

**Canby's Dropwort
(*Oxypolis canbyi*)**

**5-Year Review:
Summary and Evaluation**



Canby's dropwort and yellow pitcher-plants at Crosby Oxypolis Heritage Preserve.

**U.S. Fish and Wildlife Service
Southeast Region
South Carolina Ecological Services Field Office
Charleston, South Carolina**

5-YEAR REVIEW

Canby's dropwort (*Oxypolis canbyi*)

I. GENERAL INFORMATION

A. Methodology used to complete the review: In conducting this 5-year review, we relied on available information pertaining to historic and current distributions, life histories, and habitats of this species. Our sources include the final rule listing this species under the Endangered Species Act (ESA); peer reviewed scientific publications; unpublished field observations by the U.S. Fish and Wildlife Service (Service), State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts. A *Federal Register* notice announcing the initiation of this review and requesting information was published on March 25, 2014 (79 FR 16366), and a 60-day comment period was opened. Comments and suggestions regarding the review were received from botanical experts from Service field offices and State agencies within the known range. Comments received were evaluated and addressed, as appropriate (see Appendix A).

B. Reviewers

Lead Region - Southeast Region: Kelly Bibb, 404-679-7132

Lead Field Office – South Carolina Ecological Services Field Office, Charleston, SC, Jason Ayers, 843-727-4707, extension 220.

Cooperating Office(s) - Athens, GA, Ecological Services, Pete Patavinna, 706-613-9493, extension 236; Raleigh, NC, Ecological Services, Dale Suiter 919-856-4520 extension 18.

C. Background

- 1. Federal Register Notice citation announcing initiation of this review:** March 25, 2014, 79 FR 16366.
- 2. Species status:** In 2015, we determined that the status of the species is unknown. Surveys conducted for Canby's dropwort since the 2010 5-year review vary from State to State. The Maryland population has been surveyed every year since 2006. Most populations in Georgia have been surveyed at least once since 2009. The North Carolina population and most of the South Carolina populations have not been surveyed in recent years. Of those populations surveyed, the stability and viability of individual populations seems dependent upon habitat conditions. However, given the insufficient survey data, particularly in South Carolina, it is difficult to surmise an overall status of the species.

3. **Recovery achieved:** 2 (26-50% recovery objectives achieved)
4. **Listing history**
Original Listing
Federal Register Notice: 51 FR 6690
 Date listed: February 25, 1986
 Entity listed: Species
 Classification: Endangered
5. **Review History:** Recovery Data Call 2010 - 2015
 Recovery Plan – 1990

 5-year review November 6, 1991 (56 FR 56882) - In this review, different species were simultaneously evaluated with no in-depth assessment of the five factors, threats, etc., as they pertained to the different species' recovery. In particular, no changes in status were proposed for this plant.

 5-year review September 13, 2010 (71 FR 42871) – The 2010 5-year review determined that the status of the species was unknown and that routine monitoring of populations was needed to assess populations trends. No changes were proposed for the classification of this species.
6. **Species' Recovery Priority Number at start of review (48 FR 43098):**
 5. This number indicates Canby's dropwort has a high degree of threat and low recovery potential.
7. **Recovery Plan:** Canby's Dropwort Recovery Plan, April 10, 1990

II. REVIEW ANALYSIS

- A. **Application of the 1996 Distinct Population Segment (DPS) policy**
 Canby's dropwort is a plant and, therefore, not covered by the DPS policy. The DPS policy will not be addressed further in this review.
- B. **Recovery Criteria**
 1. **Does the species have a final, approved recovery plan containing objective measurable criteria?** Yes
 2. **Adequacy of recovery criteria**
 - a. **Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?** Yes

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria? Yes

3. List the recovery criteria as they appear in the recovery plan and discuss how each criterion has or has not been met, citing information.

The recovery plan states that Canby's dropwort shall be considered for removal from the Federal list when the following criteria are met.

1. It has been determined 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.

Currently, it is still unclear what determines, per the recovery plan, Canby's dropwort populations to be truly self-sustaining. Various elements including precipitation, herbivory, canopy conditions, etc., appear to affect individual populations in different ways. For example, all populations decline during drought events. However, some recover relatively quickly after normal rainfall returns while others appear not to respond to the point of extirpation. Section II.C.2.a. discusses these elements in greater detail.

Throughout the range of the species, there are eleven populations that are at least partially protected. Partially protected populations include those where only a portion of an occupied wetland is protected. Management for Canby's dropwort at these sites varies greatly from intense management to no current management. These populations include five sites in South Carolina* (Piney Bay in Bamberg County, Longleaf Pine Heritage Preserve in Lee County, Tibwin Savannah in Charleston County, Crosby Oxypolis Heritage Preserve in Colleton County, and Lisa Mathews Memorial Bay in Bamberg County), five sites in Georgia (Big Dukes Pond Natural Area in Jenkins County, Black Cypress Pond in Jenkins County, Oakbin Pond in Dooly County, McCaffe Church in Lee County, and Neyami Savannah in Lee County), and one site in Maryland (Crescent Preserve in Queen Ann's County). As noted in the last 5-year review, Big Cypress Meadow in Scotland County, North Carolina is only partially owned by The Nature Conservancy. The protected portion of Big Cypress Meadow is not the area where Canby's dropwort has been documented. However, the North Carolina Department of Agriculture and Consumer Services' Plant Conservation Program is considering options for purchasing a 130-acre portion of McIntosh Bay where Canby's dropwort previously occurred. Even with the protection of this tract, a sizeable portion of McIntosh Bay would still remain unprotected in private ownership.

