teretifolius</i>	B. [Bruce] A. Sorrie	8265	24-Oct-1994	Horry
G3	58486	<i>Tsuga caroliniana</i>	Wilbur H Duncan	13952	24-Aug-1952	Pickens
G3	141865	<i>Tsuga caroliniana</i>	O. [Oliver] M. [Myles] Freeman	57686	20-Aug-1957	Greenville
G2G3	542088	<i>Waldsteinia lobata</i>	Caroline C. Douglass	581	19-Apr-1979	Oconee

Appendix 8. USCH vouchers collected from Janet Harrison High Pond Heritage Preserve in Aiken County (42 specimens total).

USESAs Status	Accession Number	Species Name	Collector(s)	Collector's Number	Collection Date
	109652	<i>Acalypha rhomboidea</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011017	1-Oct-2010
	109664	<i>Ambrosia artemisiifolia</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011005	1-Oct-2010
	62304	<i>Baccharis halimifolia</i>	Hill, Steven	25303	30-Oct-1993
	109640	<i>Bidens discoidea</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011028	1-Oct-2010
	109591	<i>Carex festucacea</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011004	1-Jul-2010
	65244	<i>Carex longii</i>	Hill, Steven	23682	9-Jul-1992
	65359	<i>Carex luxurida</i>	Hill, Steven	23687	9-Jul-1992
	109668	<i>Cuscuta pentagona</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011001	1-Oct-2010
	109095	<i>Cuscuta pentagona</i> var. <i>pentagona</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7151009	15-Jul-2010
	109660	<i>Cyperus polystachyos</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011009	1-Oct-2010
	109655	<i>Cyperus pseudovegetus</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011014	1-Oct-2010
	109659	<i>Cyperus retrorsus</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011010	1-Oct-2010
	109656	<i>Digitaria ischaemum</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011013	1-Oct-2010
	109644	<i>Diodia virginiana</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011024	1-Oct-2010
	110001	<i>Diodia virginiana</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7301008	30-Jul-2010
	109191	<i>Echinodorus tenellus</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011011	1-Jul-2010
	109639	<i>Eclipta prostrata</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011029	1-Oct-2010
	109406	<i>Eleocharis acicularis</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011010	1-Jul-2010
	65230	<i>Eleocharis obtusa</i>	Hill, Steven	23918	20-Jul-1992
	108297	<i>Eleocharis obtusa</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7151002	15-Jul-2010
	45516	<i>Eryngium prostratum</i>	Rayner, Douglas	1275	30-Jul-1981
	54696	<i>Eryngium prostratum</i>	Outlaw, M.		22-Jun-1991
	109097	<i>Eryngium prostratum</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011015	1-Jul-2010
	109665	<i>Euthamia caroliniana</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011004	1-Oct-2010
	73708	<i>Fimbristylis autumnalis</i>	Hill, Steven	25300	30-Oct-1993
	109403	<i>Galium tinctorium</i> var. <i>tinctorium</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	07011012	1-Jul-2010
LE: Endangered	53824	<i>Harperella nodosa</i>	Nelson, John; Bennett, S.	9323	13-Jul-1990
	109367	<i>Hydrocotyle umbellata</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7301010	30-Jul-2010
	109663	<i>Ipomoea lacunosa</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011006	1-Oct-2010
	109647	<i>Ipomoea nil</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011021	1-Oct-2010
	54693	<i>Juncus acuminatus</i>	Outlaw, M.		22-Jun-1991
	65341	<i>Juncus acuminatus</i>	Hill, Steven	23675	9-Jul-1992
	109999	<i>Juncus acuminatus</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011002	1-Jul-2010
	109375	<i>Juncus brachycarpus</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7301003	30-Jul-2010

	110000	<i>Juncus brachycarpus</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011001	1-Jul-2010
	65357	<i>Juncus dichotomus</i>	Hill, Steven	23686	9-Jul-1992
	109592	<i>Juncus diffusissimus</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011003	1-Jul-2010
	54694	<i>Juncus effusus</i>	Outlaw, M.		22-Jun-1991
	65358	<i>Juncus effusus</i>	Hill, Steven	23681	9-Jul-1992
	109384	<i>Juncus repens</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7301001	30-Jul-2010
	109590	<i>Leersia hexandra</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011005	1-Jul-2010
	109098	<i>Lindernia dubia</i> var. <i>anagallidea</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011014	1-Jul-2010
	109093	<i>Ludwigia brevipes</i>	Brown, Herrick; Pittman, Albert; Boyle, Kathy	7151006	15-Jul-2010
	109643	<i>Ludwigia brevipes</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011025	1-Oct-2010
	109896	<i>Ludwigia brevipes</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011007	1-Jul-2010
	109649	<i>Ludwigia linearis</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011019	1-Oct-2010
	109365	<i>Ludwigia spathulata</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7301012	30-Jul-2010
	109638	<i>Melochia corchorifolia</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011030	1-Oct-2010
	109173	<i>Nymphoides cordata</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick		1-Jul-2010
	109646	<i>Oldenlandia boscii</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011022	1-Oct-2010
	109645	<i>Oldenlandia uniflora</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011023	1-Oct-2010
	109658	<i>Panicum dichotomiflorum</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011011	1-Oct-2010
	109662	<i>Panicum verrucosum</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011007	1-Oct-2010
	109666	<i>Persicaria longiseta</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011002	1-Oct-2010
	65765	<i>Phoradendron leucarpum</i>	Hill, Steven	23923	20-Jul-1992
	109633	<i>Phyllanthus caroliniensis</i> ssp. <i>caroliniensis</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011033	1-Oct-2010
	109667	<i>Polygonum pensylvanicum</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011003	1-Oct-2010
	109642	<i>Polypremum procumbens</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011026	1-Oct-2010
	109094	<i>Proserpinaca palustris</i> var. <i>palustris</i>	Pittman, Albert; Brown, Herrick; Boyle, Kathy	7151008	15-Jul-2010
	109898	<i>Ptilimnium capillaceum</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011009	1-Jul-2010
	109895	<i>Pyrrhopappus carolinianus</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011006	1-Jul-2010
	109366	<i>Rotala ramosior</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7301011	30-Jul-2010
	109648	<i>Rotala ramosior</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011020	1-Oct-2010
	109654	<i>Saccharum giganteum</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011015	1-Oct-2010
	54695	<i>Schedonorus arundinaceus</i>	Outlaw, M.		22-Jun-1991
	109641	<i>Senna obtusifolia</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011027	1-Oct-2010
	109635	<i>Senna occidentalis</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011031	1-Oct-2010
	109632	<i>Sida spinosa</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011034	1-Oct-2010
	64644	<i>Steinchisma hians</i>	Hill, Steven	23919	20-Jul-1992
	109661	<i>Steinchisma hians</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011008	1-Oct-2010
	109653	<i>Symphyotrichum dumosum</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011016	1-Oct-2010
	9790	<i>Utricularia radiata</i>	Pittman, Albert; Boyle, Kathy; Brown, Herrick	7011008	1-Jul-2010

	109650	Xanthium strumarium	Pittman, Albert; Boyle, Kathy; Brown, Herrick	10011018	1-Oct-2010
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Appendix 9. Occurrences of Federally listed species on SC Heritage properties, as recorded in the SC Heritage Trust Biotics database.

(1) *Amphianthus pusillus* (LT) at Forty Acre Rock Heritage Preserve, as observed in spring 2012. In the database, all 22 *A. pusillus* pools are encompassed in a single ‘element occurrence’ (EO), number 5.

	POOL ID	LOCATION (NAD83)	AREA (square meters) OF POLYGON (i.e., semi-perma- nent pool)	PERCENT COVERAGE BY VEGETATION	PERCENT COVERAGE OF VEGETATED AREA BY AMPHIANTHUS PUSILLUS	AREA (square meters) OF A. PUSILLUS
	T5	543,376 3,836,452	0.9	90	90	0.7
	1	543,377 3,836,450	0.5	70	80	0.3
	T2	543,342 3,836,450	4.7	90	90	3.8
	2	543,375 3,836,449	0.5	50	30	0.1
	T4	543,374 3,836,446	0.5	90	90	0.4
	T3	543,373 3,836,444	0.6	90	90	0.5
	T1	543,333 3,836,444	4.3	90	90	3.5
	3	543,378 3,836,444	10.5	80	50	4.2
	4	543,377 3,836,432	15.0	90	10	1.4
	5	543,383 3,836,427	3.0	90	10	0.3
	6	543,372 3,836,408	5.5	90	5	0.2
	7	543,376 3,836,407	0.2	90	100	0.2
	8	543,337 3,836,403	7.2	70	90	4.6

	POOL ID	LOCATION (NAD83)	AREA (square meters) OF POLYGON (i.e., semi-perma- nent pool)	PERCENT COVERAGE BY VEGETATION	PERCENT COVERAGE OF VEGETATED AREA BY AMPHIANTHUS PUSILLUS	AREA (square meters) OF A. PUSILLUS
	9	543,328 3,836,402	2.2	80	100	1.8
	10	543,336 3,836,400	9.5	80	50	3.8
	11	543,343 3,836,400	0.3	20	5	0.0
	12	543,378 3,836,399	2.3	100	10	0.2
	13	543,329 3,836,398	7.2	90	90	5.8
	14	543,345 3,836,396	8.9	80	90	6.4
	15	543,344 3,836,393	0.2	60	5	0.0
	16	543,345 3,836,390	26.1	80	60	12.5
	17	543,345 3,836,367	0.5	90	20	0.1
						50.7

