

Interim Core Map Documentation for Dwarf-flowered Heartleaf

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Draft Interim Core Map Developer: Compliance Services International (CSI)

Species Summary

The Dwarf-flowered heartleaf (*Hexastylis naniflora*; Entity ID 734) is a dicotyledonous threatened plant found in the Eastern United States. The United States Fish and Wildlife Service (FWS) has not assigned designated critical habitat (DCH) for Dwarf-flowered heartleaf. This species inhabits acidic sandy-loam soils that are very deep and moderately permeable. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams. Additional habitat information is provided in **Appendix 1**.

EPA Review Notes

The developers created this core map using EPA's process available at: <https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas>. EPA reviewed the draft interim map and documentation and evaluated if: (1) the map and documentation are consistent with EPA's process; (2) areas included or excluded from the interim core map are consistent with the biology, habitat, and/or recovery needs of the species; (3) data sources are documented and appropriate; and (4) the GIS data and mapping process are consistent with the stated intention of the developer. EPA agrees that this map is a reasonable depiction of core areas for this species and was consistent with EPA's mapping process. This documentation was not prepared by EPA, but EPA may have edited this documentation for clarity or other purposes. Views expressed in this documentation are not necessarily the viewpoints of EPA or its staff.

The core map developed for this species is considered interim and can be used to develop pesticide use limitation areas (PULAs). This core map incorporates information developed by FWS and made available to the public; however, the core map has not been formally reviewed by FWS. This interim core map may be revised in the future to incorporate expert feedback from FWS.

This core map does not replace or revise any range or designated critical habitat developed by FWS.

Description of Core Map

The core map for the Dwarf-flowered heartleaf is based on biological information. The draft FWS Species Status Assessment included textual descriptions of habitats that were used to find usable geospatial data contributing to the core map. Known location information from the Global Biodiversity Information Facility (GBIF), iNaturalist, and NatureServe databases were not used for core map development because they did not improve upon more robust biological habitat datasets.

In North Carolina, the species habitat is represented using a model developed for the Dwarf-flowered heartleaf by the North Carolina Department of Transportation (NCDOT), specifically areas considered "high" potential habitat. In South Carolina, the core map was restricted to sandy loam soils based on a description of its habitat restriction to "Pacolet sandy loam, Madison gravelly sandy loam, and Musella fine sandy loam soils" (FWS 2019). These habitat areas were clipped to the species range, then had contiguous cultivated

areas > 25 acres (EPA 2025) removed to develop the core map.

Available known location information from iNaturalist, the GBIF database, and NatureServe were not used due to core map development scope, low observation count, or simply in favor of more complete and recent datasets.

The core map developed in this document for the Dwarf-flowered heartleaf spans 537,196 acres. A summary of acreage by National Landcover Database (NLCD) land use type is provided in Table 1.

Based on the United States Environmental Protection Agencies (EPA) “best professional judgment classification” system, CSI has graded this core map as “moderate” (4) because assumptions were made when connecting species life history and/or biological needs (habitat preferences) to a Geographical Information System (GIS) dataset, in this case the Soil Survey Geographic Database (SSURGO) (USDA 2023). More information about this classification system and its definitions can be found in the core map process document (EPA 2024).

