U.S. FISH AND WILDLIFE SERVICE

Post-Delisting Monitoring Plan

for

Dwarf-Flowered Heartleaf
(*Hexastylis naniflora*)

Photo courtesy of US Fish and Wildlife Service

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

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

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

The purpose of this post-delisting monitoring is to verify that dwarf-flowered heartleaf (*Hexastylis naniflora*) remains secure from the risk of extinction after it has been removed from the protections of the Act. The Service prepared this draft post-delisting monitoring (PDM) plan (Plan), with input from the North Carolina Natural Heritage Program (NCNHP) and the North Carolina Department of Transportation (NCDOT), based largely on monitoring methods developed in March 2012 during a field coordination meeting with NCNHP, NCDOT, and the Service (Robinson and Padgett 2016). This draft Plan is designed to detect substantial declines in dwarf-flowered heartleaf occurrences with reasonable certainty and precision.

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

II. Summary of Species Status at Delisting

A. Demographic Parameters

Dwarf-flowered heartleaf is a perennial, evergreen, herbaceous plant endemic to the upper Piedmont region of western North Carolina and upstate South Carolina. It occurs on uplands with acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for the species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with mountain laurel (*Kalmia latifolia*) (Padgett 2004, Weakley 2015, Service 2018), or moist soils adjacent to creeks, streamheads, lakes, or rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains (Newberry 1993).

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

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

B. Discussion of Populations

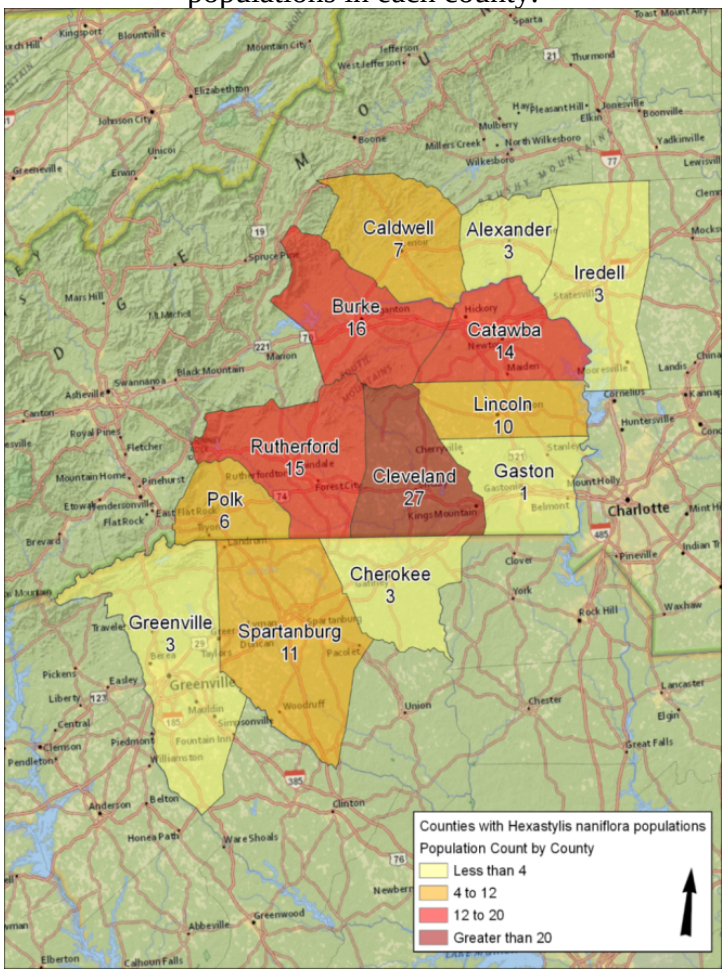
When dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant "populations" (Service 1989). Explicit criteria for recognizing these populations were not given in the listing rule, but based on information in Asheville Ecological Services Field Office files, it appears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

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

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

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

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



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

III. Public Review and Comment

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

IV. Monitoring Methods and Locations

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

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

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

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

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

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

The PDM will be a continuation of the monitoring described above and occur within at least 12 previously monitored populations (Appendix A).

A. Procedures to Assure Consistency

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

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

B. Frequency and Duration of Monitoring

PDM will follow the methods discussed above and will be initiated during the first full growing season following the publication of a final rule to delist dwarf-flowered heartleaf. As staff resources and funding allow, PDM will occur within at least 12 of the 25 previously monitored populations (Appendix A). Monitoring will be conducted on a two-year cycle in which at least 6 sites are monitored each year for six years (each site receives three complete monitoring cycles).

IV. Definition of Response Triggers for Potential Monitoring Outcomes

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

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

A. Category I

<u>PDM indicates that dwarf-flowered heartleaf remains secure without ESA protections</u>.
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)

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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.