Interim Core Map Documentation for the Canby's Dropwort

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

Species Summary

The Canby's dropwort (*Oxypolis canbyi*; Entity ID 976) is an endangered dicotyledonous plant. The U.S. Fish and Wildlife Service (FWS) has not designated a critical habitat for the Canby's dropwort. This species grows in coastal plain habitats, including pond cypress savannas, wet pineland savannas, wet meadows, bays located in the Carolinas, sloughs, and around the edges of cypress-pine ponds. Additional information is provided in **Appendix 1**.

EPA Review Notes

The developers created this core map using the U.S. Environmental Protection Agency's (EPA) 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 the agency'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 the agency's mapping process. This documentation was not prepared by EPA, but EPA may have edited this documentation for clarity or other purposes. This documentation may include views that are not necessarily the view 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 Canby's dropwort is biological information type which consists of a refinement of the species range based on well-defined known location data and excluding areas of cultivated land > 25 acres. The outer extent of the core map is the FWS range, but unique refinements were made for each of the four states in which the species occurs. These refinements are based on spatial datasets created to match textual descriptions of population information in the most recent FWS Five-Year Review (5YR; FWS 2022). Refinements are summarized here, with a full description of their development provided in **Appendix 2**.

- North Carolina: There is a single population located in Big Cypress Meadow. This meadow was identified and a shape manually drawn (using GIS) to capture its full extent. While the species has not been observed here since 2004, the shape was included in the core map to be conservative. It is relatively

small and located in an undeveloped area, so is not expected to meaningfully impact pesticide registration decisions.

- South Carolina: Three of six extant populations were identified and manually drawn (using GIS) to capture their full extent. The remaining three extant populations are represented by NatureServe public element occurrences clipped to the respective county known to contain that population.
- Georgia: The Georgia Department of Natural Resources (GDNR) maintains quadrants that are relatively precise compared to NatureServe public element occurrences. These were queried for observations occurring within the past 25 years and exported.
- Maryland: In Maryland, the shape representing species range was used, unmodified.

The core map developed in this document for the Canby's dropwort spans 669,142 acres (**Figure 1**). A summary of acreage by National Landcover Database (NLCD) land use type is provided in **Table 1**.

Based on EPA's "best professional judgment classification" system, this core map is graded as "average" (3) because it largely comprises well-defined boundaries that can be identified based on textual descriptions of habitat from trusted USFWS documents. More information about this classification system and its definitions can be found in the core map process document (EPA 2024).

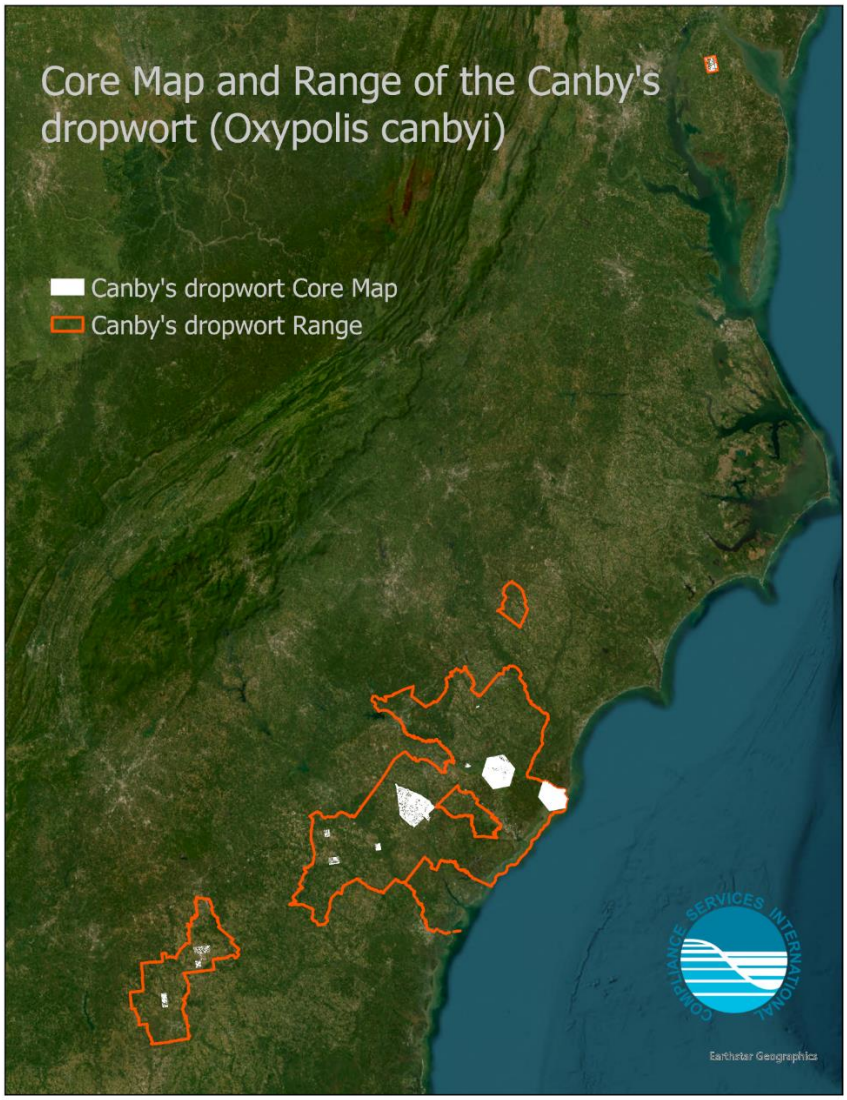

Figure 1. Interim core map for the Canby's dropwort in comparison to range (orange, FWS 2024).

NLCD_Land_Cover_Class	Acres
Woody Wetlands	233,784
Evergreen Forest	140,341
Open Water	104,859
Emergent Herbaceous Wetlands	47,413
Cultivated Crops	37,300
Shrub/Scrub	26,194
Developed, Open Space	21,881
Herbaceous	17,498
Deciduous Forest	13,506
Hay/Pasture	9,994
Developed, Low Intensity	8,510
Mixed Forest	3,777
Developed, Medium Intensity	2,473
Barren Land	878
Developed, High Intensity	796

Table 1. Acres by National Land cover Database (NLCD) class within the core map of the Canby's dropwort. Total core map area (based on NLCD pixel count): 669,204 acres[1].