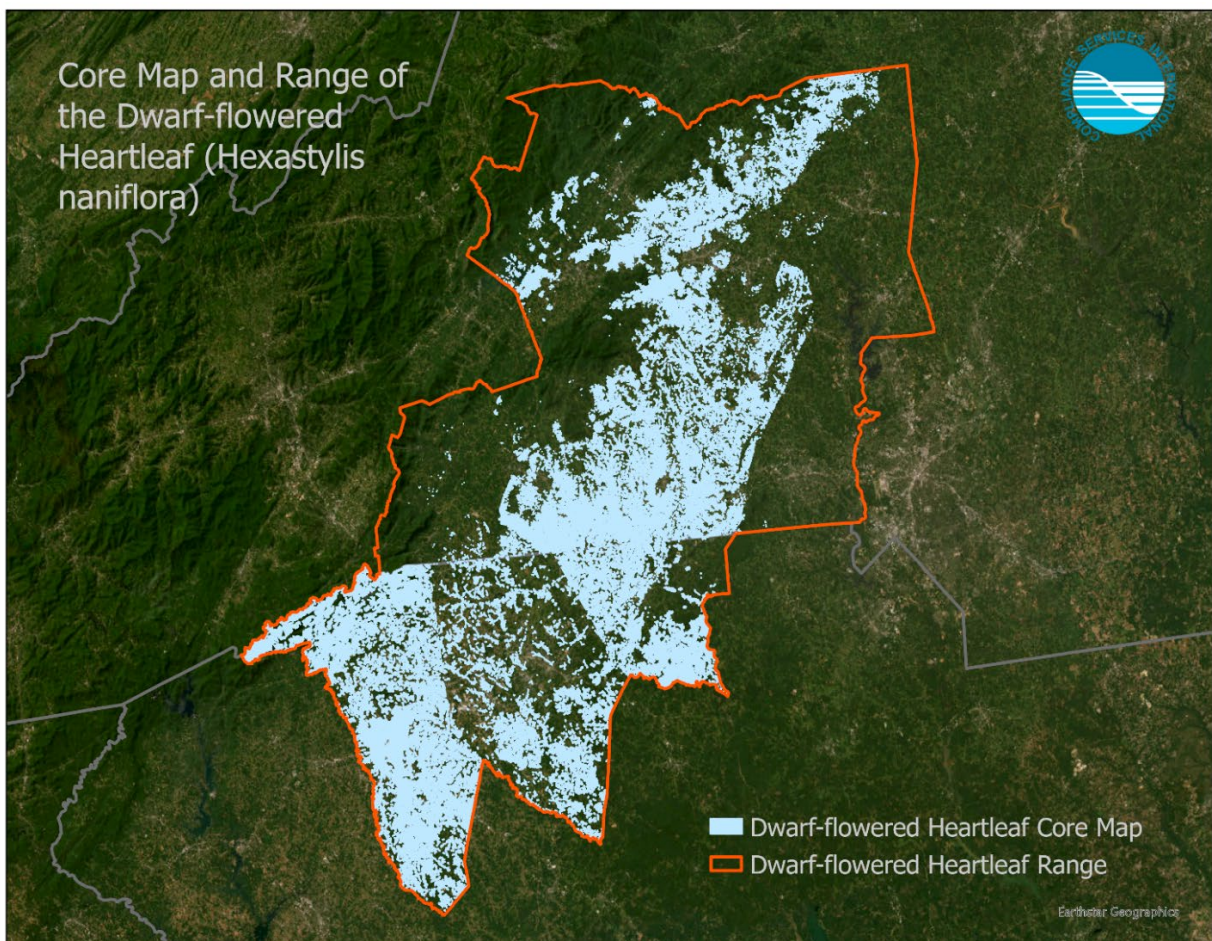


Figure 1. Interim core map for the Dwarf-flowered heartleaf.

NLCD_Land_Cover_Class	Acres
Deciduous Forest	185,910
Mixed Forest	83,478
Evergreen Forest	55,548
Developed, Open Space	51,569
Developed, Medium Intensity	18,210
Herbaceous	12,597
Woody Wetlands	11,191
Shrub/Scrub	10,356
Developed, High Intensity	9,200
Open Water	1,258
Cultivated Crops	1,064
Emergent Herbaceous Wetlands	559
Barren Land	547

Table 1. Acres by National Land Cover Database (NLCD) class within the core map of the Dwarf-flowered heartleaf. Total core map area (based on NLCD pixel count): 537,218 acres¹.

¹ This acreage is slightly different from the core map acreage (537,196) due to the pixelation of NLCD land cover. The core map is not developed from raster data.

Evaluation of Known Location Information

There were four evaluated datasets with known location information:

- Descriptions of locations provided by FWS;
- Occurrence locations in iNaturalist;
- Occurrence locations in GBIF; and
- Occurrence locations in NatureServe.

Compliance Services International evaluated these four datasets before developing the core map. Overall, there were 30 research-grade observations found in iNaturalist². The GBIF dataset included one georeferenced observation. Both datasets were useful as validation against other datasets, but did not otherwise contribute to the core map development process.

The FWS location information did not include extant population information that could be easily identified or otherwise converted to geospatial information.

NatureServe public element occurrence (EO) data were also evaluated and are considered by CSI to be more robust than the iNaturalist and GBIF datasets for this species. These data were considered for refinement, but ultimately not used because habitat refinements to species range were sufficient.

Approach Used to Create Core Map

The core map was developed using EPA’s process for developing core maps for species listed by the FWS and their designated critical habitats (DCH)² (referred to as “the process”). This core map was developed by CSI using the four steps described in the process document:

1. Compile available information for a species;
2. Identify core map type from among the following defined types: DCH, range, and biological information. From EPA, summaries of each core map type are provided below (EPA 2024).
3. Develop the core map for the species; and
4. Document the core map.

For step 1, CSI compiled available information for Dwarf-flowered heartleaf from FWS, as well as observation information available from various publicly available sources including iNaturalist, GBIF, and NatureServe. The information compiled for Dwarf-flowered heartleaf is included in **Appendix 1**. Influential information that impacted the development of the core map includes a description of the species habitat from the FWS Draft Species Status Assessment:

- “Dwarf-flowered heartleaf occurs on piedmont uplands on acidic sandy-loam soils that are very deep

² According to iNaturalist, an observation is designated as “research grade” if it 1) is verifiable with date, coordinates, photos/sounds, and not captive; 2) achieves community agreement defined as “more than 2/3 of identifiers needs to agree on the species level ID or lower;” and 3) “must pass a data quality assessment, which includes checks for accurate date and location, evidence of a wild organism, and clear evidence of the organism itself” (<https://help.inaturalist.org/en/support/solutions/articles/151000169936-what-is-the-data-quality-assessment-and-how-do-observations-qualify-to-become-research-grade->).

and moderately permeable (Gaddy 1981, 1987). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, Weakley 2015, FWS 2015), or moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams... The species appears to be restricted to Pacolet sandy loam, Madison gravelly sandy loam, and Musella fine sandy loam soils” (FWS 2019).

For step 2, CSI used the compiled information including the species range, known locations, and habitat location information to determine the core map type. Compliance Services International compared the known location data to the range and found that known locations from larger databases (iNaturalist and GBIF) were relatively limited compared to the range, so could only be used for validation of other datasets in core map development. Known location information from FWS was not detailed or specific enough to be used as a refinement of core map extent from species range.

Review of the available data also suggested that the core map should exclude landcover types inconsistent with the Dwarf-flowered heartleaf habitat. In South Carolina, the SSURGO database was used to represent reasonable potential habitat for this species. In North Carolina, a species-specific model was found and developed for the species. Additionally, the Dwarf-flowered heartleaf would not be expected to be found on agricultural land (*i.e.*, it is an “off-field” species). When weighing this information together, CSI selected the biological information core map type, limited to an extent of species range. Compliance Services International used a combination of range, habitat information, and the EPA cultivated areas > 25 acres layer to derive this core map.