Although these populations are protected via conservation easements, owned by The Nature Conservancy, or managed by a natural resources agency, many are not self-sustaining due to habitat conditions resulting from lack of management. Tibwin Savannah, within the Francis Marion National Forest, was previously described having excellent habitat for Canby's dropwort (Gaddy 2006) although

only one plant was found at that time. A 2014 survey of Tibwin Savannah detected no individuals of Canby's dropwort, revealed extensive loblolly pine and hardwood encroachment, and noted the need for prescribed fire (Brubaker 2014). Three of the four other protected populations in South Carolina may be self-sustaining, having all rebounded from low numbers associated with a 2012 drought. Likewise, at the Crescent Preserve Site in Maryland, the population totaled 223 plants: 10 times as many as were observed in the 2010 study and the most recorded since the mid-1980s.

From 2013 surveys in Georgia, one of the protected sites (Neyami Savannah) had abundant plants within its right-of-way, and has reliably had scattered plants in the less-disturbed pine-cypress swamp. Nearby, the protected McAfee Church site supported a population of several thousand dense plants. These stem numbers, 30-40% reproductive, are despite a 2010 drought and the possible alteration of hydrology from road construction projects. The newest protected site in Georgia, Black Cypress Pond, supported hundreds of plants when last surveyed. The USDA's Natural Resources Conservation Service holds a permanent conservation easement for this property and has approved a site management plan (Lisa Kruse, Georgia Department of Natural Resources, personal communication 2015). No plants were found at the other two protected sites during the most recent (2013) survey. At these sites habitat quality is being impacted from lack of fire (Big Dukes Pond) and from altered hydrology (Oakbin Preserve)(see section II.C.2.a. for more information on these sites). This criterion has not been met.

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

No additional populations have been discovered or reintroduced since the 2010 5-year review, although three additional populations have been protected. As discussed in that review, many of the populations that have been discovered since Canby's dropwort was listed in 1990 are on private land and have not been surveyed in a long time. However, there is an effort being initiated in South Carolina and Georgia, to fund a comprehensive Canby's dropwort survey of historic sites as well as to collect and germinate seeds for the planting of seedlings at appropriate sites. (see section II.C.2.a. for more information). This criterion has not been met.

3. 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 2010 5-year review. As described above, several of these populations are

likely not self-sustaining due to lack of management and offsite issues (see section II.C.2.a. for more information). This criterion has been partially met.

C. Updated Information and Current Species Status

Canby's dropwort is a perennial herb with erect or ascending stems and stands 0.8 to 1.2 meters (2.6-3.9 feet) tall. The slender leaves are hollow and quill-like. The small five-parted flowers are borne on compound umbels and have white petals and pale green sepals, some of which are tinged with red. The plant has a slight dill fragrance. The flowers are bisexual and/or unisexual, and appear from mid-August to early October. There may be some self-pollination but the flowers are protandrous (anthers release their pollen before the stigma of the same flower is receptive), indicating some outcrossing. There is no information on pollinators of this species. The fruit is a strongly-winged, 4-6 mm long, schizocarp (a dry fruit that splits into two or more closed, one-seeded parts once it matures). Canby's dropwort has a distinctive stoloniferous rhizome (rhizomes that grow stolon-like stems) with lower internodes that are a pink or purple color. This rhizome readily distinguishes Canby's dropwort from similar species such as *Oxypolis filiformis* (water cowbane). Reproduction is primarily asexual through rooting at the nodes of the rhizomes. This is a strongly clonal species and therefore can form large numbers of stems under favorable habitat conditions (Murdock and Rayner 1990).

This plant 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. Although there are a large number of Carolina bays in South Carolina and Georgia, most do not support the savanna conditions necessary for Canby's dropwort. The pond cypress savanna wetlands are quite rare (Bennett and Nelson 1991) and are considered globally imperiled (NatureServe 2009).

Canby's dropwort typically occurs in wetlands with loam or sandy loam acidic soils with medium to high organic content and a clay hardpan (Murdock and Rayner 1990, Gaddy 2006, Everett and Daniels 2010, NatureServe 2014). These include McColl loam, Grady loam, Rembert loam, Portsmouth loam, Rains sandy loam, and Coxville fine sandy loam. These soils are indicative of the wetland bays and depressions that support Canby's dropwort which generally are poorly drained and have high water tables with greatly fluctuating water levels. Wetlands that have relatively open canopies of pond cypress (*Taxodium ascendens*), and remain saturated or flooded most of the year, tend to support the largest and most viable Canby's dropwort populations.

Everett and Daniels (2010) conducted a study of the soils, hydrology, and geomorphology of the Lisa Matthews Memorial Bay in Bamberg County, South Carolina, a protected property with a relatively large and stable Canby's dropwort population. From field work and examining rainfall data dating back to 1960, Everett and Daniels developed an equation for modeling water levels. Based on this model, they determined that shallow portions of Lisa Matthews Bay were "likely" to be inundated every year in February and March. Furthermore, during

the flowering period for Canby's dropwort, there is only a 21% and 38% chance that the shallow areas of the bay will be dry in July and August respectively. During the 30-month study, it was also observed that the deepest section of the bay was never dry.