Evaluation of Known Location Information

There are four datasets with spatially delineated known location information:

- iNaturalist;
- Global Biodiversity Information Facility (GBIF);
- NatureServe (Explorer, public version); and
- Georgia Department of Natural Resources

However, valuable textual descriptions of known location data in FWS documents contributed to the spatial delineation in some other areas where the species occurs, and as a refinement on the spatial datasets above that contributed to the core map.

Compliance Services International (CSI) evaluated these datasets before developing the core map. Overall, there were 13 research grade observations found in iNaturalist[2]. These 13 locations were generally consistent with (but sparser than) other datasets in Maryland and South Carolina. The iNaturalist observations did not capture populations in North Carolina or Georgia. These iNaturalist observations additionally constituted the full extent of usable observation data in GBIF. **Appendices 1 and 2** include more information on the available known location information.

[1] This acreage is slightly different from the core map acreage (669,142) due to the pixelation of NLCD land cover. The core map is not a raster dataset.

[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-).

Observation data from GDNR were limited to populations in Georgia but found to be of good quality and reasonably precise. These were juxtaposed against NatureServe public element occurrences and found to be somewhat more accurate. The NatureServe dataset was used in other states as a refinement of species extent from its range.

Finally, textual descriptions by FWS of known areas of extant occupancy were spatially delineated by CSI. Details on this process are provided in **Appendix 2**.

Approach Used to Create Core Map

The core map was developed using the process EPA uses to develop core maps for draft Pesticide Use Limitation Areas for species listed by the FWS and their designated critical habitats[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: Designated Critical Habitat, 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 the Canby's dropwort from FWS, as well as observation information available from various publicly available sources (including iNaturalist, GBIF, NatureServe, and GDNR). The information compiled for the Canby's dropwort is included in **Appendix 1**.

For step 2, CSI used the compiled information including the species range, known location, and habitat location information to determine the core map type. CSI compared the known location data to the range and found that known locations were not only consistent with the range, but usable as an improved extent for the core map development process. Review of the available data also suggested that the species is likely located in smaller areas within the extent that was based on known observations because the species has specific habitat requirements that are not located everywhere within the extent of known observations. When weighing that information together, CSI selected the core map type of 'biological information'. The core map was developed using known location areas within this space. CSI did not use habitat information 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 the process document. For this interim core map, CSI identified known location areas that were refined from species range (except in Maryland, where the shape for range was used). That extent was established using state-level datasets from Georgia and textual descriptions of population information in other states. **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

CSI considered applying a habitat or landcover-based refinement to develop the interim core map. In North Carolina, this would have been done using a species-specific habitat model developed for the Canby's dropwort by the North Carolina Department of Transportation (NCDOT), created under what is termed the "ATLAS" Project. Elsewhere, the landcover refinement would have been done using LANDFIRE classes cross-

walked to descriptions of habitat for this species. Ultimately, CSI determined that the core map was sufficiently refined as-is, and that further refinements based on habitat may risk increasing uncertainty in the accuracy of spatial areas depicted. Use of the NCDOT dataset would not have significantly changed the core map's extent or area.

Appendix 1. Information compiled for the Canby's dropwort

1. **Recent FWS documents**
   - 5 Year Review (2015) https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2269.pdf.
   - 5 Year Review (2022) https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3631.pdf.
   - Recovery Plan (1990) https://ecos.fws.gov/docs/recovery_plan/900410.pdf.

2. **Background information**

- Status: Federally listed as threatened in 1986.
- Resiliency, redundancy, and representation (the 3Rs)
    - The 3 Rs were not specifically described in the species recovery plan or most recent 5-year review for this species and there is no species status assessment.
- Habitat, Life History, and Ecology
    - Wetlands species
    - Habitat: "grows in Coastal Plain habitats including pond cypress savannas, wet pineland savannas, wet meadows, Carolina bays, sloughs, and around the edges of cypress-pine ponds" (5 Year Review, 2015).
    - "Soil profiles at most of the 23 study sites included loams with some organic matter in the topsoil and sandy gravels and clays in the subsoil. However, seven sites had clay soil with no topsoil, organic matter, or loam in their profiles. Most sites had an A horizon of a few to 15 cm deep, followed by a B layer of sandy, gravelly clay, followed by a grayish-white clay hardpan. The clay hardpan was usually located at a depth of 20-30 cm. Soils represented at the 23 sites included Grady loam (six sites), Coxville fine sand, (four sites), Seagate fine sand (two sites), Rembert sandy loam (two sites), and Pantego loam (two sites)" (5-year review 2015).
    - Pollinators: There is no information on pollinators of this species.
- Taxonomy
    - Wetland plant – *Oxypolis canbyi* was originally described as a variety of the more common *O. filiformis* (Coulter and Rose 1990). Fernald (1939) later elevated the taxon to a full species based on differences in leaf and fruit characters.
- Relevant Potential Pesticide Use Sites
    - The Crosby and Longleaf Heritage Preserves are managed by the South Carolina Department of Natural Resources. It is unclear whether pesticides are used to manage these areas (5 Year Review, 2022).

- "Because of the proximity of many of the extant *O. canbyi* populations to power line and highway rights-of-way, agricultural fields, and pine plantations, there is a possibility for damage of plants from off-target herbicide drift. No Instances of this have yet been documented, but the potential cannot be ignored, particularly where aerial application is involved" (Recovery Plan, 1990).

- Relevant Recovery Criteria and Actions
  - 5-Year Review (2022) – Delisting Criteria (all criteria must be met)
    - *It has been documented that at least 14 of the currently extant populations are self-sustaining and that necessary management actions have been undertaken by the landowners or cooperating agencies to ensure their continued survival.*

      There are eleven extant Canby's dropwort populations that meet the protected and managed recovery criterion. Whether these populations are self-sustaining is questionable. A self-sustaining Canby's dropwort population, determined by species experts, would 4 contain at least 1,000 stems for five or more years (Jeff Glitzenstein and Lisa Kruse, pers. comm., 2021). To date, there are four Canby's dropwort populations out of the original 14 from the 1994 Recovery Plan that meet the recovery criteria of self-sustaining and protected: Pristine Pine Preserve (MD), Lisa Mathews Memorial Bay (SC), and Big Dukes Pond and Woodward (GA).