For step 3, CSI used the best-available data sources to generate the core map. Data sources are discussed in EPA’s core map process document. For this interim core map, CSI followed EPA’s decision framework to arrive at a core map type of biological information. Designated critical habitat was quickly eliminated as a core map type because the Dwarf-flowered heartleaf does not have DCH. The range core map type was not selected because the species range is neither refined nor endemic.

In North Carolina, a species-specific model of low- and high-potential habitat for the Dwarf-flowered heartleaf was developed by the NCDOT. Areas of high potential habitat (approximately 229,000 acres) were selected to represent the core map for this state. In South Carolina, the core map was restricted to sandy loam soils based on a description of its habitat restriction to “Pacolet sandy loam, Madison gravelly sandy loam, and Musella fine sandy loam soils” (FWS 2019). Additionally, the dataset from NCDOT was used to validate the SSURGO database in South Carolina by examining soil texture types within these areas of high potential habitat in North Carolina. Finally, cultivated lands were removed from this area; this removed 0.6% of area. **Appendix 2** provides more details on the GIS analysis and data used to generate the core map.

Discussion of Approaches and Data that were Considered but Not Included in Core Map

Known Observation Datasets

Datasets such as iNaturalist, GBIF, and NatureServe were considered but not used. NatureServe public EOs are viewable in their mapper as hexagons corresponding to locations where the species may have been observed. The current range of the species encompasses all of the occurrences based on visual inspection. Range was selected as the outer extent and further refined with biological data in North Carolina.

Appendix 1. Information compiled for Dwarf-flowered heartleaf

1. Recent FWS documents

- 5-Year Review (2011): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/1713.pdf
- Draft Species Status Assessment (SSA) (2019): <https://iris.fws.gov/APPS/ServCat/DownloadFile/231673>
- ITIS: https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=194912#null
- Proposed Delisting (2021): <https://www.govinfo.gov/content/pkg/FR-2021-04-26/pdf/2021-08459.pdf#page=1>

2. Background information

- Status: Federally listed as threatened in 1989. Population proposed for delisting in 2021.
- Resiliency, redundancy, and representation (the 3Rs) (FWS 2019).
 - Resiliency: “There are 78 populations of Dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). Table 4.2 shows the contribution of each resilience category as follows: 36% (very high); 7% (high); 34% (moderate); 23% (low). When looking at cumulative percentages of resilience, it is interesting to note that 77% of all of the populations are classified as moderate to very high resilience (Table 2).”

County	Very High	High	Moderate	Low	Totals
Alexander	1		1	1	3
Burke/Catawba /Caldwell			1		1
Burke	2		4	2	8
Caldwell	2	2		1	5
Catawba	4	2	4	2	12
Cherokee	1				1
Cleveland/ Rutherford	1				1
Cleaveland	4	1	7	6	18
Gaston			1		1
Greenville				2	2
Iredell			1	2	3
Lincoln	2		1	2	5
Polk	2		3	1	6
Rutherford	7		3		10
Spartansburg	2				2
Totals	28	5	26	19	78
<i>% of total</i>	<i>36</i>	<i>7</i>	<i>34</i>	<i>23</i>	<i>100</i>
<i>Cumulative %</i>	<i>40</i>	<i>43</i>	<i>77</i>	<i>100</i>	<i>--</i>

Table 2. Population resilience categories by county for Dwarf-flowered heartleaf (FWS 2019). Copied from Table 4.2 of the Draft Species Status Assessment (FWS 2019).

- Redundancy: “As stated previously, there are 78 populations of Dwarf-flowered heartleaf that have been observed since 2005 (Table 4.1), and resilience of these populations is as follows: 28 (very high); 5 (high); 26 (moderate); 19 (low). The populations are spread across the range, although a majority occurs in North Carolina. Although, there appears to be adequate redundancy within the range of Dwarf-flowered heartleaf to withstand the impacts of localized press catastrophic disturbances, the species range is very small, making it potentially vulnerable to long-term catastrophic events, such as climate change.”
- Representation: “Representation describes the ability of a species to adapt to changing environmental conditions. We lack genetic and ecological diversity data to characterize representation for Dwarf-flowered heartleaf. In the absence of species-specific genetic and ecological diversity information, we typically evaluate representation based on the extent and variability of habitat characteristics across the geographical range. However, the Dwarf-flowered heartleaf has a very limited range, and after consulting with experts, we decided delineating representative “units was not appropriate for this species.”
- Habitat, Life History, and Ecology (FWS 2019)
 - Habitat: “Dwarf-flowered heartleaf occurs on piedmont uplands on acidic sandy-loam soils that are very deep and moderately permeable (Gaddy 1981, 1987). Typical habitats for this species include mesic to dry bluffs, slopes, or ravines in deciduous forests that are frequently associated with *Kalmia latifolia* (Padgett 2004, Weakley 2015, FWS 2015), or moist soils adjacent to creeks, streamheads, or along lakes and rivers. Plants have been observed to grow larger and have more frequent flowering in floodplains along rivers, lakes, and streams (Newberry 1993). Wagner (2013) conducted a habitat suitability study to quantify the habitat requirements for Dwarf-flowered heartleaf, which may be used for helping identify the species when not in flower (relative to other *Hexastylis* species habitat preferences), find new populations, or identify suitable sites for transplants.”
 - Soils: “The species appears to be restricted to Pacolet sandy loam, Madison gravelly sandy loam, and Musella fine sandy loam soils (Gaddy 1981,1987). The species grows in acidic soils along bluffs and adjacent slopes, in boggy areas next to streams and creekheads, and along the slopes of nearby hillsides and ravines (Gaddy 1980, 1981). It is primarily found inhabiting north- to northwest-facing slopes, bluffs, and ravines in close proximity to creeks or streams. Within these areas exists the soil type required for *Hexastylis naniflora* to grow. It grows primarily on well-drained, sandy, acidic soils, and will not grow in heavy clay.”
 - Pollinators: “The pollination of *Hexastylis* has not been well studied but the genus was thought to be pollinated by insects including flies, wasps, and thrips.
- Taxonomy (ITIS)
 - Family: *Aristolochiaceae* (birthworts).
 - Genus: *Hexastylis*
 - Species: *Hexastylis naniflora*