(2) *Echinacea laevigata* (LE) at Buzzard Roost Heritage Preserve.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
21	304813 / 3848928	2012-08-31	M.S. Bunch D.C. Soblo R. Cain A.B. Pittman K.A. Boyle J.W. Holling	1993 (Bunch & Soblo): >20 plants, 2 with last year's flower stalks. 2007 (Bunch & Cain): 289 plants, 29 in flower. 2010 (Bunch & Cain): 354 plants, 20 in flower. 2012 (Pittman): Sterile rosettes, 35; fruiting stems, 12; stems in flower, 13. Total number of plants, 60 (possibly an underestimate, since peak flowering time for <i>E. laevigata</i> is June-July and this observation was made in late August). An additional single sterile rosette is ~200 feet to the north-northeast, at 304836 / 3848998 (WGS 84). Viability Rating: AB	1993: In disturbed area along old logging road. In 2010: On two toe ridges on southeast side of mountain. 2012: On southeast facing slopes with typical heliophytic Compositae species (<i>Silphium compositum</i> , <i>S. astericus</i> , <i>Solidago odora</i>) present but overall a more mesic hardwood stand, with <i>Diospyros virginiana</i> , <i>Quercus coccinea</i> , <i>Q. rubra</i> , <i>Q. stellata</i> , <i>Carya glabra</i> , and <i>Prunus serotina</i> mixed with the <i>Pinus virginiana</i> and <i>Quercus prinus</i> that typically dominate the drier exposures of the preserve. Dense stands of Heath Family shrubs and bracken fern are noticeably absent. <i>Chasmanthium</i> spp., <i>Arundinaria applachiana</i> , <i>Chionanthus virginicus</i> , <i>Cornus florida</i> , and <i>Hexastylis arifolia</i> are abundant in the deeper soils. In the immediate vicinity of the <i>E. laevigata</i> stems, <i>Liatris spicata</i> and <i>Eryngium yuccifolium</i> are prominent, with some <i>Liatris</i> nearly 1.5 meters in height. About 200 feet to the north-northeast, a single <i>E. laevigata</i> is in low open drain with <i>Collinsonia tuberosa</i> on nearby toe slopes.	Although lacking the dense Heath thickets that characterize other areas on Buzzard Roost, this site will require ongoing prescribed fire or other intensive management to control woody vegetation.
22	304089 / 3848997	2012-08-22	M.S. Bunch D.A. Rayner R. Cain A.B. Pittman K.A. Boyle	1993 (Bunch & Rayner): Population of unknown size. 2010 (Bunch & Cain): 671 plants. 2012 (Pittman & Boyle): Several hundred plants in main population plus additional plants, generally in groups of <10 individuals with few reproductive stems, scattered downslope to ~304037 / 3848861(WGS84). Viability Rating: AB	The main portion of the population is in a burned-over area approaching the Buzzard Roost summit, with numerous stump sprouts of blackgum and other hardwoods. Downslope and to the south-southwest, additional scattered plants are in and near an abandoned roadbed with a canopy of Virginia Pine and ground cover of <i>Pteridium aquilinum</i> , <i>Schizachyrium scoparium</i> , <i>Paspalum floridanum</i> , and <i>Mimosa microphylla</i> . Soil is red clay, indicative of heavily-weathered amphibolite.	Will require ongoing prescribed fire or other intensive management to control woody vegetation.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
50	304498 / 3848772	2012-08-31	T. Waldrop C.M. Emanuel A.B. Pittman K.A. Boyle J.W. Holling	1993 (Waldrop & Emanuel): A total of 111 to 164 plants, 32 to 41 in flower, in 4 groups from north to south: 21 plants, 5 in flower, in an 8 by 21 meter area (reported by Emanuel as site "BR-ACQ/02"); 33 plants, 6 in flower, in a 27 by 41 meter area (reported by Emanuel as site "BR-ACQ/01"); 6 to 10 plants, none in flower, in a 10 by 13 meter area (reported by Emanuel as site "BR-ACQ/03"); and 51 to 100 plants, 21 to 30 in flower, in a >1 hectare area (reported by Emanuel as site "BR-ACQ/04"). 2012 (Pittman): A total of 30 plants, 1 in flower, 15 in fruit. Note: possibly some plants were overlooked since peak flowering time for <i>E. laevigata</i> is June-July and this observation was made in late August. Viability Rating: AB	<i>E. laevigata</i> is limited to the midslopes (1200-1600 feet), with several widely scattered stands on narrow ridges and dissected slopes on southeastern exposures of Buzzard Roost Mountain. The canopy is dominated by <i>Pinus virginiana</i> but <i>P. pungens</i> is scattered throughout, particularly at higher elevations. Co-dominant with the pines are a variety of xerophytic fire-resistant scrub oaks: <i>Quercus prinus</i>, <i>Q. marilandica</i>, <i>Q. stellata</i>, and <i>Q. velutina</i>. Mid-story woody species include <i>Oxydendrum arboreum</i>, <i>Acer rubrum</i>, and <i>Nyssa sylvatica</i>. The mid-story is sometimes extremely dense with heath species and other understory hardwood species, including <i>Cornus florida</i>, <i>Vaccinium pallidum</i>, <i>V. arboreum</i>, <i>V. corymbosum</i>, and <i>V. stamineum</i>. <i>Rhododendron minus</i> and <i>R. maximum</i> dominate the shallow, vegetation-filled rills that dissect the property. These rills become narrow gullies nearly impenetrable with both <i>rhododendron</i> and mountain laurel, as well as <i>Chionanthus virginicus</i>, <i>Leucothoe recurva</i>, <i>Liriodendron tulipifera</i>, <i>Oxydendrum arboreum</i>, <i>Sassafras albidum</i>, <i>Styrax</i> sp. and several species of <i>Smilax</i>. In the more open areas (area was burned in 2010) and where <i>E. laevigata</i> is most abundant, graminoid and other herbaceous species typify the site. Graminoids include <i>Arundinaria appalachiana</i>, <i>Schizachyrium scoparium</i>, <i>Sorghastrum nutans</i>, <i>Panicum virgatum</i>, <i>Paspalum floridanum</i>, <i>Dichanthelium commutatum</i>, <i>Piptochaetium avenaceum</i>, <i>Danthonia</i> sp., and <i>Scleria triglomerata</i>. Heliophytic species are common and include <i>Agave virginiana</i>, <i>Clitoria mariana</i>, <i>Coreopsis major</i>, <i>Calystegia catesbeiana</i>, <i>Collinsonia tuberosa</i>, <i>Helianthus</i> sp., <i>Iris verna</i>, <i>Sericocarpus asteroides</i>, <i>S. linifolius</i>, <i>Liatris spicata</i>, <i>Parthenium integrifolium</i>, <i>Pityopsis graminifolia</i>, <i>Silphium compositum</i>, <i>S. astericus</i>, <i>Solidago odora</i>, <i>S. speciosa</i>, and <i>Tephrosia virginiana</i>. Also scattered throughout the stands are <i>Epigaea repens</i>, <i>Chamaelirium luteum</i>, <i>Chimaphila maculata</i>, <i>Mimosa microphylla</i>, <i>Parthenium integrifolium</i>, <i>Toxicodendron pubescens</i>, <i>Robinia viscosa</i>, and <i>Smilax glauca</i>. <i>Pteridium aquilinum</i> forms scattered dense clones. <i>Eryngium yuccifolium</i> is strongly correlated at all Buzzard Roost sites with the <i>E. laevigata</i> occurrences, as is the case for other known locations of this species in the South Carolina mountains. Significant collections: <i>Allium cernuum</i> and <i>Helianthus</i> sp. (with dense lower leaf surface tomentose and long involucre). Azimuth is 204 to 244 degrees and slope 40 to 55 percent. Soils are thin and rocky, with exposures of amphibolite gneiss and quartzite. Underlying rock is mapped as Poor Mountain Amphibolite. The most extensive exposures are observed as cap rock approaching the summit. The dominant natural community in the area is <i>Pinus virginiana</i> - (<i>Pinus rigida</i>, <i>Pinus pungens</i>) / <i>Schizachyrium scoparium</i> Forest -- CEG008500 (common name: Appalachian Low-Elevation Mixed Pine / Little Bluestem Forest).	Will require ongoing prescribed fire or other intensive management to control woody vegetation.

(3) *Helonias bullata* (LT) at Watson Cooper Heritage Preserve.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
1	346499/3887220	2013-07-27	McDowell Dan Pattillo M.S. Bunch Linda Lee K.A. Boyle	Approximately 1000 plants in five colonies (see graphs below for details). Low percentages of plants have been flowering in Colonies 1,2, and 3, while flowering has increased dramatically in Colony 4 since 2008. With only a few years of data, trends in Colony 5 (not shown) are not yet clear. Viability Rating: AB	In moist to wet mineral soil and in sphagnum, often with <i>Carex</i> spp., in montane bogs. At Watson-Cooper, such areas are maintained in an open condition by chemical and mechanical management of the otherwise dense <i>Rhododendron</i> and <i>Leucothoe</i> .	In addition to competition from woody vegetation, <i>H. bullata</i> has at times been adversely affected by deer and rabbit browsing as well as hog and human damage. Changes in water flow have also had effects, with low water causing population decrease and high water scouring and exposing plant roots. Wind and frost have damaged over 30% of flowers at one of the large colonies.