    - *Through reintroduction, rehabilitation, and/or discovery of new populations, five additional self-sustaining populations exist within the species' historical range.*

      This criterion has been partially met. One new Canby's dropwort population (Oakland Plantation in Berkeley County, SC) was found in 2018, and one new Canby's dropwort population was introduced (Brubaker Farm in Berkeley County, SC). Efforts are underway to reintroduce the Canby's dropwort at the Big Cypress Meadow, NC.

    - *All 19 populations and their habitat are protected from present and foreseeable human-related and natural threats that may interfere with the survival of any of the populations.*

      There are eleven populations (five in South Carolina, five in Georgia, and one in Maryland) that are currently protected and managed to some degree by landowners or cooperating agencies. This is an increase of three populations from the 2015 5-year review. Several of these populations are not self-sustaining due to lack of management or hydrological degradation. This criterion has been partially met.

3. Range

- Size: 10,588,698 acres.
- Description: "Historically, Canby's Dropwort occurred in Delaware, Maryland, North and South Carolina, and Georgia. Today, Canby's Dropwort only occurs in three

states: Maryland, South Carolina, and Georgia. Further, Canby's range within these states has been reduced greatly over time with Canby's Dropwort being extirpated from 11 counties since the time it was listed" (5 Year Review, 2022).

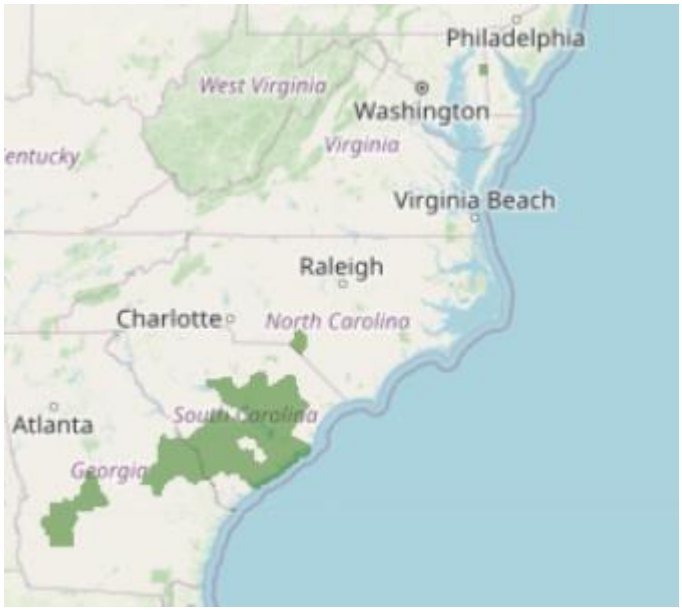

Figure 2. FWS Range from ECOS last updated 9/13/2023 (https://ecos.fws.gov/ecp/species/7738).

4. Description of Critical Habitat

This species does not have critical habitat**.**

5. Known Locations

- Known locations summarized in 2022 5-year review.
    - There is one remaining disjunct population in the northeast, located in Queen Anne's County, Maryland, the remaining extant Canby's dropwort populations occur in the Southeast in South Carolina and Georgia.
    - Delaware: In the 1990 Recovery Plan, there was one reported extirpated population from Sussex County. There is not much information on this population.
    - Maryland: Pristine Pine's Preserve located in Queen Anne's County, contains a stable to increasing Canby's population. As a protected and well-managed The Nature Conservancy (TNC) site, this Canby's population counts towards the recovery of the species. This site is fire maintained and management with prescribed fire in years 2015 and 2017 resulted in a population boom, with numbers going from 121 stems in 2015 to 3805 stems in 2020 (Deborah Landau, pers. comm., 2021).
    - North Carolina: A historic Canby's population occurs at Big Cypress Meadow located in Scotland County. This population was last seen 2004 with two stems reported. The population gradually decreased: 1980: 10,000 plants; 1986: 10,000 plants; 1987: 2000-3000 plants; 1992: 100+ plants seen; 2004: two stems reported (North Carolina Heritage Program, 2020). Lack of fire and management likely caused the population decline.
    - South Carolina: There are 31 historic Canby's dropwort populations in SC. To

date, six of these are extant (**Table 1**). Five are protected (Crosby Heritage Preserve (HP), Longleaf HP, Oakland Plantation, Lisa Mathews Memorial Bay, and Brubaker Farm) and one is not protected (Monkey Bay). The Oakland Plantation population is a newly discovered stable, protected population (**Table 1**). The Brubaker Canby's dropwort population is a newly introduced population to a wetland area in Charleston County that is managed with fire. Three Canby's dropwort populations meet recovery objectives, stable, managed, and protected: Lisa Mathews Memorial Bay, Oakland Plantation, and Longleaf Heritage Preserve. All three of these recovery populations are managed with fire.

- Georgia: There are nine Canby's dropwort populations in Georgia that no longer occur: two are extirpated, three have a historic status, and four have a failed to find status (Lisa Kruse, pers. comm. and unpublished data, 2021). To date, 12 Canby's dropwort populations occur in Georgia (**Table 2**). Five populations are protected and four of these populations appear stable to increasing with 200 to 10,000 individuals (**Table 2**). Seven Canby's populations remain unprotected, and the majority contain 100-200 individuals. Known locations described in FWS' 2022 5-Year Review. The following is information for extant populations and/or EOs that are protected or partially protected.
    - Georgia: **Table 2** (below) lists 12 extant populations in Georgia. Five of these populations are protected and named in the Table.
    - Maryland: "Pristine Pine's Preserve located in Queen Anne's County, contains a stable to increasing Canby's population". The Nature Conservancy (TNC) manages this site.
    - South Carolina: **Table 1** (below) lists six extant populations in South Carolina. Five of these populations are protected and named in the Table.

The following figures and tables (**Figure A1-2** and **Tables 1 and 2**) were taken from FWS documents that illustrate and elaborate on occurrence data described in those documents.