- Relevant Potential Pesticide Use Sites
 - Conversion of habitat to pasture or other agricultural uses is listed as a threat to this species. However, pesticides are not specifically listed as a threat to this species.
- Relevant Recovery Criteria and Actions
 - A Recovery Plan is not available for this species. However, the species has been proposed for delisting based on an increased number of known populations; habitat protection for many of the populations; species viability, even in highly developed areas; and conservation efforts (FWS 2021).

3. Description of Species Range

- 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 (Proposed Delisting, 2021).
- Distribution: Although Dwarf-flowered heartleaf is restricted in range, it is not as rare as once thought (FWS 2010, NCNHP 2016). When Dwarf-flowered heartleaf was federally listed in 1989, the listing rule described 24 extant “populations” (and one extirpated population) distributed across eight counties in the upper Piedmont of North and South Carolina. Since 1989, the range has expanded to include five additional counties in North Carolina. In North Carolina, it is found in Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, Polk, and Rutherford Counties. In South Carolina, it is in Cherokee, Greenville, and Spartanburg Counties. As of 2018, the distribution of this species consisted of 119 populations distributed across 13 counties in these two states (Figure 2.2).” (FWS 2019).

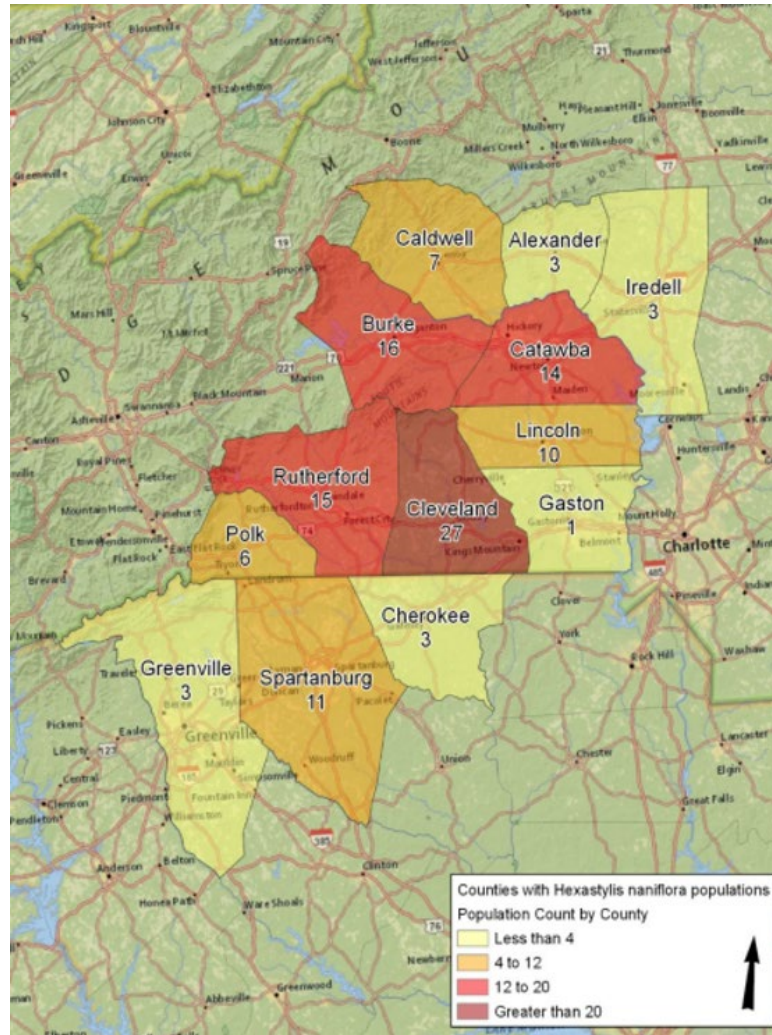


Figure 2. Current county distribution for Dwarf-flowered heartleaf, with associated number of known populations within each county. Copied from Figure 2.2 of the Draft SSA (FWS 2019).

- 32 verifiable observations, 30 of which are research-grade with public coordinate data (Figure 4).
- These locations are concentrated near Charlotte, NC and are in general agreement with species range. However, the observations were not considered for use in core map development because these point observations were considered less robust and/or accurate than the habitat-based areas within the range. Further details of those datasets and the approach used are provided in **Appendix 2**.