Census of Colonies 1, 2, and 3: Years 1990–2012
(no census data for 2002 & 2004, no colony-specific data for 2011)

Year	Total Plants	Plants in Flower
1990	400	0
1991	400	0
1992	400	0
1993	400	0
1994	400	0
1995	400	0
1996	400	0
1997	400	0
1998	400	0
1999	400	0
2000	400	0
2001	400	0
2002	400	0
2003	400	0
2004	400	0
2005	400	0
2006	400	0
2007	400	0
2008	400	50
2009	400	20
2010	400	0
2011	400	0
2012	400	0

Census of Colony 4: Years 2003–2012
(no census data for 2004 & 2006, no colony-specific data for 2011)

Year	Total Plants	Plants in Flower
2003	700	20
2004	700	80
2005	700	10
2006	700	0
2007	700	200
2008	700	600
2009	700	300
2010	700	450
2011	700	0
2012	700	0

(4) *Lindera melissifolia* at Woodbury Heritage Preserve / Wildlife Management Area.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
22	664592 / 3732681	2010-10-13	A.G. Murphy A.B. Pittman K.A. Boyle	2009(Murphy's site A1): Several plants, in flower, with at least 1 plant probably female; presence of males unclear. 2010(Pittman): About 10 plants, none in fruit (fruit possibly gone by mid-October). Viability Rating: C	2009: Plants in wettest portion of wetland. 2010: On southeast rim of wet depression. Rare shrubs <i>Litsea aestivalis</i> and <i>Ilex amelanchier</i> scattered throughout the depression. Community is pond cypress depression forest. Another population of <i>L. melissifolia</i> is ~0.3 mile to the northwest in a similar depression, but non-suitable habitat (i.e., forested upland) is in-between.	Extensive surrounding forests of loblolly pine, together with years of drought, are resulting in widespread invasion of young pine trees that may eventually overtake the site and dry out the depression wetland. Sweetgum is also invading. Depression margins -- favored location of <i>L. melissifolia</i> -- are at highest risk.
23	664284 / 3733173	2010-10-06	A.G. Murphy A.B. Pittman K.A. Boyle	2009(Murphy's sites E6, F7, F8, and F9): Large population, some in flower; all examined flowers male. All plants appeared healthy, but some dead stems were present. 2010(Pittman): Thousands of plants, some in fruit, and, especially at south end of site, some dead stems. Greatest density of plants is at depression edges. Viability Rating: A?	2010: In long narrow northeast/southwest oriented wet depression, extending into the surrounding pine forest at north end of depression. Rare shrubs <i>Litsea aestivalis</i> and <i>Ilex amelanchier</i> are scattered throughout the depression. Community is pond cypress pond, grading at south end into a swamp tupelo pond with understory of fetterbush <i>Lyonia</i> and red bay, and abundant marsh fern. Another large population of <i>L. melissifolia</i> is ~0.1 mile to the north in a similar depression, but non-suitable habitat (i.e., forested upland) is in-between. Another, smaller population is ~0.1 mile to the south.	Extensive surrounding forests of loblolly pine, together with years of drought, are resulting in widespread invasion of young pine trees that may eventually overtake the site and dry out the depression wetland. Sweetgum is also invading. Depression margins -- favored location of <i>L. melissifolia</i> -- are at highest risk.
24	664352 / 3732966	2010-10-13	B.L. Wichman R.K. Peet A.G. Murphy A.B. Pittman K.A. Boyle	2008(Wichmann and Peet): A few scattered plants. 2009(Murphy's site B2): A few plants. 2010(Pittman): Hundreds of plants, none in fruit (fruit possibly gone by mid-October), as well as 10-20 plants scattered through depression. Viability Rating: AB	2008: Scattered. 2009: On southern edge of wetland. 2010: On northeastern edge of wetland, as well as a few scattered through rest of depression. The rare shrub <i>Litsea aestivalis</i> is scattered throughout the depression. Community is pond cypress depression forest. Another, larger population of <i>L. melissifolia</i> is ~0.1 mile to the north in a similar depression, but non-suitable habitat (i.e., forested upland) is in-between.	Extensive surrounding forests of loblolly pine, together with years of drought, are resulting in widespread invasion of young pine trees that may eventually overtake the site and dry out the depression wetland. Sweetgum is also invading. Depression margins -- favored location of <i>L. melissifolia</i> -- are at highest risk.
25	664115 / 3733240	2010-10-13	A.G. Murphy A.B. Pittman K.A. Boyle	2009(Murphy's site D5): Site dense with thousands of plants, many in flower (both sexes). Some plants 4 feet in height. Also some dead stems. 2010(Pittman): Thousands of plants, none in fruit (fruit possibly gone by mid-October). Viability Rating: A?	The rare shrub <i>Litsea aestivalis</i> is scattered throughout the depression. Community is pond-cypress / swamp-tupelo depression forest, with understory of <i>Lyonia lucida</i> . Another large population of <i>L. melissifolia</i> is ~0.1 mile to the south in a similar depression, but non-suitable habitat (i.e., forested upland) is in-between.	Extensive surrounding forests of loblolly pine, together with years of drought, are resulting in widespread invasion of young pine trees that may eventually overtake the site and dry out the depression wetland. Sweetgum is also invading. Depression margins -- favored location of <i>L. melissifolia</i> -- are at highest risk.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
26	659635 / 3739372	2010-10-20	A.G. Murphy A.B. Pittman K.A. Boyle H.H.K. Brown	2009(Murphy's sites G10, G11, and G12): About 50 plants, in flower, 1 female and all others male. 2010(Pittman): 50-100 plants, none in fruit (fruit possibly gone by mid-October). Viability Rating: C	2009: At southern edge of wetland. 2010: At southern and eastern edges of wet depression. Community is pond cypress depression forest.	Extensive surrounding forests of loblolly pine, together with years of drought, are resulting in widespread invasion of young pine trees that may eventually overtake the site and dry out the depression wetland. Sweetgum is also invading. Depression margins -- favored location of <i>L. melissifolia</i> -- are at highest risk.
27	663691 / 3733407	2010-10-20	A.G. Murphy A.B. Pittman K.A. Boyle H.H.K. Brown	2009(Murphy's sites C3 and C3a): 8 plants in flower (all male) plus a number of plants not in flower; and, 0.03 mile to the east, 3 plants in flower (both sexes). Some dead stems at both locations. 2010(Pittman): About 100 plants at the two 2009 locations, and ~20 additional plants 0.08 mile to the west. No fruit observed (fruit possibly gone by mid-October). Viability Rating: BC	Associated species include strongly dominant <i>Lyonia lucida</i> , as well as <i>Clethra alnifolia</i> , <i>Diospyros virginiana</i> , <i>Ilex coriacea</i> , <i>Lyonia mariana</i> , <i>Myrica cerifera</i> , <i>Pinus taeda</i> , <i>Quercus nigra</i> , <i>Smilax laurifolia</i> , <i>Symplocos tinctoria</i> , <i>Taxodium ascendens</i> , and <i>Vaccinium virgatum</i> . Community is the evergreen-dominated outer margin of a small pond cypress depression forest.	Much competition from fetterbush and other evergreen shrubs, but recent fire appears to have provided <i>L. melissifolia</i> some additional space in this typically crowded community. Continued controlled burning would be helpful.
28	663913 / 3733393	2010-10-13	A.G. Murphy A.B. Pittman K.A. Boyle	2009(Murphy's site D4): 16 plants in flower, all examined flowers male. 2010(Pittman): Hundreds of plants, none in fruit (fruit possibly gone by mid-October). Viability Rating: BC	Associated species include <i>Carex striata</i> . Community is a small pond-cypress / swamp-tupelo depression forest. Another population of <i>L. melissifolia</i> is ~0.1 mile to the west in the outer margins of a similar depression, but a small disturbed area is in-between.	Extensive surrounding forests of loblolly pine, together with years of drought, are resulting in widespread invasion of young pine trees that may eventually overtake the site and dry out the depression wetland. Sweetgum is also invading. Depression margins -- favored location of <i>L. melissifolia</i> -- are at highest risk.
30	661327 / 3737172	2011-10-26	K.A. Boyle A.B. Pittman	About 100 stems (presumably clonal) with seasonally yellow leaves in an 8 by 15 meter area; no flowers or fruit. Viability Rating: BC	On a sandy rim on the southeast side of a pond cypress / swamp blackgum Carolina bay, at outer edge of the <i>Lyonia lucida</i> dominated evergreen thicket surrounding the bay. A few <i>L. melissifolia</i> stems extend into the adjacent jeep trail and firebreak. In addition to <i>L. lucida</i> , other associated plants include <i>Acer rubrum</i> , <i>Clethra alnifolia</i> *, <i>Gaylussacia frondosa</i> , <i>Ilex glabra</i> *, <i>Liquidambar styraciflua</i> , <i>Lyonia ligustrina</i> , <i>Persea palustris</i> , <i>Rhyncospora</i> sp. (in firebreak), <i>Smilax laurifolia</i> , and <i>Vaccinium corymbosum</i> (* indicates dominant). Offsite loblolly pine, managed for silviculture, dominates the adjacent upland.	The adjacent jeep trail / firebreak must be maintained with care, to avoid damage to the <i>L. melissifolia</i> .