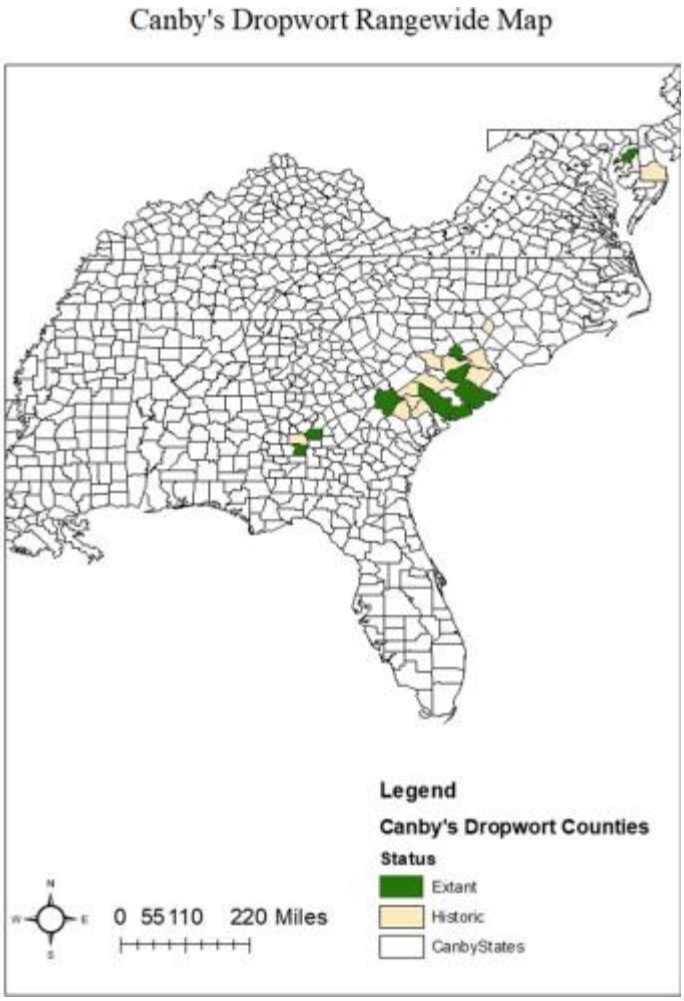

Figure 3. The range-wide distribution of the Canby's dropwort (Oxypolis canbyi). Copied from Figure A1-2 in FWS source document.

- There is one remaining disjunct population in the northeast, located in Queen Anne's County, Maryland, the remaining extant Canby's dropwort populations occur in the Southeast in South Carolina and Georgia.

Population Name	County	Protected Yes/No*	Managed	Number of Individuals**
Lisa Mathews Memorial Bay	Bamberg	Yes, SCNPS	Yes	10,000
Oakland Plantation	Berkeley	Yes, CE	Yes	5,000+
Brubaker Farm	Charleston	Yes, CE	Yes	100-200
Monkey Bay	Clarendon	No	No	50
Crosby HP	Colleton	Yes, SCDNR	No	500-750
Longleaf HP	Lee	Yes, SCDNR	Yes	100-200

*Agencies responsible for protected sites SCNP S= South Carolina Native Plant Society; CE = private landowner with a conservation easement, and SCDNR= South Carolina Department of Natural Resources.
**Number of individuals includes a mix of estimates of number of individuals and stem counts.

Table 2. Extant Canby's dropwort populations in South Carolina. Copied from Table 1 in FWS source document.

Population Name	County	Protected Yes/No	Managed	Number of Individuals
Big Dukes Pond Wildlife Management Area	Jenkins	Yes, GADNR, CE	Yes	>1,000
Woodward Canby's Dropwort Preserve	Dooly	Yes, CE	Yes	>10,000
Neyami Savanna, GA Department of Transportation	Lee	Yes, CE	Yes	<1,000
Perrin Pond	Burke	No	No	150-200
Layfield Pond	Dooly	No	No	10-100
Black Pond, Wetland Reserve Easement	Jenkins	Yes, CE	Yes	10-100
Forrester Flats	Lee	No	Unknown	100-200
Oakbin Pond, TNC	Dooly	Yes, TNC CE	Yes	200
Roadside Park	Lee	No	Yes	<100
West Daniel Pond	Burke	No	No	4
Greater Unadilla Pond	Dooly	No	No	10-100
Harmony Church Pond	Dooly	No	Unknown	10-20

*Agencies responsible for protected sites CE = private landowner with a conservation easement, GADNR = Georgia Department of Natural Resources, and TNC = The Nature Conservancy.

Table 3. Extant Canby's dropwort populations in Georgia. Copied from Table 2 in FWS source document.

State	County	Populations 1990	Populations 2006	Populations 2014	Populations 2021
MD	Queen Anne's	1	1	1(1)	1(1)
NC	Scotland	1	1	0	0
SC	Allendale	1	3	0	0
SC	Bamberg	1	2	2(2)	1(1)
SC	Barnwell	2	0	0	0
SC	Berkeley	1	0	0	1(1)
SC	Charleston	0	1	1(1)	1(1)
SC	Clarendon	4	1	0	0
SC	Colleton	1	1	1(1)	1(1)
SC	Florence	0	0	0	0
SC	Hampton	1	0	0	0
SC	Lee	1	0	1(1)	1(1)
SC	Orangeburg	1	0	0	0
SC	Richland	1	0	0	0
SC	Sumter	0	0	0	0
SC	Williamsburg	1	0	0	0
GA	Burke	0	2	2(0)	2(0)
GA	Dooly	4	5	5(1)	5(2)
GA	Jenkins	0	3	2(2)	2(2)
GA	Lee	4	4	4(2)	3(1)
GA	Screven	0	4	0	0
Total		**25**	**8**	**18(11)**	**18(11)**

Table 4. Cumulative number of extant Canby's dropwort populations in 1990, 2006, 2014, and 2021. The number of protected populations in parentheses. Copied from Table 3 in FWS source document.