Observations

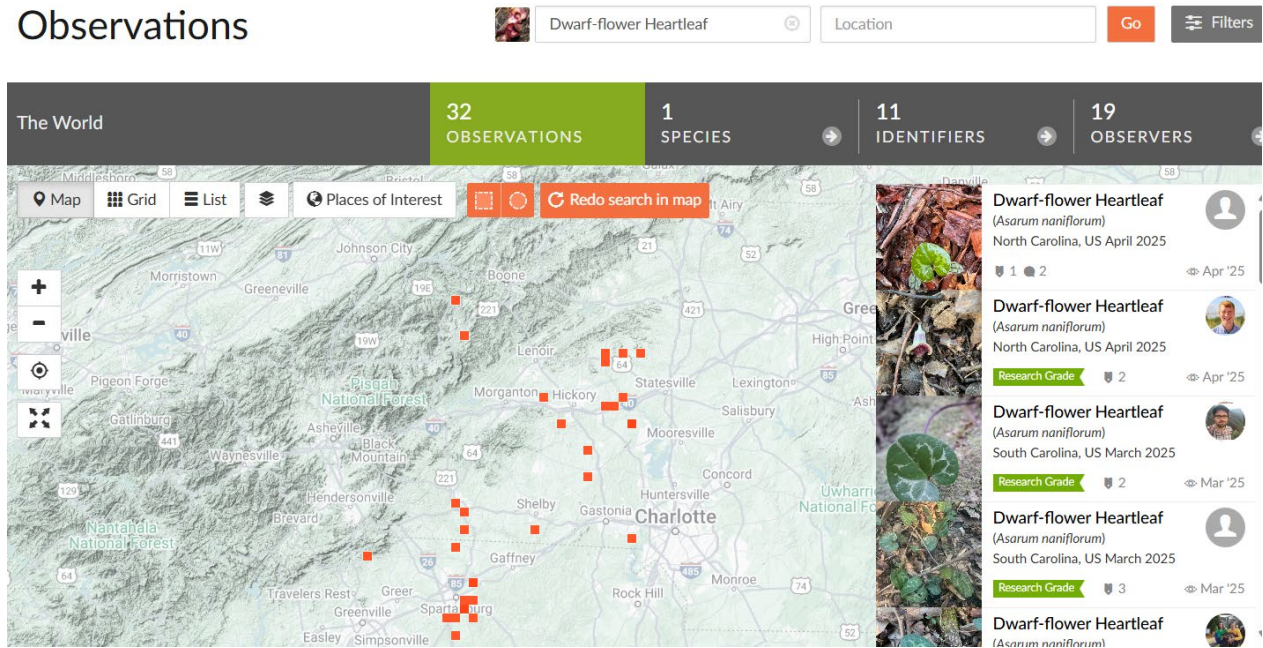


Figure 4. iNaturalist occurrences for the Dwarf-flowered heartleaf.

- GBIF: <https://www.gbif.org/species/5331108>
 - GBIF includes 464 occurrence records; one of which is georeferenced with usable coordinate data based on latitude/longitude precision (3+ decimal places) and relative recency (2010-present). This observation is located in North Carolina.
 - The usable coordinate is consistent with range, but does not meaningfully contribute to core map development.

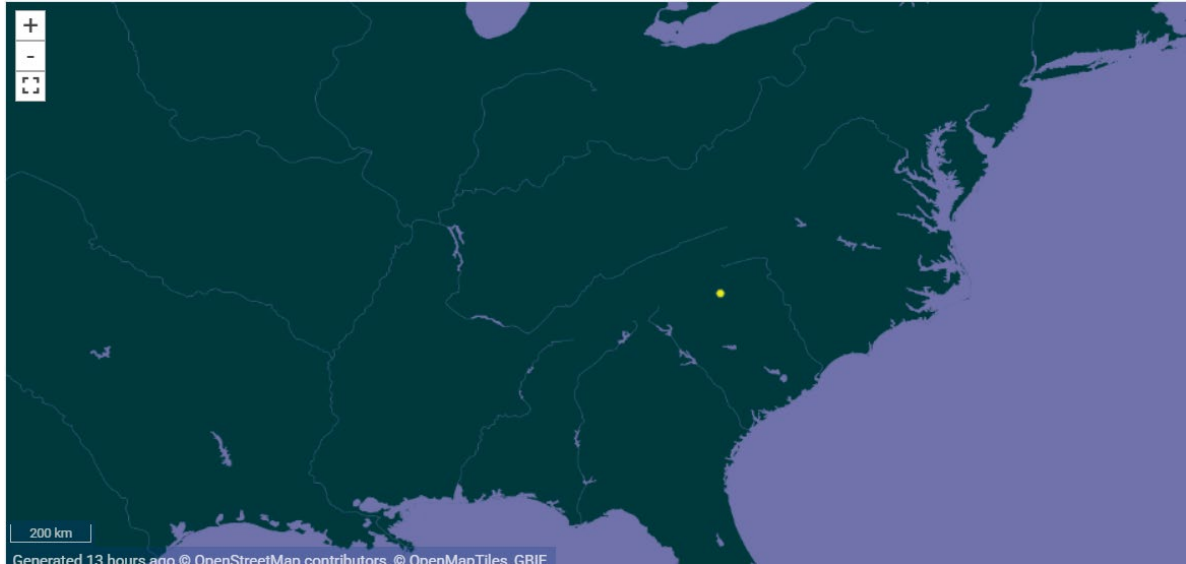


Figure 5. GBIF occurrences of the Dwarf-flowered heartleaf.

- NatureServe Explorer: <https://explorer.natureserve.org/>
 - As with the iNaturalist data for this species, occurrences in NatureServe are concentrated near Charlotte, NC in general agreement with species range. However, the observations were not considered for use in core map development because these observations were considered less robust than the habitat-based areas within the range. Further details of those datasets and the approach used are provided in Appendix 2.