An understanding of genetic diversity within a rare species aids in developing targeted conservation strategies for that species. Because Canby's dropwort occurs in somewhat isolated populations, the gene flow and genetic variation available within its populations have been questioned (Murdock and Rayner 1990). Geographically restricted species, such as Canby's dropwort, typically have lower genetic diversity at both the species and population level than more widely distributed plant species (Hamrick and Godt 1989). To determine if this is the case for Canby's dropwort, the Georgia Department of Natural Resources funded a genetic diversity study that sampled Canby's Dropwort populations across its range (Hamrick 2012). Allozyme diversity was used to estimate genetic diversity, and was measured from leaf samples from fourteen populations (South Carolina: 5; Georgia: 8; and Maryland: 1). For comparison, ten populations of a similar, more common species, *Oxypolis filiformis*, were also sampled. As expected, Canby's dropwort exhibited less genetic diversity than *Oxypolis filiformis*. However, both species exhibited almost twice the percentage of polymorphic loci at the population and species level than the mean for all plant species. In addition, the expected heterozygosity per individual calculated over all loci, as well as the mean number and percentage of polymorphic alleles at the species and population level "would place these two *Oxypolis* species among the top 10% of the plant species that have been analyzed for allozyme variation" Hamrick (2012) concluded that this result is consistent with both *Oxypolis* species being polyploid, rather than diploid, species. The data from this study need to be analyzed to prioritize populations with unique genetic diversity for conservation and to design *ex situ* collections to sample the species' representative diversity.

The 1990 recovery plan states that various techniques including seed germination, propagation, and transplantation should be developed to reestablish populations in suitable habitat. These techniques could serve to salvage and utilize genetic resources from those populations that face possible localized extirpation (Northern Prairie Wildlife Research Center, 2013; Glitzenstein 2015). In 2007, the Georgia Department of Natural Resources funded a germination study that analyzed the effect of various temperature regimes on Canby's dropwort germination and found that the highest germination rate to be 28% and occurred in the treatment that mimicked summer conditions (Alley 2011). Those results led to a later study that examined alternating wet and dry periods, as naturally occurs in Canby's dropwort habitat, on seed germination. This study found that up to half of the mericarps, or fruit segments, collected for the 2007 study contained no seed (Alley 2011). By removing the empty mericarps, germination rates were found to be 75% after 16 months in summer-like conditions using a continuously hot treatment regime. Simulating wet and dry periods for seeds collected in 2009 appeared to have no effect on germination although very few

seeds were available that year due to drought conditions in Georgia. Finally, tetrazolium testing was used to determine if embryonic tissues from collected seeds were living. From this testing it was concluded that if viable seeds remain under suitable conditions, germination can be delayed for one or more years which may be due to enzymes that inhibit initial germination (Alley 2011). Similarly, at a U.S. Forest Service Seed Laboratory, Canby's dropwort germination under various temperature and light regimes were conducted. From this study, germination rates exceeded 50% after a relatively long incubation period with negligible germination taking place for at least the first year after ripe seeds were collected (Glitzenstein 2015).

The 2010 5-Year Review noted that approximately 53 populations have been documented over the last 30 years in Maryland, North Carolina, South Carolina and Georgia with one population extirpated from Delaware. No new or reintroduced populations have been documented since the last review, although three additional sites have been protected. Likewise no known populations have been determined to have been extirpated during this period although at several sites plants were not observed during the most recent surveys. Updated surveys have not been conducted for the North Carolina population nor most of the South Carolina populations.

2. Five Factor Analysis (threats, conservation measures and regulatory mechanisms)

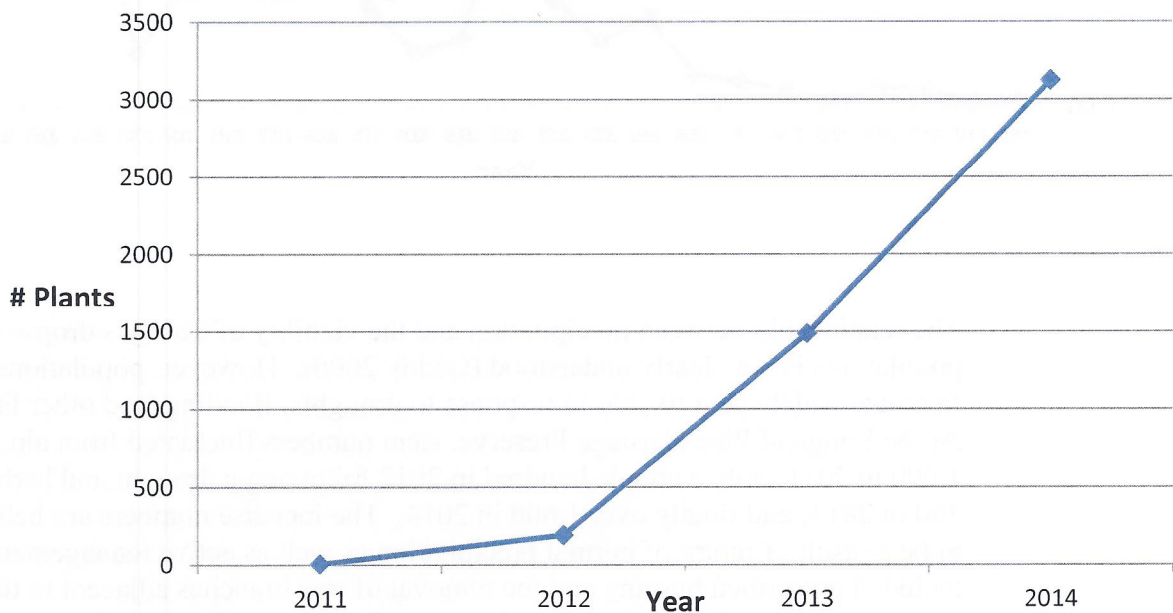
a. Present or threatened destruction, modification or curtailment of its habitat or range: The most significant threat to Canby's dropwort is the direct loss or alteration of its rare wetland habitat. Ditching and draining of wetland areas, primarily for agriculture and silviculture, have reduced the frequency, depth and duration of surface water, lowered the groundwater table, and changed the vegetative composition in many areas of the mid-Atlantic coastal plain where the species historically occurred. Reducing surface water, changing soil moisture levels and lowering of the water table enables other plants to become established, modifies vegetative succession, and makes sites less conducive overall to the plant's growth and reproduction (Murdock and Rayner 1990). Fire suppression has also lead to woody plant succession and reduced open, grassy wetland habitats (NatureServe 2014). As a result, many sites have been invaded by shrubs and some sites have been planted in pine. Other sites have been dredged thus breaking the clay hardpan and draining the wetland (Murdock and Rayner 1990, Gaddy 2006).