- FWS Five-Year Review (2022) Textual Descriptions
    - Maryland
        - Pristine Pine's Preserve in Queen Anne's, MD

Figure 4. Spatial delineation of Pristine Pine's Preserve in Queen Anne's, MD. The preserve was not identified, so is represented by this portion of the Canby's dropwort range.

    - North Carolina
        - Big Cypress Meadow in Scotland, MD

Figure 5. Big Cypress Meadow in Scotland County, NC.

- South Carolina
    - Crosby HP in Colleton, SC
    - Longleaf HP in Lee, SC
    - Monkey Bay in Clarendon, SC
    - Brubaker Farm in Charleston, SC
    - Lisa Matthews Memorial Bay in Bamber, SC
    - Oakland Plantation in Berkeley, SC

Figure 6. Spatial delineations of the 6 extant populations in South Carolina. Top row (left-right): Crosby HP, Longleaf HP, Monkey Bay. Bottom row: Brubaker Farm, Lisa Matthews Memorial Bay, Oakland Plantation.

- Georgia Department of Natural Resources: https://georgiabiodiversity.org/portal/profile?group=all&es_id=17526

    - Species extent for the Canby's dropwort in Georgia is represented by county, quarter quads, HUC8 and HUC10 watersheds, Level 3 and 4 Ecoregions, and 24-km hexagon grids. The quarter quads are the most precise (smallest area), and these were exported for this species. There were 19 of these shapes, 11 of which were recent (within the last 25 years).

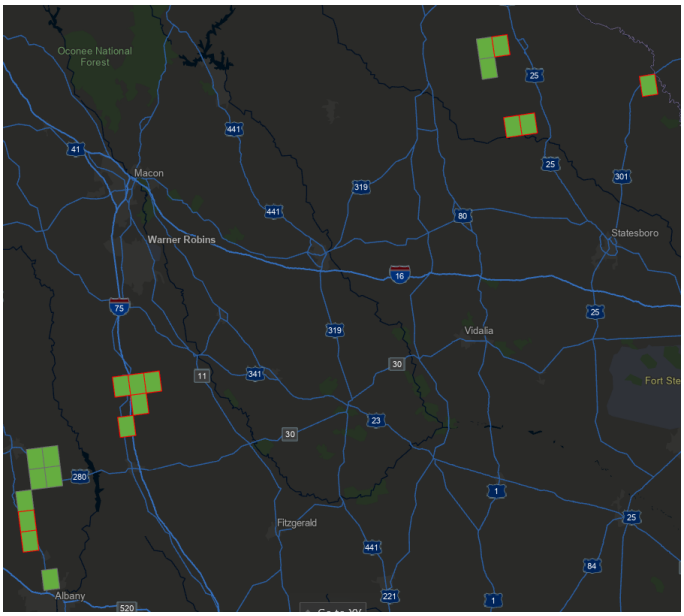

Figure 7. GDNR quarter quads for the Canby's dropwort (green). Recent quarter quads (within 25 years) outlined in red.

- GBIF: https://https://www.gbif.org/species/3034750
  - GBIF includes 165 records, five of which had usable coordinate data based on latitude/longitude precision (3+ decimal places) and relative recency (2010-present).

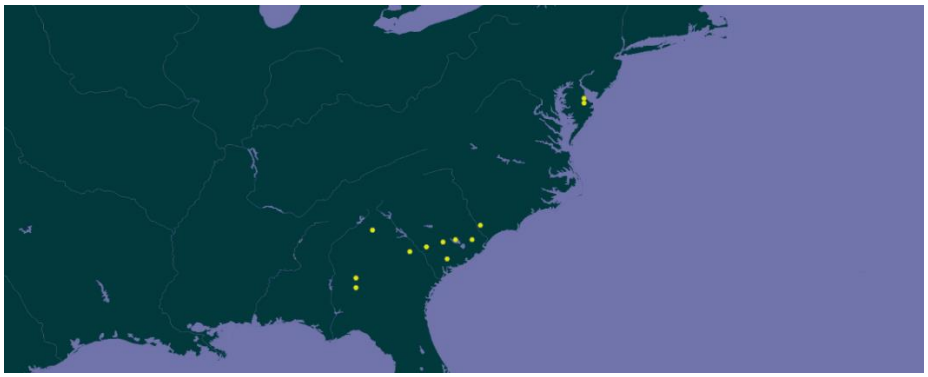

Figure 8. GBIF occurrences for the Canby's dropwort.

- iNaturalist: https://www.inaturalist.org/observations?verifiable=true&taxon_id=1021133.
  - 13 research grade observations with coordinates, all dated since October 2014, see map below (**Figure 9**).
  - These locations align with the FWS documentation of known populations in Maryland and South Carolina.
  - There are no occurrences for the Canby's dropwort outside of Maryland and South Carolina, despite range in North Carolina and Georgia.

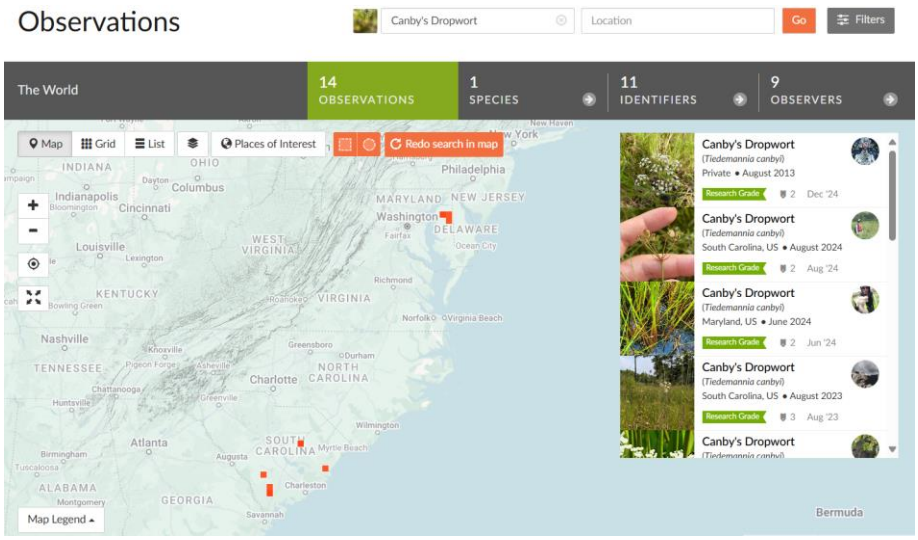

Figure 9. iNaturalist observations for the Canby's dropwort (iNaturalist 2025).