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
31	661515 / 3737090	2011-11-02	A.B. Pittman K.A. Boyle H.H.K. Brown	Several hundred stems (presumably clonal) in a 30 x 50 meter area; no flowers or fruit. Leaves seasonally senesced to light brown -- not the bright yellow typical of high-pocosin sites. Viability Rating: B	Stems are scattered in shallow swales (i.e., in slightly undulating topography with some accumulation of organic matter in very slight depressions) beyond the southern rim of a Carolina bay. Soils, mapped as Lakeland, are dark, loose, and very sandy at the surface. The dense but fairly low (shrub dominants ~0.5 meter in height) pocosin-like vegetation (primarily broadleaf sclerophyllous plants) runs in long linear east/west strips. Associated species include <i>Andropogon glaucopsis</i> , <i>Gaylussacia frondosa</i> *, <i>Ilex opaca</i> , <i>I. glabra</i> *, <i>Liquidambar styraciflua</i> , <i>Lyonia lucida</i> *, <i>Magnolia virginiana</i> , <i>Myrica pumila</i> , <i>Persea palustris</i> , <i>Pinus taeda</i> , <i>Taxodium ascendens</i> (as seedlings), and <i>Vaccinium corymbosum</i> (* indicates dominant). The surrounding vegetation is a very altered longleaf pine xeric scrub community, with longleaf replaced by planted loblolly pine. Small turkey oak and live oak trees are common. Area appears to have burned recently. Much apparently suitable habitat for pondberry extends to the south and west, near several Carolina bays.	Continued controlled burning should help keep competing pocosin-like vegetation in check.
32	662517 / 3733402	2012-10-26	A.B. Pittman K.A. Boyle	Two large groups of plants, >300 stems in the eastern group (3733402 / 662517 NAD83) and >500 stems in the western group (3733363 / 662343), separated by a northeast/southwest distance of ~0.1 mile. Most plants 1-2.5 feet in height, no fruit. Some flower buds were present; those examined were all male. Viability Rating: B	In a recently-burned sandy swale with little accumulated organic matter on the ground. No standing water although some evidence of periodic ponding. Plants are most abundant along ecotone on southern edge of swale, growing among evergreen hollies and other clonal waxy-leaved shrub species. Canopy species include <i>Acer rubrum</i> , <i>Nyssa biflora</i> , <i>Pinus serotina</i> , <i>P. taeda</i> *, and <i>Taxodium ascendens</i> *, and the midstory includes <i>Acer rubrum</i> , <i>Aronia arbutifolia</i> , <i>Cyrilla racemiflora</i> , <i>Gordonia lasianthus</i> , <i>Ilex coriacea</i> *, <i>I. glabra</i> , <i>I. myrtifolia</i> , <i>Lyonia ligustrina</i> , <i>L. lucida</i> *, <i>L. mariana</i> *, <i>Magnolia virginiana</i> , <i>Morella cerifera</i> , <i>Parthenocissus quinquefolia</i> , <i>Persea</i> spp., <i>Quercus virginiana</i> , <i>Smilax laurifolia</i> , <i>S. rotundifolia</i> , <i>Toxicodendron radicans</i> , <i>Vaccinium corymbosum</i> and <i>V. stamineum</i> (* indicates dominant). The herbaceous layer is depauperate, with <i>Sarracenia flava</i> , <i>Sphagnum</i> spp., and <i>Xyris</i> spp. in scattered open areas. <i>Andropogon glaucopsis</i> occurs in low areas that may periodically hold water. Surrounding the swale is an extensive eolian dune field, in the southwestern quadrant of the Brittons Neck peninsula. Adjacent ridges are planted in longleaf pine. Large live oaks, often with numerous seedlings, occur on drier ridge edges.	Some of the vegetation growing with <i>L. melissifolia</i> has been scorched or killed by recent fire but some loblolly pines of about one-foot DBH survive, and pond cypress and other trees and shrubs are resprouting. Also, numerous loblolly pine and sweetgum seedlings are colonizing the swale, penetrating into the center. Continued burning is needed to keep competing vegetation in check.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
33	662129 / 3733439	2012-10-23	A.B. Pittman K.A. Boyle	Two large groups of plants, >500 stems in each, separated by an east/west distance of ~0.05 mile. Eastern group is at 3733439 / 665129 (NAD83), western group at 3733452 662045. Most plants 1-2.5 feet in height, no fruit. Some flower buds were present; those examined were all male. Viability Rating: B	In a recently-burned sandy swale with some accumulated organic matter on the ground. No standing water although some evidence of periodic ponding. Plants are most abundant along ecotone on southern edge of swale, growing among very dense evergreen hollies and other clonal waxy-leaved shrub species. Canopy species include <i>Acer rubrum</i>, <i>Nyssa biflora</i>, <i>Pinus serotina</i>, <i>P. taeda</i>*, and <i>Taxodium ascendens</i>*. The shrub layer includes <i>Acer rubrum</i>, <i>Aronia arbutifolia</i>, <i>Cyrilla racemiflora</i>, <i>Gordonia lasianthus</i>, <i>Ilex coriacea</i>*, <i>I. glabra</i>, <i>I. myrtifolia</i>, <i>Lyonia ligustrina</i>, <i>L. lucida</i>*, <i>L. mariana</i>*, <i>Magnolia virginiana</i>, <i>Morella cerifera</i>, <i>Parthenocissus quinquefolia</i>, <i>Persea</i> spp., <i>Quercus virginiana</i>, <i>Smilax laurifolia</i>, <i>S. rotundifolia</i>, <i>Toxicodendron radicans</i>, <i>Vaccinium corymbosum</i> and <i>V. stamineum</i>, (* indicates dominant). The herbaceous layer is depauperate, with <i>Sarracenia flava</i>, <i>Sphagnum</i> spp., and <i>Xyris</i> spp. in scattered open areas. <i>Andropogon glaucopsis</i> occurs in low areas that may periodically hold water. Surrounding the swale is an extensive eolian dune field, in the southwestern quadrant of the Brittons Neck peninsula. Adjacent ridges are planted in longleaf pine. Large live oaks, often with numerous seedlings, occur on drier ridge edges.	Much of the vegetation growing with <i>L. melissifolia</i> has been scorched or killed by recent hot fire but some loblolly pines of about one-foot DBH survive, and pond cypress and other trees and shrubs are resprouting. Also, numerous loblolly pine and sweetgum seedlings are colonizing the swale, penetrating into the center. Continued burning is needed to keep competing vegetation in check.
34	662653 / 3733983	2012-11-02	A.B. Pittman K.A. Boyle W.M. Grooms	In the largest group of plants (662653 / 3733983 NAD83), ~180 stems. An additional ~230 plants in ten nearby (<0.2 mile) locations: 662553 / 3734063 (~50 plants), 662581 / 3734058 (3 plants), 662557 / 3734003 (~50 plants), 662543 / 3733999 (~40 plants), 662558 / 3733971 (10 plants), 662594 / 3733960 (2 plants), 662663 / 3733931 (3 plants), 662636 / 3733788 (6 plants), 662492 / 3733743 (50 plants), and 662506 / 3733730 (15 plants). Most plants 1-2.5 feet in height, no fruit. Some flower buds were present; those examined were all male. On 12 October 2012, few yellow leaves, most plants still entirely green; by 2 November, plants yellow. Viability Rating: C	In a mature loblolly pine plantation occupying a large isolated depression. Pondberry is growing among dense evergreen hollies and other clonal waxy-leaved shrub species under a canopy of row-planted pine. Other canopy species include <i>Acer rubrum</i>, <i>Nyssa biflora</i>, <i>Pinus serotina</i>, and <i>Taxodium ascendens</i>, and the midstory includes <i>Acer rubrum</i>, <i>Aronia arbutifolia</i>, <i>Cyrilla racemiflora</i>, <i>Gordonia lasianthus</i>, <i>Ilex coriacea</i>*, <i>I. glabra</i>*, <i>Lyonia ligustrina</i>, <i>L. lucida</i>*, <i>Magnolia virginiana</i>, <i>Morella cerifera</i>, <i>Parthenocissus quinquefolia</i>, <i>Persea</i> spp., <i>Smilax laurifolia</i>, <i>S. rotundifolia</i>, <i>Toxicodendron radicans</i>, <i>Vaccinium corymbosum</i>, and <i>V. stamineum</i> (* indicates dominant). The herbaceous layer is depauperate, with <i>Sarracenia flava</i>, <i>Xyris</i> spp., and <i>Lachnocaulon beyrichianum</i> in scattered open areas. Soils are Leon sand. Surrounding the depression is an extensive eolian dune field, in the southwestern quadrant of the Brittons Neck peninsula. Adjacent ridges are planted in longleaf pine.	Population is in a silvicultural setting. Much of the shrubby vegetation growing with <i>L. melissifolia</i> has been scorched or top-killed by recent fire and now stands at about 2-3 feet in height, allowing some sunlight to reach the 1-2.5 -foot pondberry. Continued burning is needed to keep competing vegetation - already resprouting - in check.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
35	662834 / 3733169	2012-11-09	A.B. Pittman K.A. Boyle W.M. Grooms J.W. Holling	Large group of plants (>500 stems), with two much smaller groups (~10 plants each) 0.02-0.05 mile to the southwest. Large group is at 662834 / 3733169 (NAD83), small groups at 662808 / 3733147 and 662786 / 3733109. No fruit. In the large group, most stems were short (20-40 cm) and without leaves on 11 November. A few taller stems (~1 m) stood at the periphery, mixed in with waxy-leaved evergreens; these stems held leaves. Viability Rating: B	In a large irregular depression with little accumulated organic matter on the ground. No standing water although some evidence of periodic ponding. A pond cypress savanna community occupies the interior of the depression, with a ring of clonal evergreen shrubs at the upland ecotone. Near the southeastern edge of the depression, pondberry occurs in small openings in the very dense shrub zone. Canopy species include <i>Acer rubrum</i>, <i>Nyssa biflora</i>*, <i>Pinus taeda</i>, and <i>Taxodium ascendens</i>* and the midstory includes <i>Cyrilla racemiflora</i>, <i>Gordonia lasianthus</i>, <i>Ilex coriacea</i>, <i>I. myrtifolia</i>*, <i>Lyonia lucida</i>*, <i>Magnolia virginiana</i>, <i>Quercus virginiana</i>, and <i>Vaccinium corymbosum</i> (* indicates dominant). The herbaceous layer is very depauperate; small hummocks of <i>Sphagnum</i> spp. are present. In the lowest areas of the depression, where water apparently ponds seasonally, <i>Andropogon glaucopsis</i> is dense, continuous, and extensive. Sweetgum and loblolly pine saplings are also present in some parts of the depression. Surrounding the depression is an extensive eolian dune field, in the southwestern quadrant of the Brittons Neck peninsula. Adjacent ridges are planted in longleaf pine.	Control of invading sweetgum and loblolly pine seedlings is recommended because as these seedlings grow larger they will place an increasing evapotranspiration demand on the wetland. Some mature loblolly (>10-inch DBH) is already present both in the center and at the edges of the depression; these trees, if not removed, will provide abundant loblolly seed for years to come.
36	662426 / 3733072	2012-11-09	A.B. Pittman K.A. Boyle W.M. Grooms J.W. Holling	About 150 plants in a 5 x 15 meter area, with a smaller group (~30 plants in 3 x 5 meters) 0.02 mile to the west. Larger group is at 662426 / 3733072 (NAD83), smaller group at 662397 / 3733069. No fruit. Viability Rating: BC	In a narrow shallow depression with no accumulated organic matter on the ground. No standing water although some evidence of periodic ponding. Pondberry occurs in the lowest portion of the depression. Canopy species include <i>Acer rubrum</i>, <i>Liquidambar styraciflua</i>, <i>Nyssa biflora</i>*, <i>Pinus taeda</i>, and <i>Taxodium ascendens</i>*, and the relatively open midstory includes <i>Gordonia lasianthus</i>, <i>Ilex coriacea</i>*, <i>I. myrtifolia</i>, <i>Lyonia lucida</i>*, <i>L. mariana</i>, <i>Magnolia virginiana</i>, <i>Persea borbonia</i>, and <i>Vaccinium corymbosum</i> (* indicates dominant). The herbaceous layer is depauperate; in the lowest areas are small hummocks of <i>Sphagnum</i> spp., <i>Lachnanthes carolina</i>, and <i>Thelypteris palustris</i>, as well as an extensive stand of <i>Andropogon glaucopsis</i>. Sweetgum and loblolly pine seedlings are present in some parts of the depression. Surrounding the depression is an extensive eolian dune field, in the southwestern quadrant of the Brittons Neck peninsula. Adjacent ridges are planted in longleaf pine.	Control of invading sweetgum and loblolly pine is recommended because as these seedlings grow larger they will place increasing evapotranspiration demands on the wetland. Charred tree butts indicate that the area has burned in the past; a continuing program of prescribed fire is needed.
37	662508 / 3733609	2012-03-08	Ann Cubeta K.A. Boyle W.M. Grooms	About 20-30 plants, most in flower. Viability Rating: C	In a small opening in dense evergreen vegetation (<i>Lyonia lucida</i> , <i>Ilex</i> spp.) at northeast end of small northeast-southwest trending depression.	Control competing woody vegetation.