Appendix 2. GIS Data Review and Method to Develop Core Map

The core map for this species is based on biological information, which includes the habitat used by this species found within a spatial extent of range. In North Carolina, the core map identifies all areas within the range with a “high” potential habitat for the species, according to a species-specific model developed by the NCDOT. In South Carolina, the core map is represented by a soils layers queried for various “sandy loam” texture classes. These state-specific layers were merged and had contiguous cultivated areas > 25 acres removed to create the final core map shape.

1. References and Software

- North Carolina Department of Transportation. 2021. "Dwarf Flowered Heartleaf - Potential Habitat." ATLAS Project. Accessed March 1, 2025. <https://xfer.services.ncdot.gov/gisdot/AtlasData/AtlasSpeciesModels/ATLASPlantMachineLearningModels/>.
- NRCS Soil Survey Geographic Database (SSURGO): <https://sdmdataaccess.sc.egov.usda.gov>
- Software used: ArcGIS Pro version 3.2.
- EPA Modified Cultivated Layer: <https://cdn.arcgis.com/home/item.html?id=159e70ce4c284f5b972c687037f8a668>.
- FWS Species Range: <https://ecos.fws.gov/ecp/species/2458>.

2. Datasets Used in Core Map Development

2.1. Range

There is no available information about when the range for this species was last updated. A shapefile including species range for all listed species was downloaded from the FWS ECOS website on January 24, 2025. The shapefile was converted to a feature class stored in a file geodatabase and reprojected to WKID #4269 (“North America Albers Equal Area Conic”).

1. Using an ArcGIS Web Map the species was queried based on the ECOS listed “Entity ID” of 734 and exported as a feature class to a temporary file geodatabase as a standalone Entity ID-specific layer.
2. The area of the range was calculated automatically by loading it into the software (ArcGIS Pro version 3.2) and reading its area from the attribute table (“Shape_Area”), then converting its units (square meters) into acres with a conversion rate of 0.000247105.
3. This shapefile was added to an ArcGIS Pro map and compared against the available known locations described in the FWS 5-Year Review, and the available occurrence information from the GBIF, iNaturalist, and NatureServe databases.

2.2. NCDOT ATLAS

Regions of suitable habitat were used to refine the core map based on biological information in North Carolina. The NCDOT completed a project named “ATLAS” in 2021 that categorized land within the range as low, moderate, or high potential habitat ability for species habitat for the Dwarf-flowered heartleaf. Professional judgment was used to exclude areas of Low and Moderate potential habitat, while High suitability were included. Categories of “Low” and “High” for this species are defined as follows:

- Low: Regions and sites where biologists would be very surprised to find this species and its habitat (occurrence here should be extremely rare).
- High: Biologists expect to frequently encounter areas that look like potential habitat based on visible environmental and vegetation community characteristics (Figure 6, NCDOT 2021).