Gaddy's 2006 report noted that of the 32 previously documented Canby's dropwort sites that were visited, very few were in ideal condition. Many sites had been ditched, drained, and/or logged. Even if not degraded from direct anthropogenic causes, some form of management is necessary to hinder the invasion of trees and shrubs that ultimately alter natural hydrology and decrease

sunlight from canopy closure. Historically prescribed fires and higher water tables maintained the open canopy conditions where Canby's dropwort occurred. Due to numerous factors, prescribed fire is not practical in many areas and other means such as hand or light mechanized removal of woody vegetation is necessary (Murdock and Rayner 1990, NatureServe 2014).

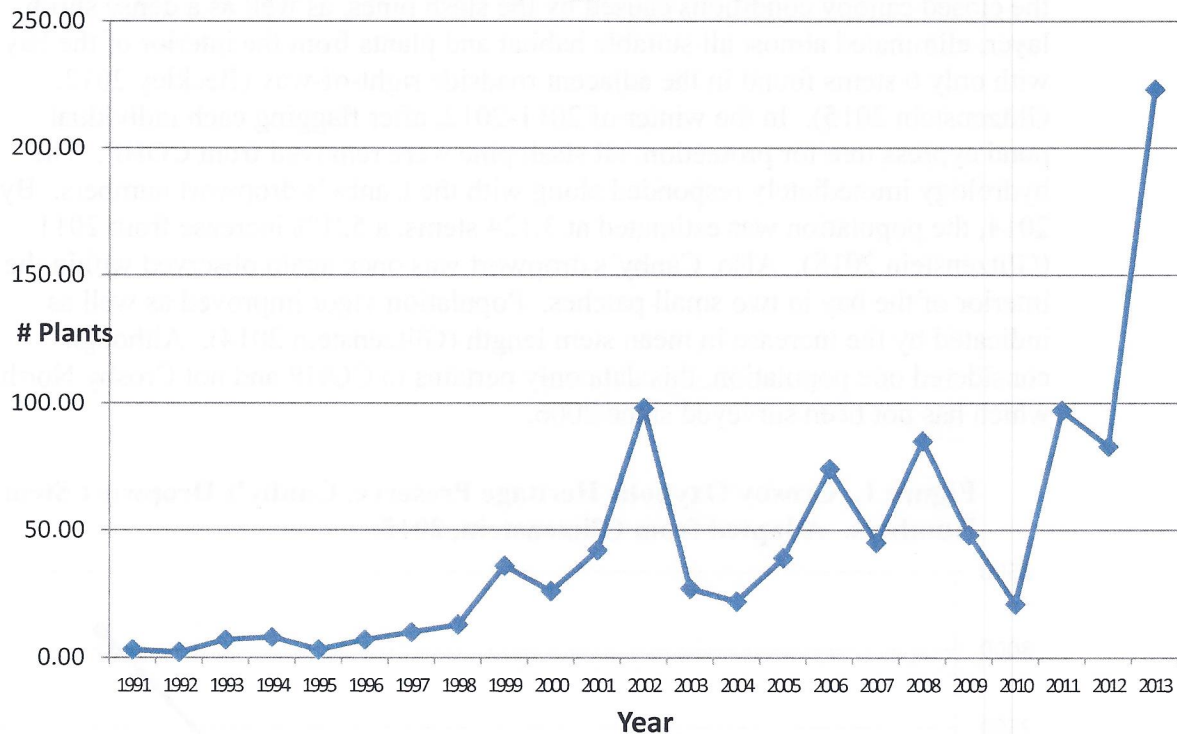
Crosby Oxypolis Heritage Preserve (COHP) Colleton County, South Carolina is described in the recovery plan as having been impacted from several sources of disturbance including the establishment of a slash pine overstory. COHP was acquired by the South Carolina Department of Natural Resources to protect the existing population of Canby's dropwort. COHP is adjacent to a U.S. Highway and had not been burned since the 1980s (Beckley 2012). Monitoring of the population at COHP from the 1980s indicated a severely variable population with stem counts in some years as low as 50 to as high as 3000+ in others. By 2011, the closed canopy conditions caused by the slash pines, as well as a dense shrub layer, eliminated almost all suitable habitat and plants from the interior of the bay with only 6 stems found in the adjacent roadside right-of-way (Beckley 2012, Glitzenstein 2015). In the winter of 2011-2012, after flagging each individual pond cypress tree for protection, all slash pine were removed from COHP. The hydrology immediately responded along with the Canby's dropwort numbers. By 2014, the population was estimated at 3,124 stems, a 521% increase from 2011 (Glitzenstein 2015). Also, Canby's dropwort was once again observed within the interior of the bay in two small patches. Population vigor improved as well as indicated by the increase in mean stem length (Glitzenstein 2014). Although considered one population, this data only pertains to COHP and not Crosby North which has not been surveyed since 2006.