(5) *Oxypolis canbyi* (LE) at Crosby Oxypolis Heritage Preserve.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
1	518074 / 3638820	2010-10-27	A.E. Radford J.R. Bozeman J.S. Radford D.A. Rayner L.L. Gaddy A.B. Pittman K.A. Boyle H.H.K. Brown	In 1980s through early 1990s, plants in roadside powerline and in the bay interior. 2010: Plants in the powerline only, ~750 stems in four groups, with ~90% in flower or fruit. On the Heritage Preserve (south) side of SC-63, occupying a ~60 meter square area are three groups: 165 stems at 32.88816/-80.80746, 50 stems at 32.88803/-80.80695, and 26 stems at 32.88794/-80.80656 (NAD27). On the privately owned north side of SC-63, east of Azalea Patch Road, is a fourth group with ~500 plants, at 32.8882/-80.8061 (originally reported in 2006 by Gaddy). Viability Rating: CD	In the 1980s through early 1990s (Rayner and Pittman), plants were observed in the SC-63 roadside powerline right-of-way and also in the forested Carolina bay interior that lies adjacent to the powerline. The bay interior plants, in deepening shade, became non-flowering and etiolated. In 2010 (Pittman and Boyle), plants were observed in the right-of-way only. Throughout the population, occasional black swallowtail caterpillars were feeding on <i>O. canbyi</i> leaves. The preserve encompasses a portion of a large, altered, heavily forested Carolina bay, with SC-63 cutting through the north end of the bay depression. Planted slash pine currently dominates, but the native community of the bay interior is assumed to be pond-cypress/myrtle-holly wetland. Although <i>O. canbyi</i> is no longer seen in the bay interior, the plant is stoloniferous and clones may persist in the duff and upper mineral horizon. In 1990, associated plant species included <i>Solidago microcephala</i>, <i>Hypericum</i> sp., <i>Sphagnum</i> sp., <i>Rhynchospora</i> sp., <i>Rhexia</i> sp., <i>Lycopodium</i> sp., and <i>Eriocaulon</i> sp. In 2010, associated species (i.e., plants in powerline right-of-way) included the following woody species: <i>Acer rubrum</i>, <i>Arundinaria tecta</i>*, <i>Ilex glabra</i>, <i>Ilex myrtifolia</i>, <i>Ludwigia pilosa</i>, <i>Lyonia lucida</i>, <i>Magnolia virginiana</i>, <i>Morella cerifera</i> (dominant in bay interior), <i>Nyssa biflora</i> (dominant in bay interior), <i>Liquidambar styraciflua</i>, <i>Persea</i> sp. (dominant in bay interior), <i>Pinus elliottii</i> (dominant in bay interior), <i>Pinus taeda</i>, and <i>Rubus argutus</i>; the following herbaceous species: <i>Bidens bipinnata</i>, <i>Boltonia asteroides</i>, <i>Centella erecta</i>, <i>Cuphea carthagenensis</i>, <i>Erigeron vernus</i>, <i>Eriocaulon decangulare</i> var. <i>decangulare</i>, <i>Eupatorium capillifolium</i>, <i>E. leucolepis</i>, <i>Euthamia</i> sp., <i>Helianthemum</i> sp., <i>Hypericum denticulatum</i>, <i>Hypericum galioides</i>, <i>Leersia hexandra</i>, <i>Lobelia nuttallii</i>, <i>Ludwigia pilosa</i>, <i>Myriophyllum proserpinaca</i>, <i>Osmunda cinnamomea</i>, <i>Oxypolis filiformis</i> (morphologically very similar to <i>O. canbyi</i>), <i>Panicum hemitomon</i>*, <i>Phyllanthus urinaria</i>, <i>Pluchea foetida</i> var. <i>foetida</i>, <i>Pluchea rosea</i>, <i>Polygala lutea</i>, <i>Proserpinaca pectinata</i>, <i>Rhexia mariana</i> var. <i>ventricosa</i>*, <i>Rhynchospora chalarocephala</i>*, <i>Sabatia difformis</i>, <i>Sabatia</i> sp., <i>Saccharum giganteum</i>, <i>Smilax laurifolia</i>, <i>Symphyotrichum dumosum</i>, <i>Tripsacum dactyloides</i>, <i>Viola lanceolata</i>, <i>Woodwardia areolata</i>, <i>W. virginica</i>, and <i>Xyris fimbriata</i>. Also present are the exotic species: <i>Paspalum notatum</i>* (very abundant, occupying much of the area of the right-of-way), <i>Paspalum urvillei</i>, <i>Phyllanthus urinaria</i>, and <i>Sesbania punicea</i>. (* indicates dominant) In 2012, the interior of the Heritage-owned portion of the bay was cut, creating a wet savanna-like landscape.	Plants are in a roadside powerline right-of-way that apparently is herbicided regularly by the power company.