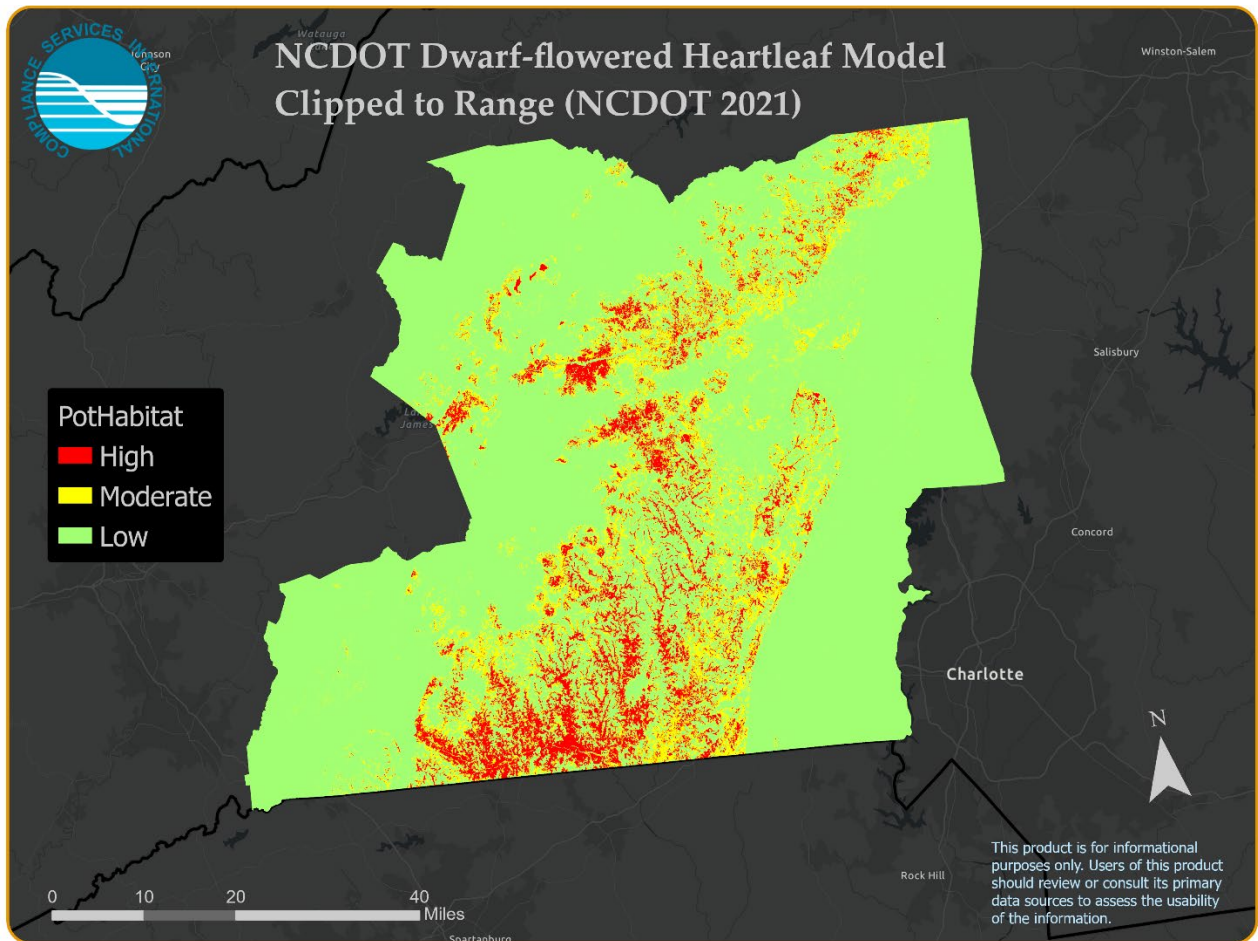


Figure 6. Areas of low, moderate, and high habitat suitability for the Dwarf-flowered heartleaf range in North Carolina (NCDOT 2021).

2.3. Soil Survey Geographic Database (SSURGO)

The NCDOT dataset used to represent areas of high potential habitat does not extend beyond North Carolina. To represent areas of high potential habitat in South Carolina, the description of habitat referenced in **Appendix 1** was used to identify land cover characteristics conducive to Dwarf-flowered heartleaf habitat. In particular, the Draft SSA states that the species “appears to be restricted to Pacolet sandy loam, Madison gravelly sandy loam, and Musella fine sandy loam soils.”

The USGS SSURGO database was used to find areas consistent with this description but queried to include a broader definition of sandy loam soil to be conservative. This approach was examined and validated against the NCDOT high-suitability areas before its incorporation into core map development, as follows:

1. The SSURGO soils layer was clipped to the entire Dwarf-flowered heartleaf species range, using the Pairwise Clip tool.
2. A series of inner joins³ were used to match specific shapes (“mukey”) to texture class. The following tables were joined sequentially:

³ Textures were presumed to represent the surface soil layer. Value filters for “major component” and “representative value” were not considered.

- a. Component (“component”)
 - b. Horizon (“chorizon”)
 - c. Horizon Texture Group (“chtexturegrp”)
 - d. Horizon (“chtexture”)
3. The Pairwise Dissolve tool was used to dissolve the clipped SSURGO layer by texture classification.
 4. The Tabulate Area tool was used to calculate respective areas of texture classifications within a polygon representing the NCDOT high suitability area.

This analysis confirmed that “SANDY_LOAM” is the predominant soil type within high suitability areas (41%)

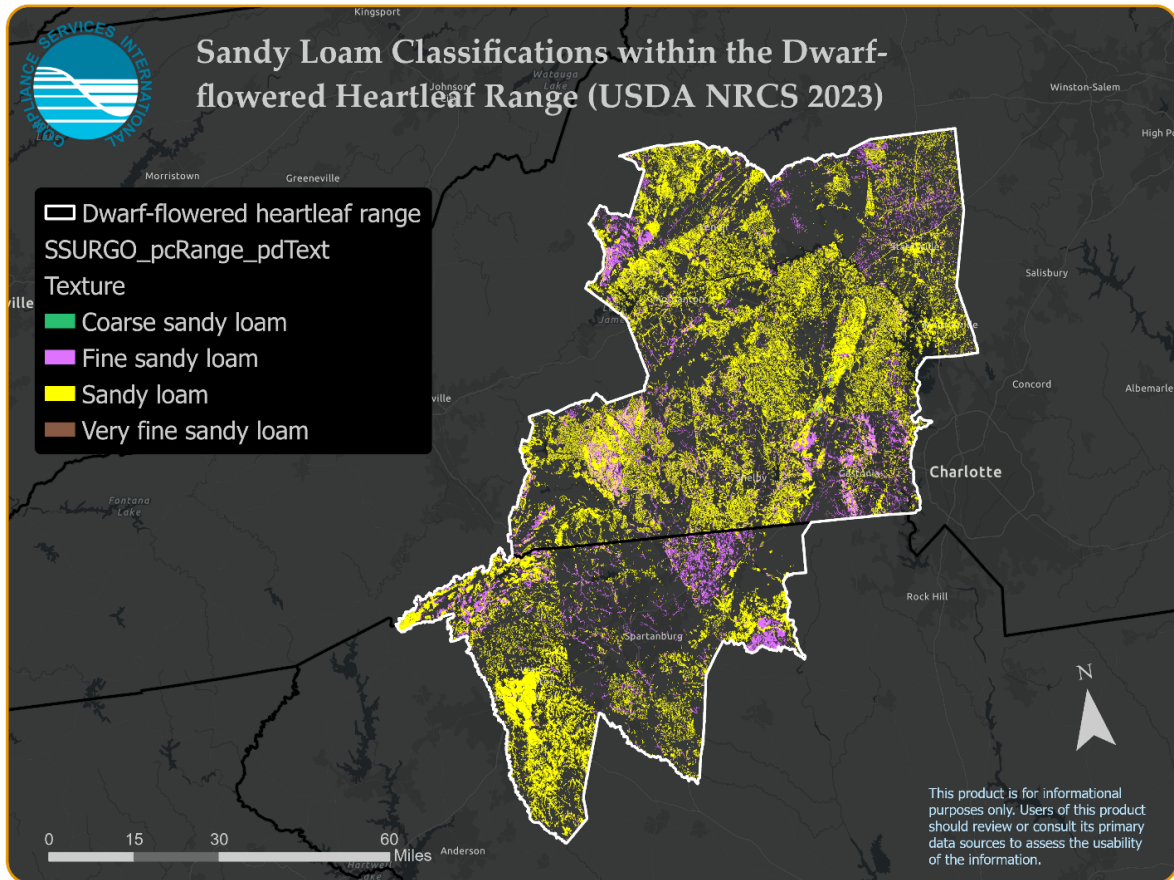


Figure 7. Sandy loam classifications within the Dwarf-flowered Heartleaf range (Natural Resources Conservation Service 2023).