Figure 1. Crosby Oxypolis Heritage Preserve, Canby's Dropwort Stem Numbers. Adapted from Glitzenstein, 2015.



The Queen Anne’s County Maryland population has been monitored every year beginning in 1991 (Deborah Landau, The Nature Conservancy, personal communication 2014). For the first 10 years of monitoring, the total number of plants never exceeded 50. In 2001, small patches of trees were removed with volunteers. In 2003, a professional crew was used to remove the remaining trees. Figure 2 shows a significant increase after the 2001 removal. The population declined initially after the 2003 work likely due to the disturbance of the crew. However, the population has increased dramatically to the highest number ever recorded in 2013.

Figure 2. Queen Anne’s County Maryland, Canby’s Dropwort 1991-2013. Adapted from Landau, Oxypolis Canby Annual Census. 2014.



The relationship between precipitation and the viability of Canby’s dropwort populations is not clearly understood (Gaddy 2006). However, populations do fluctuate widely year to year in response to droughts, flooding, and other factors. At the Longleaf Pine Heritage Preserve, stem numbers fluctuated from almost 1,000 in 2011; only a couple hundred in 2012 following a drought and herbivory; 700 in 2013; and finally over 1,600 in 2014. The increase numbers are believed to be a result of return of normal precipitation as well as active management that included prescribed burning and the removal of tree branches adjacent to the power-line right-of-way resulting in increased sunlight. Stem numbers not only

increased overall, but the number of stems outside of the right-of-way and within the adjacent cypress savannah increased from 2 stems in 2011, to 51 stems in 2014 (Glitzenstein 2015).

One hypothesis resulting from Canby's dropwort surveys in Georgia is plant numbers increase in dry years that immediately follow wet years (Lisa Kruse, Georgia Department of Natural Resources, personal communication 2014). However, several historic populations in Georgia did not respond in 2013 per this prediction as no plants were found at three sites and less than five were found at a fourth site. One of these, Big Dukes Pond, is owned and managed by the Georgia Department of Natural Resources (DNR). Previous surveys (2005-2011) noted pine encroachment and a closing canopy with stem counts less than 100 in all years except 2006 (169). Reproductive stems varied from 38% to 100%. Georgia DNR cut, girdled, or herbicided all canopy pine trees in 2010 within a 10-acre area that supported Canby's dropwort. However, in a 2013 survey, no plants were observed despite the pine removal and a return of suitable water levels. Three other populations (Neyami Savannah, McAfee Church, and Virgil Black Cypress Pond) did respond to the end of the drought in 2013 with abundant and reproductive stems.

Canby's dropwort has exhibited the capacity for substantial increases as conditions improve (Glitzenstein 2014), although it is not known how severe and prolonged of a drought Canby's dropwort populations can recover from (NatureServe 2014). The management and subsequent quality of wetland habitats may explain why many populations have rebounded after severe weather years while others, particularly those in degraded habitats, have not. For example, at Lisa Mathews Memorial Bay, estimates of stem numbers went from "too numerous to count" in 2009 (John Brubaker, South Carolina Native Plant Society, personal communication 2010), to only a couple of hundred in 2012 (Jeff Glitzenstein, personal communication, 2015), to 10,000+ stems in 2014 (John Brubaker, South Carolina Native Plant Society, personal communication 2014). Other populations that have not been managed or restored with subsequent habitat declines do not appear to rebound when hydrologic conditions improve. At Big Cypress Meadow in North Carolina, the habitat has declined and plants have not been observed since 2004 (Laura Robinson, North Carolina Department of Environment and Natural Resources, personal communication 2014) although the population was as high as 10,000 plants in the 1980s (Gaddy 2006).

The table below illustrates the cumulative number of known populations reported in 1990, the number of protected populations in 2006 and 2014, and the number of sites with Canby's dropwort present as of the most recent site specific survey. There is no new information on the cumulative number of reported sites for this review. However, the number of populations that were at least partially owned and managed by natural resource agencies or conservation organizations increased from eight to eleven by 2014.

Table 1. Cumulative number of reported known Canby's dropwort populations in 1990, the number of protected populations in 2006 and 2014, and the number of sites with Canby's dropwort known to be present.