(6) *Ptilimnium nodosum* (LE) at Janet Harrison High Pond Heritage Preserve.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
1	445504 / 3742545	2013-09-27	D.A. Rayner A.E. Hodge D. Soblo S.R. Hill A.B. Pittman K.A. Boyle H.H.K. Brown C.A. Aulbach	As summarized by C.A. Aulbach in 2011: Year # of plants 1985: 500 1991: 66 1992: ~2,000 1997: 301 1998: ~1,650 1999: ~5,350 2001: ~7,000 2002: 142 2003: 3,115 2004: ~1,750 2006: >10,000 2007: >5,000 2011: ~5,100 Viability Rating: AB	1985: In low, rectangular, man-made area within highpond, especially at the northern and southern margins of this area. Area has been cultivated in the last few years. 1992: Growing with <i>Coreopsis rosea</i> , <i>Eleocharis</i> , and <i>Panicum hians</i> in a depression meadow community in wet, sandy soil. 2010: The contours of the pond have been greatly altered in an effort to create a more natural body of water. The deep rectangular pit had been filled, leaving the water fairly shallow throughout. Associated herbaceous species include <i>Acalypha rhomboidea</i> , <i>Ambrosia artemisiifolia</i> , <i>Baccharis halimifolia</i> , <i>Bidens discoidea</i> , <i>Carex festucacea</i> , <i>C. longii</i> , <i>C. lurida</i> , <i>Cuscuta pentagona</i> , <i>C. pentagona</i> var. <i>pentagona</i> , <i>Cyperus pseudovegetus</i> , <i>C. retrorsus</i> , <i>Digitaria ischaemum</i> , <i>Diodia virginiana</i> , <i>Echinodorus tenellus</i> , <i>Eclipta prostrata</i> , <i>Eleocharis acicularis</i> , <i>E. obtusa</i> , <i>Eryngium prostratum</i> , <i>Euthamia caroliniana</i> , <i>Fimbristylis autumnalis</i> , <i>Galium tinctorium</i> var. <i>tinctorium</i> , <i>Hydrocotyle umbellata</i> , <i>Ipomoea lacunosa</i> , <i>I. nil</i> , <i>Juncus acuminatus</i> , <i>J. brachycarpus</i> , <i>J. dichotomus</i> , <i>J. diffusissimus</i> , <i>J. effusus</i> , <i>J. repens</i> , <i>Leersia hexandra</i> , <i>Lindernia dubia</i> var. <i>anagallidea</i> , <i>Ludwigia brevipes</i> , <i>L. linearis</i> , <i>L. spathulata</i> , <i>Melochia corchorifolia</i> , <i>Nymphoides cordata</i> , <i>Oldenlandia boscii</i> , <i>O. uniflora</i> , <i>Panicum dichotomiflorum</i> , <i>P. verrucosum</i> , <i>Persicaria longiseta</i> , <i>Phoradendron leucarpum</i> , <i>Phyllanthus caroliniensis</i> ssp. <i>caroliniensis</i> , <i>Polygonum pensylvanicum</i> , <i>Polypremum procumbens</i> , <i>Proserpinaca palustris</i> , <i>Ptilimnium capillaceum</i> , <i>Pyrrhopappus carolinianus</i> , <i>Rotala ramosior</i> , <i>Saccharum giganteum</i> , <i>Schedonorus arundinaceus</i> , <i>Senna obtusifolia</i> , <i>S. occidentalis</i> , <i>Sida spinosa</i> , <i>Steinchisma hians</i> , <i>Symphyotrichum dumosum</i> , <i>Utricularia radiata</i> , and <i>Xanthium strumarium</i> .	Abundant rainfall in 2013 raised the water level of the pond, discouraging woody invaders; still, some loblolly pine, groundsel bush, and sweet gum suckers were present. In previous years cattail has been observed as well, but none was seen in 2013. Continue mechanical and chemical control of these species.

(7) *Ribes echinellum* (LT) at Stevens Creek Heritage Preserve.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
5	392477 / 3728250	2012-04-06	J. Lawrence J.R. Massey A.E. Radford W.L. Matthews R.M. Hendrick B. Zattan G.A. Wallace A.B. Pittman K.A. Boyle	Large population, distributed as scattered individuals or in small clumps for a distance of ~1400 meters. Most of the larger plants in flower or fruit. Viability Rating: A	On north facing bluffs overlooking Stevens Creek, in a relict mixed mesophytic forest community that has been well documented by Radford and others. 2012 (Pittman): The bluffs along Stevens Creek continue to be the heart of the <i>Ribes</i> population but a number of plants can also be found on uplands at some distance from the creek, in fact southward to within 0.2 mile of S-88. See map below.	A dense and robust ground cover of <i>Galium aparine</i> has become established in the bluff area of the preserve. Monitor for possible effects on <i>R. echinellum</i> and other significant species.
6	393394 / 3728469	2013-05-09	J.W. Holling A.B. Pittman K.A. Boyle	About 20-30 plants, with an additional 20-30 plants on same contour ~25 meters upstream. All plants small, apparently recovering from top-kill by a recent fire. No evidence of reproduction. Viability Rating: B	On a low south-facing slope overlooking a shallow rill. In a somewhat disturbed oak-hickory forest, with <i>Carya cordiformis</i> , <i>C. ovata</i> , <i>Ostrya virginiana</i> , <i>Quercus alba</i> *, <i>Q. nigra</i> , and <i>Ulmus rubra</i> in the canopy; <i>Acer barbatum</i> *, <i>A. leucoderme</i> , <i>A. rubrum</i> , <i>Arundinaria gigantea</i> ssp. <i>tecta</i> , <i>Ligustrum sinense</i> *, <i>Ostrya virginiana</i> *, <i>Prunus serotina</i> , and <i>Rhus aromatica</i> in the mid-story; and <i>Asplenium platyneuron</i> , <i>Elymus virginicus</i> , <i>Lonicera japonica</i> , <i>Melica mutica</i> , <i>Nothoscordum bivalve</i> *, <i>Parthenocissus quinquefolia</i> , <i>Phacelia dubia</i> , <i>Scutellaria ovata</i> , <i>Tradescantia hirsuticaulis</i> , <i>Trillium discolor</i> , and <i>Zephyranthes atamasca</i> in the herbaceous layer (* indicates dominant). Soil is circumneutral (as determined by Hellige-Truog Soil pH Test Kit). A short distance upstream from <i>R. echinellum</i> is another site of interest. The rill bifurcates, exposing a small outcrop of granitoid gneiss ~50 feet in elevation above the Stevens Creek floodplain. The herbaceous layer is rich, with rare species <i>Scutellaria ovata</i> and <i>Tradescantia hirsuticaulis</i> on the outcrop and <i>Enemion biternatum</i> in the loose rich loam downslope. In the canopy, <i>Carya cordiformis</i> and <i>C. ovata</i> and <i>Quercus michauxii</i> and <i>Q. alba</i> , plus <i>Ulmus rubra</i> , are abundant. Continuing uphill and onto the uplands, hardwoods give way to an extensive loblolly pine plantation.	On adjacent uplands, replace loblolly pine plantations with native oak / hickory / shortleaf pine communities.
7	392848 / 3728611	2013-06-20	K.A. Boyle J.W. Holling A.B. Pittman	2013-05-22 - 2013-06-20: About 71 plants in 14 scattered clumps, and, ~500 feet to the northwest (392735 / 3728683 WGS84), an additional 15 plants. At both sites most plants are small, possibly recovering from top-kill by fire. No evidence of reproduction. Viability Rating: AB	In fairly young, disturbed forest with <i>Acer barbatum</i> , <i>A. leucoderme</i> , <i>A. rubrum</i> , <i>Carpinus americana</i> , <i>Carya alba</i> , <i>C. cordiformis</i> , <i>C. tomentosa</i> , <i>Diospyros virginiana</i> , <i>Fraxinus americana</i> , <i>Liquidambar styraciflua</i> , <i>Liriodendron tulipifera</i> , <i>Quercus michauxii</i> , <i>Q. nigra</i> , <i>Q. rubra</i> , <i>Q. velutina</i> , and <i>Tilia americana</i> in the canopy. <i>Ulmus alata</i> and saplings of canopy species form an even-structured sub- canopy. Shrub layer includes <i>Aesculus sylvatica</i> *, <i>Arundinaria tecta</i> , <i>Carpinus caroliniana</i> , <i>Cercis canadensis</i> , <i>Ligustrum sinense</i> , and <i>Viburnum rufidulum</i> (* indicates dominant) with woody vines <i>Parthenocissus quinquefolia</i> and <i>Vitis rotundifolia</i> scattered in the midstory. The sparse herbaceous layer includes <i>Brachyelytrum erectum</i> , <i>Chasmanthium</i> sp., <i>Danthonia spicata</i> *, <i>Scleria</i> sp.*, and <i>Sisyrinchium atlanticum</i> . The invasives honeysuckle (<i>Lonicera japonica</i>) and Chinese privet (<i>Ligustrum sinense</i>) are scattered throughout the area, and abundant in some spots. Entire area was likely clearcut in the recent past, as there are many logs on the ground, much exposed mineral soil, and extensive rill erosion leading down to the floodplain below.	Control honeysuckle and privet.