while “SANDY_CLAY_LOAM” and “FINE_SANDY_LOAM” added another 13% and 9%, respectively. The only other classification to represent more than 5% was “CLAY_LOAM” at 19%. It was judged that this was suitable validation for the use of the SSURGO layer to represent Dwarf-flowered heartleaf areas in South Carolina.

2.4. EPA Cultivated Lands Layer

The EPA has developed and published its own cultivated layer for use in core map development as a potential refinement of extent. For the Dwarf-flowered heartleaf, core map extent was refined by this layer using the Pairwise Erase tool to remove significant areas of agriculture because the species habitat is not consistent with cultivated land and is therefore considered by CSI to be an “off-field” species. This removed

only 0.6% of area but is considered a reasonable refinement for core map development for an off-field species.

3. Creating the Core Map

3.1. Habitat-Based Core Map Development

North Carolina

In North Carolina, the core map was developed from biological/habitat information produced by the NCDOT, a species-specific model for the Dwarf-flowered heartleaf. Generally, NCDOT models are produced with an extent of species range, which was the case for this species. The habitat-based core map in North Carolina was developed according to this procedure:

1. Import the species model (“DwarfFloweredHeartleafThreeLevelPotentialHabitat”) and save as a new layer with a projection of WKID #4269 (“NCDOT”).
2. Use the Select by Attributes tool to select features from the previous layer (“NCDOT”) with high potential habitat using this SQL query: PotHabitat = 'High'. Export selected features as a new layer, “NCDOT_sel”.
3. Use the Pairwise Dissolve tool to dissolve the previous layer (“NCDOT_pcRange_sel”) into a single feature; save as a new layer, “NCDOT_sel_pd”.

South Carolina

In South Carolina, the core map was developed from soil texture information contained in the SSURGO database. The habitat-based core map in South Carolina was developed according to this procedure:

1. Use the Pairwise Clip tool to clip the SSURGO polygon layer by species range (“DFH_range”) and save as a new layer “SSURGO_pcRange”.
2. Add an inner join to the SSURGO “Component” table on the “mukey” field in both datasets.
3. Add an inner join to the SSURGO “Chorizon” table on the “cokey” field in both datasets.
4. Add an inner join to the SSURGO “Horizon Texture Group” table on the “chkey” field in both datasets.
5. Add an inner join to the SSURGO “Horizon Texture” table on the “chtgkey” field in both datasets.
6. Use the Select by Attributes tool to select records from the previous layer “SSURGO_pcRange” that correspond to sandy loam soils, using this SQL query: chtexture.texcl IN ('Coarse sandy loam', 'Fine sandy loam', 'Sandy loam', 'Very fine sandy loam'). Export selected features as a new featureclass, “SSURGO_pcRange_SandyLoam”.
7. Use the Pairwise Dissolve tool to dissolve the previous layer (“SSURGO_pcRange_SandyLoam”) into a new layer with a single feature, “SSURGO_pcRange_SandyLoam_pd”.
8. Import a layer of U.S. state boundaries. Use the Select tool to select just South Carolina. This will facilitate the clip used in the next step.
9. Use the Pairwise Clip tool to clip the previous layer (“SSURGO_pcRange_SandyLoam_pd”) by the highlighted South Carolina shape and save as a new layer “SSURGO_pcRange_SandyLoam_pd_pcSC”. Choose to output the feature with WKID #4269.

3.2. Merging Core Map Layers

The layers developed in the previous section for both states interesting the species range were merged

according to this procedure:

1. Use the Merge tool to merge the core map datasets (listed below) into a single layer, named “DFH_habitat.”
 - a. NCDOT_sel_pd
 - b. SSURGO_pcRange_SandyLoam_pd_pcSC
2. Use the Pairwise Dissolve tool to dissolve the previous layer (“DFH_habitat”) into a single feature, named “DFH_habitat_pd.”

3.3. Cultivated Lands-based Refinement

The Dwarf-flowered heartleaf is not expected to be found in agricultural areas, so a refinement to exclude areas of agriculture was applied. Here agricultural areas are represented by EPA’s modified cultivated layer, which includes areas spanning at least 25 acres. This was done as follows:

1. Use the Pairwise Erase tool to exclude cultivated areas > 25 acres according to a layer developed by EPA (“CultivatedAreas_Over25acres”). Save as a new layer (“DFH_habitat_pd_peCultivated25ac”).
2. (Optional) Export previous layer as a new layer identifiable as the species core map (“DFH_CoreMap”).

4. Datasets Considered but Not Used in Core Map Development

4.1. Known Observation Datasets

Datasets such as iNaturalist, GBIF, and NatureServe were considered but not used. NatureServe public EOs are viewable in their mapper as hexagons corresponding to locations where the species may have been observed. The current range of the species encompasses all of the occurrences based on visual inspection. Range was selected as the outer extent and further refined with biological data in North Carolina.

References

Documents

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