- NatureServe

    - CSI requested and received from NatureServe a feature layer that included 343 mi^2 hexagons viewable in the public version of the Explorer mapper (NatureServe, 2025b). These were examined relative to range and iNaturalist occurrences. NatureServe public hexagons were used as a modest refinement of species extent in South Carolina only. NatureServe notes that "If ground-disturbing activities are proposed on a site, the appropriate NatureServe Network Program should be contacted for a site-specific review of the project area. For contact information, go to the NatureServe Network Directory at: https://www.natureserve.org/ns-network-directory."

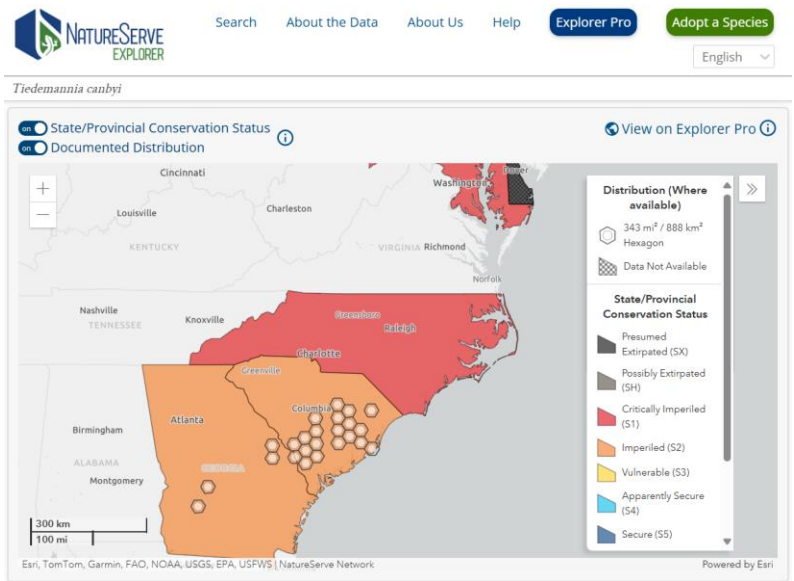

Figure 10. NatureServe Explorer occurrences for the Canby's dropwort (NatureServe 2025a).

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

The core map for this species is based on range, with extent limited to areas of occupancy of known extant populations as of 2021 (FWS 2022). The core map identifies all areas within the extent (described below), further refined to exclude areas of cultivated land > 25 acres (EPA 2025).

1. References and Software

- Georgia Department of Natural Resources (GDNR) Biodiversity Portal: https://georgiabiodiversity.org/portal/rangemaps?es_id=17526.
- NatureServe Explorer: https://explorer.natureserve.org/.
- North Carolina Department of Transportation (DOT) ATLAS Project: https://services.arcgis.com/NuWFvHYDMVmmxMeM/ArcGIS/rest/services/Canbys_Dropwort_Potential_Habitat/FeatureServer/0.
- Software used: ArcGIS Pro version 3.2.
- EPA Modified Cultivated Layer: https://cdn.arcgis.com/home/item.html?id=159e70ce4c284f5b972c687037f8a668.
- FWS Species Range: https://www.fws.gov/species/canbys-dropwort-oxypolis-canbyi.

2. Datasets Used in Core Map Development

2.1. Range

The range for this species was last updated on September 13, 2023. 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 976 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 (5YR), and the available occurrence information from iNaturalist, GBIF, and GDNR databases.

2.2. GDNR Biodiversity Portal

The GDNR Biodiversity Portal includes a mapping tool that was used to query and download known location information for the Canby's dropwort. A shapefile of the most detailed dataset available, "Quarter Quads," was exported to a file geodatabase and queried for recent observations according to the procedure detailed in Section 3. The resulting shapes were ultimately used to represent the extent of the core map of the Canby's dropwort in Georgia.

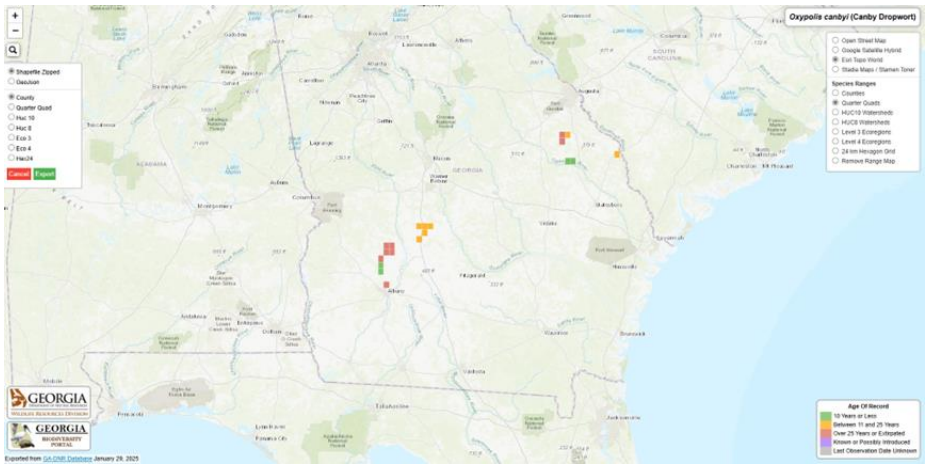

Figure 11. Quarter Quads of the Canby's dropwort (GDNR 2025).

2.3. NatureServe Explorer

NatureServe Explorer was used to identify the spatial relationship between public EOs and the range of the Canby's dropwort. These were compared with other known occurrence data from GBIF/iNaturalist, and the known populations in Maryland, North Carolina, South Carolina, and Georgia identified by FWS in the 5YR document. Element occurrence data were used to refine the core map extent in places where textual descriptions could not be identified or matched to spatial data, and where EOs existed (this occurred in South Carolina only). EOs were georeferenced and made into usable spatial data according to the procedure detailed in Section 3.