(8) *Sarracenia rubra* ssp. *jonesii* (LE) at Ashmore / Chandler Heritage Preserve.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
1	353833 / 3882653	2013-09-27	D.A. Rayner A.B. Pittman K.A. Boyle J.W. Holling H.H.K. Brown W.M. Grooms	1979: No numbers reported. 2013: At site 1 (3882653 / 353833 WGS84), a single large clump (~1 square meter) with 50-plus traps, many not expanded or only slightly expanded. At site 2 (3882697 / 353845), another single large clump (~1 square meter) with 50-plus traps, many not expanded or only slightly expanded. At site 3 (3882800 / 353844), plants more or less continuous in an area 2 meters long. At site 4 (3882878 / 353785), 8 small clumps scattered in an area 3 meters long, plus a single additional clump. At sites 3 and 4, pitcherplant trap leaves are generally expanded but diminutive and yellow-green, with little of the anthocyanin coloration typically seen in late summer (in the more sunny sites of the Wattacoo drainage, erect red-veined trap leaves - many fully expanded although now senesced - are common). Viability Rating: BC	1979: Beside waterfall on open seepage island associated with stream that drains Persimmon Ridge. Additional plants are in and above waterfall on west fork, north of stream in Wildcat Wayside Park, and also upstream from park. 2013: Along Slickum Creek, which originates on Campbell Mountain and flows southward to the South Saluda River. Underlying rock is Table Rock gneiss (TRg). Below 1400 feet, as the creek passes over relatively moderate but increasingly steep slopes, the streamside Rhododendron thickets shelter four small stands of pitcherplants. Site 1 (southernmost site) is alongside a cataract, open to the sun, with large and numerous peat moss hummocks. The herbaceous layer includes small mats or clumps of <i>Danthonia epilis</i>, <i>Solidago patula</i>, <i>Coreopsis integrifolia</i>**, <i>Oxypolis rigidior</i>, and <i>Calamagrostis porteri</i>** (** indicates tracked species). Site 2 is upstream, also relatively open to the sun, with large peat moss hummocks. Woody vegetation is dominated by mesic species such as <i>Liriodendron tulipifera</i>, <i>Ilex opaca</i>, and <i>Acer rubrum</i>. The herbaceous layer includes small mats or clumps of <i>Danthonia epilis</i>, <i>Solidago patula</i>, <i>Coreopsis integrifolia</i>**, <i>Oxypolis rigidior</i>, <i>Lobelia amoena</i>, and <i>Calamagrostis porteri</i>**. Sites 3 and 4, farther upstream, are seeps along a nearly level expanse of gneiss, with the slightly pitched streambed carved into the bedrock. Pitcherplants here are confined to very narrow strips of moisture-loving vegetation along the shallow sandy banks. Peat moss hummocks are few or absent, and overall exposure is quite shaded. Along with various bryophytes, the herbaceous vascular flora is depauperate, with <i>Galax ureolata</i> often nearby and <i>Mitchella repens</i> as ground cover. Woody shrubs and vines immediately beside the creek include <i>Alnus serrulata</i>, <i>Aronia arbutifolia</i>, <i>Arundinaria tecta</i>, <i>Calycanthus floridus</i>, <i>Hamamelis virginiana</i>, <i>Kalmia latifolia</i>, <i>Lyonia ligustrina</i>, <i>Pyrolaria pubera</i>, <i>Rhododendron maximum</i>, <i>R. arborescens</i>, <i>Smilax laurifolia</i>, <i>Viburnum cassinoides</i>, and <i>Xanthorhiza simplicissima</i>. Dominant canopy species, emergent through the dense shrub layer, include <i>Pinus virginiana</i>, <i>Quercus prinus</i>, <i>Oxydendrum arboreum</i>, <i>Acer rubrum</i>, and <i>Tsuga canadensis</i>.	Populations are small and non-reproductive. Thinning of streamside evergreen woody vegetation, allowing more sunlight to reach the herbaceous layer, may promote growth and flowering.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
4	356027 / 3884088	2013-07-24	D.A. Rayner A.B. Pittman K.A. Boyle J.W. Holling H.H.K. Brown	1979: No numbers reported. 2013: At site 1 (3884129 / 356015 WGS84), at least 20 large clumps with multiple traps, most in fruit. At site 2 (3884081 / 356032), 4 large senescent clumps, each with about a dozen mature traps, in a 4 x 10 meter area. At site 3 (3884047 / 356039), 11 large clumps, 8 in sun (at edge of cataract) and 3 in shade (in evergreen shrub thicket upstream). Viability Rating: A	1979: In seepage areas associated with steep waterslide bounded by rock outcrops. 2013: Along a creek that originates just south of Lower Gap, between Green Mountain and Campbell Mountain, and flows southward toward Wattacoo Creek. As the creek begins to drop precipitously from 1400 to 1600 feet, it emerges from dense rhododendron thicket into sunlight and onto exposed rock. Here, in an open boggy area on the creek's eastern side, is Site 1. Surrounded by sphagnum moss, the bog supports a diversity of herbaceous vegetation including <i>Arundinaria appalachiana</i>, <i>Castilleja coccinea</i>, <i>Coreopsis integrifolia</i>, <i>Drosera rotundifolia</i>, <i>Eupatorium fistulosum</i>, <i>Houstonia serpyllifolia</i>, <i>Krigia montana</i>, <i>Liatris spicata</i>, <i>Mitchella repens</i>, <i>Osmundastrum cinnamomeum</i>, <i>Oxypolis rigidior</i>, <i>Parnassia grandifolia</i>, <i>Platanthera clavellata</i>, <i>Selaginella apoda</i>, <i>Smilax laurifolia</i>, <i>Solidago patula</i> (in clonal stands), <i>Utricularia cornuta</i>, and <i>Xanthorhiza simplicissima</i>. The upper and landward edges of the bog are dense with woody vegetation, including <i>Acer rubrum</i>, <i>Liriodendron tulipifera</i>, and <i>Pinus virginiana</i> in the canopy, and <i>Alnus serrulata</i>, <i>Aronia arbutifolia</i>, <i>Kalmia latifolia</i>, <i>Lyonia ligustrina</i>, <i>Rhododendron maximum</i>, <i>R. viscosum</i>, <i>Toxicodendron pubescens</i>, and <i>Viburnum cassinoides</i> in the midstory. Site 2 is downslope, along an extremely steep ledge. Vegetation here is similar and includes several 2-foot DBH pitch pines, <i>Osmunda regalis</i>, dense <i>Arundinaria tecta</i>, and, adjacent to the cataract, a band of <i>Xanthorhiza simplicissima</i> and a dense thicket of <i>Kalmia latifolia</i>. Site 3 is further downslope and vegetation again is similar and includes an evergreen shrub thicket dense with <i>Smilax rotundifolia</i>, <i>S. smallii</i>, and <i>S. laurifolia</i>. Underlying rock is Table Rock gneiss (TRg).	