State	County	Populations 1990	Protected Populations 2006	Protected Populations 2014	Sites with Canby's Dropwort Known to be Present to Date*
MD	Queen Anne's	1	1	1	1
NC	Scotland	1	0	0	0
SC	Allendale	1	0	0	0
	Bamberg	1	1	2	1
	Barnwell	2	0	0	0
	Berkeley	1	0	0	0
	Charleston	0	1	1	0
	Clarendon	4	1	0	0
	Colleton	1	1	1	1
	Florence	0	0	0	0
	Hampton	1	0	0	0
	Lee	1	0	1	1
	Orangeburg	1	0	0	0
	Richland	1	0	0	0
	Sumter	0	0	0	0
	Williamsburg	1	0	0	0
GA	Burke	0	0	0	0
	Dooly	4	1	1	4
	Jenkins	0	1	2	1
	Lee	4	2	2	3
	Screven	0	0	0	2
Total		25	8	11	14

* All sites indicated as having known Canby's dropwort present were surveyed since the 2006 data used for the 2010 5-year review. However, the survey for some of these sites date as far back as 2010.

b. Overutilization for commercial, recreational, scientific, or educational purposes: Overutilization is not considered a threat at this time.

c. Disease or predation: Glitzenstein (2015) noted extensive herbivory of individual Canby's dropwort plants at the Longleaf Pine Heritage Preserve. It was believed that rabbits or rodents browsed the plants which resulted in significant decrease in the fall population survey. A recent prescribed fire and summer drought are thought to have contributed to both the herbivory (increased

access) and subsequent drop in individual stems. Also at the Longleaf Pine Heritage Preserve, as well as the Crosby Oxypolis Heritage Preserve, insect damage has been observed, believed to be that of the larvae of black swallowtail butterfly (*Papilio polyxenes asterius*) (Herrick Brown, South Carolina Department of Natural Resources, personal communication 2010; Johnny Stowe, South Carolina Department of Natural Resources, personal communication 2010). Black swallowtail butterfly are known to deposit their eggs on the stems of Canby's dropwort. The subsequent larvae that hatch then masticate the stems. In addition to the direct mutilation of the stems, this herbivory may also reduce sexual reproduction of Canby's dropwort because the larvae chew immediately below the umbels. The damage from butterfly larvae damage may be as high at 17% of the stems in some populations (Murdock and Rayner 1990). Unidentified insects had consumed over 23% of the plants at Crosby Oxypolis Heritage Preserve in the summer of 2013 (Glitzenstein 2014). White-tailed deer, grasshoppers, and scale insects have all been known to also forage on Canby's dropwort (Murdock and Rayner 1990). Although damage from these sources has been documented for some time, it is unclear what impact it has on the viability or persistence of established Canby's dropwort populations. Canopy closure and subsequent low light conditions may exacerbate insect damage and the effects of droughts (Rayner 1991).

d. Inadequacy of existing regulatory mechanisms: There is currently little regulatory protection of Canby's dropwort habitat. The U.S. Army Corps of Engineers (Corps) generally does not regulate dredge and fill activities in isolated wetlands because of a 2001 U.S. Supreme Court opinion. The 2001 opinion was issued in the Solid Waste Agency of Northern Cook County (SWANCC) vs. the U.S. Army Corps of Engineers *et al.* and ruled in favor of SWANCC. The Corps' requirement for a Clean Water Act Section 404 permit to fill isolated wetlands to construct a landfill was overturned. The Corps had asserted jurisdiction on the isolated intrastate waters based solely on use by migratory birds (Findlaw 2007). Since that ruling isolated wetlands are generally not considered jurisdictional by the Corps. Therefore, there is no Federal nexus and consultation under section 7 of the ESA is not required. Because Canby's dropwort primarily grows in isolated wetlands, there is currently no Federal regulatory control of actions that would affect much of its habitat.

In South Carolina and Georgia, where almost all Canby's dropwort populations occur, there are no State laws that protect the isolated wetlands that provide Canby's dropwort habitat. Maryland and North Carolina, with one Canby's dropwort population each, do regulate isolated wetlands and therefore offer some protection to the habitat (Maryland Department of the Environment 2010, North Carolina Department of Environment and Natural Resources 2010).

The ESA prohibits the taking of endangered plants from Federal lands without a permit and regulates trade of listed plants. In addition, the ESA prohibits the malicious damage or destruction of plants on Federal lands; and, their removal,

cutting, digging, damaging, or destroying in knowing violation of any State law or regulation, including criminal trespass law. The State of Maryland prohibits taking of the species from private property without the landowner's permission and from State property without a permit and regulates trade in the species (Code of Maryland regulations 08.03.08). The State of North Carolina prohibits taking of the plant without a permit and the landowner's permission and regulates trade (North Carolina General Statute 19-B, 202.12-202.19). The State of Georgia prohibits digging, removal, or sale of State listed plants from public lands without the approval of the State management authority, and regulates sale or transport of State listed plants from private property (Georgia Wildflower Preservation Act of 1973). The State of South Carolina does not have any regulations that protect endangered plants on private land. However, regulations prohibit the unauthorized taking of plants from South Carolina Heritage Preserves and State Parks (South Carolina Code of Laws: Sections 50-11-2200, 50-11-2210, and 51-3-140).

e. Other natural or manmade factors affecting its continued existence:

At least three of the fourteen known Canby's dropwort populations are at least partially within utility/roadside right-of-ways. All three of these (Neyami Savannah, Longleaf Pine Heritage Preserve, and Crosby Oxypolis Heritage Preserve) sites are protected and support some of the largest and most vigorous of the remaining extant populations. However, the Canby's dropwort at the Longleaf Pine and Crosby Oxypolis sites became relegated to these right-of-ways because the adjacent wetlands were not properly managed. Woody shrubs and pines invaded these wetlands while the right-of-ways were maintained in an open condition by utility companies. As shown above, both of these populations have significantly increased and have expanded outside of the right-of-ways in response to active management. However, all three of these populations could be significantly damaged or even extirpated from the use of herbicides (Murdock and Rayner 1990) or from severe rutting caused by mechanized equipment used for right-of-way maintenance. In fact, in 2011 several dead stems were observed at Crosby Oxypolis Heritage Preserve apparently from a recent herbicide application (Beckley 2012). One way of minimizing this potential hazard is for land managers to work with electric cooperatives or State Departments of Transportation to address these concerns.

As discussed in section II.C.2.a above, the viability and abundance of Canby's dropwort populations are correlated to some degree with precipitation and drought events. Global climate change may exacerbate the effects on individual populations by increasing the frequency, duration, and severity of droughts. Also due to global climate change, precipitation events during the growing season may occur from more intense storms that result in sudden flood events. The relationship of all these factors, as well as the potential management implications, should be further considered.

D. Synthesis – The 1990 recovery plan states that a total of 19 populations must be protected and self-sustaining for Canby’s dropwort to be considered recovered. To date eleven sites have been at least partially protected, an increase of three since the previous 5-year review. However, no plants were found at four of these sites (Oakbin Pond, Big Dukes Pond, Tibwin Savannah, and Piney Bay) when last surveyed. Thanks to management actions, the seven other protected sites have shown some resiliency and the ability to rebound from the negative effects of droughts, herbivory, etc. In Georgia, the Virgil Black Cypress Pond site will be permanently protected with a Wetland Reserve Program easement which includes funding for habitat restoration. This population consisted of hundreds of stems when surveyed in 2013. Also in Georgia, a Wetland Restoration and Enhancement Program grant was awarded to the Georgia DNR to purchase conservation easements and for habitat restoration work to benefit the Oakbin Pond and Unadilla Cypress Pond populations (Lisa Kruse, Georgia Department of Natural Resources, personal communication 2014). These projects should add to the recovery plan goal of additional protected, self-sustaining populations.

The recovery plan outlines the need for analyzing the genetic variability within and between populations as well as reestablishing populations via seed collection, germination, and propagation. Recent studies in South Carolina and Georgia have addressed the genetic variability at both population and species levels. Seed germination studies have revealed that germination rates are negligible the first year after seed collection, but increase significantly after one year when ripe seeds are maintained in optimal conditions. Using this knowledge, sites are currently being considered for transplantation of propagated seedlings within suitable, protected habitat.

Overall progress is being made in understanding and protecting this species. Active management is occurring at many protected and some unprotected sites. Several populations (Mcafee Church, Neyami Savanna, Crosby Oxypolis Heritage Preserve, Lisa Mathews Memorial Bay, and Longleaf Pine Heritage Preserve) consisted of several thousand plants as of the most recent survey. These populations, as well as the Queen Anne’s County Maryland population, have all shown resiliency and responded dramatically from management efforts that improved habitat conditions. All of these populations are also all permanently protected.

Habitat loss and degradation continues to be the biggest threat for the continued existence of Canby’s dropwort. Canby’s dropwort was known to historically occur in five States, but is now confined to four States having been extirpated from Delaware. Regulatory protection for the isolated wetlands that support Canby’s dropwort are still lacking in South Carolina and Georgia, while Maryland and North Carolina do have some protection at the State level. Given the current level of protection, the direct or indirect destruction of isolated wetland habitats is not precluded on private properties.

To accurately determine if populations are self-sustaining, and what constitutes a self-sustaining population, routine surveys are needed at all sites. The Maryland population and most of the Georgia populations are monitored on a somewhat regular basis. Only a few of the South Carolina populations are monitored with any consistency. In fact, most of the South Carolina sites have not been surveyed since Gaddy's 2006 report. In that report, one-half of the sites surveyed had been logged, partially drained, or had been overcome by shrubs and trees. Many sites require active management, such as prescribed fire or mechanized/hand clearing, to combat the encroachment of woody shrubs and trees. Due to insufficient surveys, only 14 Canby's dropwort populations can be confirmed at this time. Although progress has been made, the objectives of the recovery plan are far from being met. Considering this and the continued threats to the species, Canby's dropwort still meets the definition of endangered under the ESA.

III. RESULTS

A. Recommended Classification:

X No change is needed

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Conduct surveys and habitat assessments at all sites surveyed by Gaddy (2006) that are not routinely monitored to determine species presence and assess habitat quality. Habitat assessments should include soil type and chemistry analysis, to develop additional parameters for determining suitable sites at which to introduce Canby's dropwort populations. Initiate biennial monitoring at all sites determined to have extant populations.
2. Protect known Canby's dropwort populations on private lands with conservation easements or Wetland Reserve Program easements. Work with managers of all known populations to prevent or remove shrub/tree encroachment with prescribed fire, canopy thinning, or other techniques.
3. Assess moribund and extirpated sites as well as other isolated wetlands for suitable habitat and resource availability. Consider transplantation to these sites for reestablishment/augmentation/introduction if appropriate donor sites are identified for seed collection, germination, and propagation.
4. Improve our understanding of the relationship between precipitation (and other site parameters) and Canby's dropwort population viability. It appears that where

hydrology is relatively intact, populations can withstand more severe drought than where hydrology has been impacted. More information is needed on the relationship between precipitation levels, various anthropogenic hydrologic disturbances, and the water levels in Canby's dropwort wetlands, and the subsequent effects on populations. This information will be essential to an informed interpretation of observation or monitoring data, especially with respect to defining thresholds for management action/intervention.