In Georgia, public element occurrences for the Canby's dropwort are in proximity to the recent (within the last 25 years) "quarter quads" from the GDNR[3]. The EOs were georeferenced and adopted into the extent of the Canby's dropwort. The GDNR quarter quads were slightly more precise than EOs; therefore, the GDNR data were used for core map development.

3. Creating the Core Map

<u>Defining Extent</u>

The extent for the Canby's dropwort was created according to four distinct processes, one for each state the species range overlaps. In Maryland, the extent is the same as range because the lone extant population occurs at *Pristine Pine Reserve*, which could not be readily identified (and there were no NatureServe EOs in this state). In North Carolina, the extent was determined by manually delineating the only known extant population. The extent in South Carolina was created by manually delineating known extant populations, where possible, and incorporating NatureServe EOs and county information where necessary. The extent in Georgia is the GDNR quarter quads dated from the last 25 years.

1. Maryland
    1.1. Manually create a temporary polygon (to be later discarded) that completely contains the extent of

[3] In the context of the Georgia Biodiversity index range maps, quarter quads refer to subdivisions of the standard US Geological Survey (USGS) quadrangle maps. Each quadrangle map, commonly known as a "quad," covers a specific area of land. A quarter quad divides this area into four smaller sections.

range occurring in Maryland.

1.1.1. Use the Pairwise Clip tool to clip the range ("CD") by the manually-created polygon from the previous step, saved to a file geodatabase as "Maryland."

2. North Carolina
   2.1. Manually delineate a polygon around the area known to be *Big Cypress Meadow*. Save to a file geodatabase as "North Carolina."

3. South Carolina
   3.1. Crosby HP
      3.1.1. Manually delineate a polygon around the area known to be the *Crosby HP*. Save to a file geodatabase as "Crosby."
   3.2. Longleaf HP
      3.2.1. Manually delineate a polygon around the area known to be the *Longleaf HP*. Save to a file geodatabase as "Longleaf."
   3.3. Monkey Bay
      3.3.1. Identify *Monkey Bay* in geospatial imagery.
      3.3.2. Load the PADUS 3.0 dataset into ArcGIS Pro and select all shapes in the general vicinity of *Monkey Bay*. Use the Pairwise Dissolve tool to dissolve into a single shape, saved to a file geodatabase as "Monkey Bay."
   3.4. Lisa Matthews Memorial Bay (LMMB)
      3.4.1. LMMB was not readily identifiable in the literature but is noted in FWS documents to occur in Bamberg County. The entire county falls within the extent of NatureServe public EOs, so the county was the most refined dataset available to represent the LMMB.
      3.4.2. Load a counties layer and select for Bamberg, NC. Export layer to a file geodatabase as "LMMB."
   3.5. Oakland Plantation
      3.5.1. *Oakland Plantation* was not readily identifiable in the literature but is noted in FWS documents to occur in Berkeley County.
      3.5.2. Load a subset of public EOs received from NatureServe for the Canby's dropwort. Use the Select by Attributes tool to select EOs that are neither historical (EO_rank_cd IN ('H','H?','X','X?')) nor older than 2010.
      3.5.3. Use the Select tool to select just Berkeley county from a layer of county boundaries. Export selected feature as a temporary standalone layer.
      3.5.4. Use the Select by Location tool to select only EOs that are current and intersecting Berkeley county and save as a new layer named "Oakland".
   3.6. Brubaker Farm
      3.6.1. *Brubaker Farm* was not readily identifiable in the literature but is noted in FWS documents to occur in Charleston County.
      3.6.2. Load a subset of public EOs received from NatureServe for the Canby's dropwort. Use the Select by Attributes tool to select EOs that are neither historical (EO_rank_cd IN ('H','H?','X','X?')) nor older than 2000.
      3.6.3. Use the Select tool to select just Charleston county from a layer of county boundaries. Export selected feature as a temporary standalone layer.
      3.6.4. Use the Select by Location tool to select only EOs that are current and intersecting Charleston county and save as a new layer named "Brubaker".

4. Georgia

4.1. Download the quarter quads as a shapefile and export as a feature class in a file geodatabase ("GDNR_quarter_quads").
4.2. Use a SQL query to select only recent quads: age_text2 IN ('10 Years or Less', 'Between 11 and 25 Years'). Export selected quads as a new feature class ("GDNR_quarter_quads_recent").

The four state-level layers representing the Canby's dropwort extent were then merged using the "Merge" tool as a temporary layer. The Pairwise Dissolve tool was used to dissolve the merged layer into a single shape, saved as "CD_CoreMap_extent_pd." Finally, the previous layer was clipped to the species range ("CD") and saved as a new layer "CD_CoreMap_extent_pd_pcRange".

Refinement based on Cultivated Lands

The species is not considered to be "on-field." That is, it is unlikely the species would be found in agricultural fields and its natural habitat does not account for this land use type. To account for off-field species like the Canby's dropwort, EPA developed and published its own cultivated layer for use in core map development as a potential refinement of extent. CSI applied this refinement by using the Pairwise Erase tool on the species extent "CD_CoreMap_extent" to remove cultivated lands from the interim core map and exporting to a file geodatabase as a finalized core map layer ("CD_CoreMap"). The core map spans 669,142 acres.