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
6	353630 / 3883384	2013-09-18	J.A. Sorrow M.S. Bunch A.B. Pittman K.A. Boyle	At site 1 (3883384 / 353630 WGS84), 90 clumps, in narrow band on streamside for a distance of ~20 meters. Many but not all plants in fruit/flower. At site 2 (3883271 / 353633), on densely vegetated west side it is impractical to count individual clumps but pitcherplants, most with unexpanded trap-leaves and no fruit or flowers, are present in three areas, each 1-3 meters long and 0.5-1 meter wide, near top of ledge, plus two more, each 2-3 meters long and 0.5 meter wide, near bottom. On the more open east side, 34 clumps, with ~10 traps, most fully expanded, per clump; abundant fruit/flowers. Viability Rating: A	Along Slickum Creek, which originates on Campbell Mountain and flows southward to the South Saluda River. Underlying rock is Table Rock biotite-microcline augen gneiss (TRg). Between 1400 and 1600 feet, as the creek travels down steep slopes, are two fairly extensive occurrences of pitcherplants: Site 1 (northernmost site), along a swift cataract, is a narrow, shrub-dominated seepage on the irregular east bank, with some pitcherplants occupying positions of full sun while others are in shade. Associated woody vegetation includes <i>Alnus serrulata</i>, <i>Aronia arbutifolia</i>, <i>Arundinaria tecta</i>, <i>Kalmia latifolia</i>, <i>Lyonia ligustrina</i>, <i>Rhododendron maximum</i>, <i>R. arborescens</i>, <i>Viburnum cassinoides</i>, and <i>Xanthorhiza simplicissima</i>. Several large, crooked boles of <i>Liriodendron tulipifera</i> and <i>Acer rubrum</i> extend over cataract. At the herbaceous level, pitcherplants are intermixed with <i>Coreopsis integrifolia</i>, <i>Eupatorium fistulosum</i>, <i>Houstonia serpyllifolia</i>, <i>Lobelia puberula</i>, <i>Osmundastrum cinnamomeum</i>, <i>Osmunda regalis</i>, and <i>Oxypolis rigidior</i>. Immediately adjacent to the seep are rocky slopes with very dry woodlands dominated by <i>Pinus virginiana</i>, <i>Nyssa sylvatica</i>, and <i>Quercus prinus</i>. Site 2 is also along a cataract. On the west side, pitcherplants are in the shade of an extremely dense shrub thicket of <i>Alnus serrulata</i>, <i>Aronia arbutifolia</i>, <i>Arundinaria tecta</i>, <i>Kalmia latifolia</i>, <i>Lyonia ligustrina</i>, <i>Rhododendron maximum</i>, <i>R. arborescens</i>, <i>Smilax laurifolia</i>, <i>Tsuga canadensis</i>, <i>Viburnum cassinoides</i>, and <i>Xanthorhiza simplicissima</i>. On the east side, plants are in the sun with mainly herbaceous vegetation including <i>Xyris</i> sp., <i>Andropogon glomeratus</i>, and <i>Calamagrostis porteri</i>, and woody species are few, with mats of <i>Selaginella tortipila</i> and scattered Virginia Pine trees.	Noting the correlation between sun exposure and robust and fruiting/flowering pitcherplants, thinning of the dense streamside evergreen woody vegetation is recommended.
11	354293 / 3883385	2012-10-10	A.B. Pittman K.A. Boyle H.H.K. Brown W.M. Grooms	Fairly large population of >20 clumps with >100 trap leaves, in a 10 x 20 meter wedge-shaped area. Flowers and viable seed. Three additional sites are upstream. About 0.02 mile to the north (3883413 / 354269 WGS84) is a small planted population of three clumps with ~12 trap leaves. About 0.03 mile farther north (3883456 / 354239) is another planted population of ~10 clumps with ~30 trap leaves. About 0.04 mile farther north (3883510 / 354216) is a fairly large population (natural) of ~20 clumps with ~100 trap leaves, in a 5 x 10 meter area. Some evidence of flowering in this population but little viable seed. Viability Rating: A	In small open areas alongside stream, on dense mats 1-2 dm thick of herbaceous vegetation and organic matter; wet peat moss providing substrate. Associated with other heliophytic species such as <i>Oxypolis rigidior</i>. Drier oak and conifer species on adjoining upland form a super-canopy. Canopy species include <i>Acer rubrum</i>, <i>Amelanchier</i> sp., <i>Fraxinus americana</i>, <i>Ilex opaca</i>, <i>Liriodendron tulipifera</i>, <i>Nyssa sylvatica</i>, <i>Oxydendron arboreum</i>, <i>Pinus strobus</i>, <i>P. virginiana</i>, <i>Quercus coccinea</i>, <i>Q. montana</i>, <i>Q. velutina</i>, and <i>Tsuga canadensis</i>. The shrub layer includes <i>Alnus serrulata</i>, <i>Amelanchier</i> sp., <i>Aronia melanocarpa</i>, <i>Arundinaria montanum</i>, <i>Cornus florida</i>, <i>Hypericum</i> spp., <i>Kalmia latifolia</i>*, <i>Rhododendron maximum</i>*, <i>Rosa palustris</i>, <i>Rubus</i> spp., <i>Sambucus canadensis</i>, <i>Smilax glauca</i>, <i>S. laurifolia</i>, <i>Symplocos tinctoria</i>, <i>Viburnum cassinoides</i>, <i>Vaccinium fuscum</i>, and <i>Xanthorhiza simplicissima</i> (* indicates dominant). The herbaceous layer includes <i>Calamagrostis porteri</i>, <i>Chasmanthium</i> spp., <i>Eupatorium perfoliatum</i>, <i>Galax urceolata</i>, <i>Galium tinctorium</i>, <i>Gentiana saponaria</i>, <i>Glyceria striata</i>, <i>Houstonia serpyllifolia</i>, <i>Lycopus virginicus</i>, <i>Mitchella repens</i>, <i>Osmunda cinnamomea</i>, <i>O. regalis</i>, <i>Oxypolis rigidior</i>, <i>Platanthera clavellata</i>, <i>Sphenopholis pensylvanica</i>, <i>Symphyotrichum dumosa</i>, <i>Sphagnum</i> spp., <i>Thelypteris noveboracensis</i>, and <i>Triadenum virginicum</i>.	Thinning of streamside evergreen woody vegetation, allowing more sunlight to reach the herbaceous layer, may promote growth and flowering.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
12	354010 / 3883485	2012-10-10	A.B. Pittman K.A. Boyle H.H.K. Brown W.M. Grooms	Population planted. About seven clumps, each 10-20 cm in diameter. Some evidence of flowering but little if any viable seed; ovaries small and poorly developed. Viability Rating: BC	In sandy wash alongside small sand-bottom creek on western edge of outcrop (20-30 meters from exposed rock). Creek has no ledges, pools, or waterslides; soil is quite sandy but moist. The canopy is almost totally closed. Canopy species include <i>Acer rubrum</i> *, <i>Fraxinus americana</i> , <i>Ilex opaca</i> , <i>Liquidambar styraciflua</i> , <i>Liriodendron tulipifera</i> , <i>Nyssa sylvatica</i> *, <i>Oxydendron arboreum</i> , <i>Pinus virginiana</i> *, <i>Quercus coccinea</i> , <i>Q. montana</i> , and <i>Q. velutina</i> (* indicates dominant). Shrub layer includes <i>Alnus serrulata</i> , <i>Arundinaria montanum</i> *, <i>Kalmia latifolia</i> *, <i>Smilax glauca</i> , <i>Viburnum cassinoides</i> , and <i>Xanthorhiza simplicissima</i> . The herbaceous layer is very poorly developed, dominated by ferns <i>Osmunda cinnamomea</i> and <i>Thelypteris noveboracensis</i> , with hummocks of peat moss. <i>Lycopus virginicus</i> and <i>O. regalis</i> are also present. Immediately adjacent are dry slopes dominated by xerophytic trees. In summary, this is a planted population in a site that is drier than most known <i>S. jonesii</i> sites.	Additional thinning of surrounding woody vegetation, allowing more sunlight to reach the herbaceous layer, may promote growth and flowering.
13	356008 / 3883835	2013-08-23	D.A. Rayner Linda Lee A.B. Pittman K.A. Boyle	2013 (Pittman, Boyle): Large population, with at least 100 clumps in an area roughly 10 x 65 meters in size. Most plants in flower or fruit. Viability Rating: B	At the upper (northeastern) end of a small impoundment, in an open area along the muddy shoreline. Sedges (<i>Scleria reticularis</i> , <i>Rhyncospora</i> sp., <i>Carex</i> spp.) and grasses (<i>Andropogon glomeratus</i> , <i>Calamagrostis porteri</i> , <i>Danthonia sericea</i>), as well as dense clones of <i>Coreopsis integrifolia</i> , are intermixed with pitcherplants to form a narrow lake-side meadow. Associated woody vegetation includes <i>Alnus serrulata</i> , <i>Acer rubrum</i> , <i>Liriodendron tulipifera</i> , and <i>Liquidambar styraciflua</i> .	A number of nearby <i>Liquidambar styraciflua</i> trees have been cut in the recent past and as a result there is now an abundance of copses, a meter or less in height, extending into the pitcher plant stand. Continue to control growth and spread of <i>L. styraciflua</i> and other woody species. Also control feral hogs that have been rooting in the vicinity.

(9) *Trillium persistens* (LE) at Battle Creek Registration Site.

EO #	Location (NAD83)	Date of Last Obs	Observers	Size & Status of Population	Habitat	Management Notes
2	285191 / 3843121	2010-03-30	John Garst A.E. Hodge C.M. Plank A.B. Pittman H.H.K. Brown K.A. Boyle	2010: Approximately 100 individuals in 5 clumps, at least 10 percent in flower. Additional plants may be farther upstream. Viability Rating: AB	2010: Along Battle Creek, a short distance upstream from Lake Yonah. In shade on lower northwest facing slopes (0-10 degrees) in wet-mesic to mesic organic loam soils, pH 4.5 - 5.5. Associated species include with <i>Tsuga canadensis</i> , <i>Kalmia latifolia</i> , <i>Rhododendron maximum</i> , <i>R. caroliniana</i> , <i>Viola hasta</i> , <i>Galax aphylla</i> , <i>Polystichum acrostichoides</i> , <i>Heuchera villosa</i> , <i>Mitchella repens</i> , <i>Cardamine diphylla</i> . Community: <i>Tsuga canadensis</i> / <i>Rhododendron maximum</i> - (<i>Clethra acuminata</i> , <i>Leucothoe fontanesiana</i>) Forest (CEGL007136).	Herbarium label on Garst collection suggests occurrence of plants farther upstream "under <i>R. maximum</i> on wooded terrace in steep ravine; Battle Creek 1/3 mile from Lake Yonah, elev. about 850 ft."

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––0.2 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; Dalglish *et al.* 2010, p. 216).

Within the family Aristolochiaceae, 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 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 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.

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 resiliency 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 <i>Eugenia woodburyana</i> 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

terra incognita
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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 naniflora* (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 ever 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

endangered species/natural areas/wetland inventory conservation easement and planning

terra incognita

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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.

endangered species/natural areas/wetland inventory conservation easement and planning

U.S. Fish and Wildlife Service
Participation in Peer Review of the
Post Delisting Monitoring Plan 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 not 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:

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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
U.S. Fish and Wildlife Service

Date

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 ☒ (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?

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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 --

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(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.

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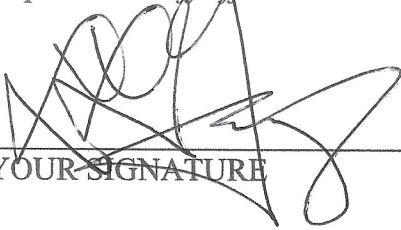
- (i) Could the research funding and support for you or your close research colleagues and collaborators be directly affected, or
- (ii) If you have any research agreements for current or continuing research funding or support from any party whose financial interests could be directly affected, and such 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).

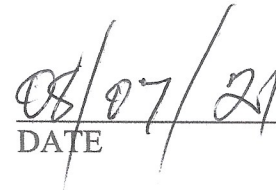
If the answer to any of the above questions under **RESEARCH FUNDING OR OTHER INTERESTS** is "yes," check here ☐ (YES), and briefly describe the circumstances below.

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
U.S. Fish and Wildlife Service

CARRIE
STRAIGHT

Digitally signed by CARRIE
STRAIGHT
Date: 2021.08.08 21:41:03 -04'00'

Date