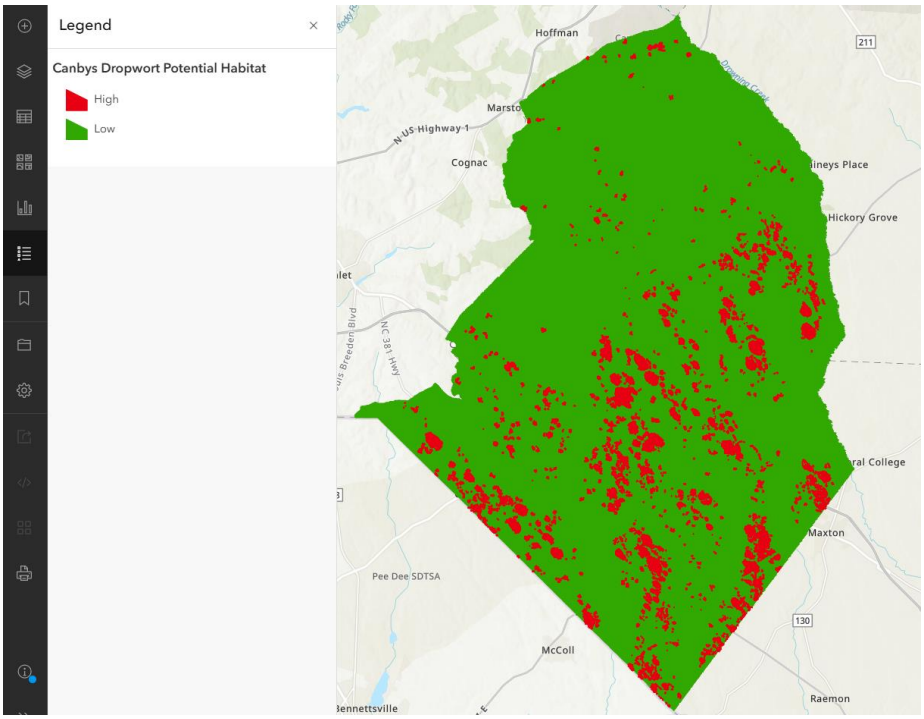

Figure 12. Areas of high habitat suitability (red) for the Canby's dropwort in North Carolina. Full extent of the graphic is Scotland County, NC (NCDOT 2021).

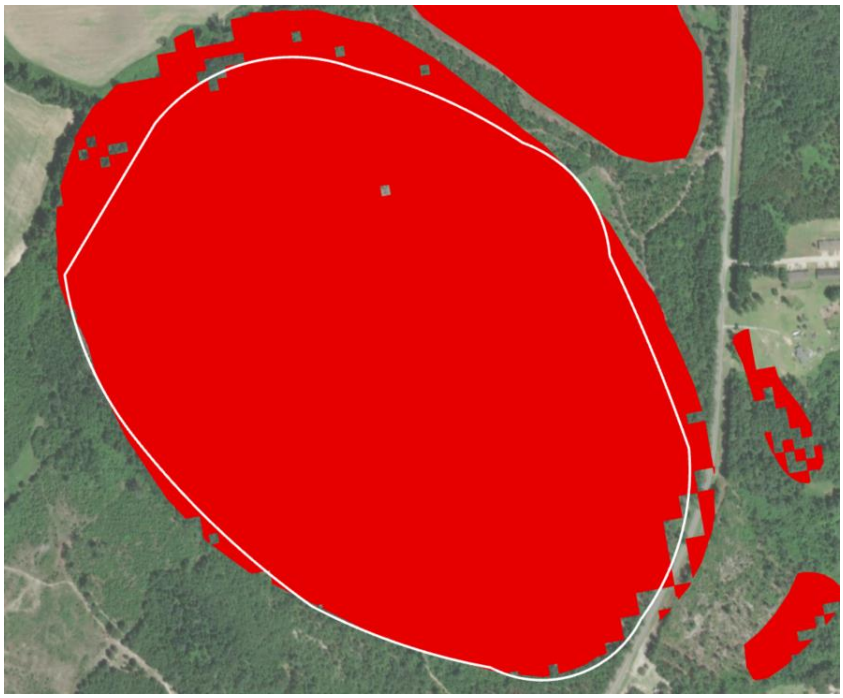

Figure 13. Big Cypress Meadow core map extent (white) in comparison to suitable ("high" probability) habitat model areas (red, NCDOT ATLAS project 2021).

References

Documents

- U.S. Environmental Protection Agency. Process EPA Uses to Develop Core Maps for Pesticide Use Limitation Areas. Accessed March 1, 2025. https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas.
- U.S. Fish and Wildlife Service. 1990. *Recovery Plan for Canby's Dropwort (*Oxypolis canbyi). Southeast Region U.S. Fish and Wildlife Service; Atlanta, Georgia. https://ecos.fws.gov/docs/recovery_plan/900410.pdf.
- U.S. Fish and Wildlife Service. 2015. *Canby's Dropwort (Oxypolis canbyi) 5-Year Review: Summary and Evaluation*. Charleston, SC: South Carolina Ecological Services Field Office. https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2269.pdf
- U.S. Fish and Wildlife Service. 2022. *Canby's Dropwort (Oxypolis canbyi) 5-Year Review: Summary and Evaluation*. Charleston, SC: South Carolina Ecological Services Field Office. https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3631.pdf.

Spatial Data & Software

- GBIF Secretariat. "*Oxypolis canbyi* (Canby's Dropwort)." *GBIF Backbone Taxonomy*. Accessed March 31, 2025. https://www.gbif.org/species/3034750.
- Georgia Department of Natural Resources. 2025. "Range Maps: Canby Dropwort." *Georgia Biodiversity Portal*. Accessed March 31, 2025. https://georgiabiodiversity.org/portal/rangemaps?es_id=17526.
- iNaturalist. "Canby's Dropwort (*Oxypolis canbyi*)." Accessed March 31, 2025. https://www.inaturalist.org/observations?verifiable=true&taxon_id=1021133.
- NatureServe. 2025a. NatureServe Network Biodiversity Location Data accessed through NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available https://explorer.natureserve.org/. (Accessed: April 22, 2025).
- NatureServe. 2025b. NatureServe Network Biodiversity Location Data. NatureServe, Arlington, Virginia. NatureServe. 2025.
- North Carolina Department of Transportation. 2020. "Canby's Dropwort - Potential Habitat." ATLAS Project. Accessed March 31, 2025. https://xfer.services.ncdot.gov/gisdot/AtlasData/AtlasSpeciesModels/ATLASPlantMachineLearningModels/.
- Software used: ArcGIS Pro version 3.2.
- U.S. Environmental Protection Agency. 2025. Modified Cultivated Layer. Accessed April 1, 2025. https://cdn.arcgis.com/home/item.html?id=159e70ce4c284f5b972c687037f8a668.
- U.S. Fish and Wildlife Service. 2025. "Canby's Dropwort (*Oxypolis canbyi*)." Environmental Conservation Online System (ECOS). Accessed March 31, 2025: https://ecos.fws.gov/ecp/species/7738.