5. Determine objective, quantitative criteria for self-sustaining populations. Examine known populations to determine stability and trends and whether they are likely to represent self-sustaining populations. Consider the role of underground rhizome health relative to population stability and vegetative fluctuations.
6. For populations confined within roadside or power-line right-of-ways, promote management actions that shift Canby's dropwort populations away from the right-of-ways and towards the interior of adjacent wetlands.
7. Conduct demographic studies that further examine genetic variability, population structures, reproduction, and indeterminate growth factors. Additional seed germination and propagation studies are needed to further refine techniques and success rates. Research to determine reliable long-term seed storage and long-term greenhouse maintenance techniques is critical for safeguarding material from populations that are declining, until suitable habitat can be made available in the wild.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW OF CANBY'S DROPWORT

Current Classification: Endangered
Recommendation resulting from the 5-Year Review:

X **No change is needed**

REVIEW CONDUCTED BY: Jason Ayers, South Carolina Ecological Services Field Office

Lead Field Supervisor, Fish and Wildlife Service

Approve: Thomas D. McCoy Date: 07/28/2015

Appendix A

Summary of peer review for the 5-year review of Canby's dropwort

A. Peer Review Method: Following the completion of the draft 5-year review, we requested and received comments from the following species experts on the draft document: Ms. Lisa Kruse (Georgia Department of Natural Resources), Mr. Jeff Glitzenstein (Tall Timbers Research Station), and Dale Suiter (U.S. Fish and Wildlife Service). We considered and incorporated suggested changes and comments as appropriate.

B. Peer Review Charge/Guidance:

We included the following language in our letter requesting peer review of the draft 5-year review.

A 5-year review is a periodic analysis of a species' status conducted to ensure that the listing classification of a species as threatened or endangered on the List of Endangered and Threatened Wildlife and Plants (List) (50 CFR 17.11 – 17.12) is accurate. The 5-year review is required by section 4(c)(2) of the Endangered Species Act of 1973, as amended (ESA). A Federal Register notice announcing the review for Canby's dropwort and requesting information was published on March 25, 2014. I have completed the draft 5-year review and am requesting your review of the draft document.

I am requesting that you consider the following in your response:

- comment on data or analyses used in the review;
- identify oversights, omissions, and inconsistencies;
- provide advice or reasonableness of judgments made from the scientific evidence;
- ensure that scientific uncertainties are clearly identified and characterized, and that potential implications of uncertainties for the technical conclusions drawn are clear;
- provide advice on the strengths and limitations of the overall product.

However, please do not provide recommendations on the ESA classification of the species. The Service must make that determination.

Please contact Jason Ayers at 843-300-0421 or Jason_ayers@fws.gov if you have any questions. I appreciate your efforts in reviewing this document and providing comments by June 5, if possible.

C. Summary of Peer Review Comments/Reports: A summary of peer review comments is provided below. The complete set of comments is available at the South Carolina Ecological Services Field Office, U.S. Fish and Wildlife Service, 176 Croghan Spur Road, Suite 200, Charleston, South Carolina, 29407.

Ms. Lisa Kruse, Georgia Department of Natural Resources, Social Circle, Georgia: Ms. Kruse noted that one additional Canby's dropwort population was permanently protected that was not considered in the draft 5-year review. She also revised the citation of two literature references, clarified seed germination treatments, and made several edits in wording particularly related to genetics. Ms. Kruse had several comments/recommendations related to the "RECOMMENDATIONS FOR FUTURE ACTIONS" section including: (1) the importance of assessing soil type and chemistry; (2) the feasibility of biennial vs. annual monitoring; (3) introducing seedlings to new areas; (4) researching the relationship of precipitation, anthropogenic hydrologic disturbances, and water levels in wetlands and the subsequent effect on populations; and (5) researching reliable long-term seed storage to protect material from declining populations.

Dr. Jeff Glitzenstein, Tall Timbers Research Station, Tallahassee, Florida: Dr. Glitzenstein suggested that Table 1 should be altered to reflect that most of the 53 populations described in Gaddy's 2006 report could not be found. He also noted that Canby's dropwort can be found in habitat besides isolated wetlands, suggested that the health of the underground network of perennial rhizomes may be a more accurate measure of population stability, discussed survey estimates, and provided additional information on seed testing.

Mr. Dale Suiter, U.S. Fish and Wildlife Service, Raleigh, NC: Mr. Suiter suggests minor edits including adding page numbers to the document, adding dates to the unpublished data, and format corrections. He also suggested clarification of what methods were used to kill pine trees within a particular bay.

D. Response to Peer Review:

Overall reviewers commented that the draft document did a good job of summarizing the known information on the species. Some reviewers did find errors in the document related to information presented about Canby's dropwort. The Service rectified these errors, incorporated all minor edits from peer reviewers, and incorporated suggestions for additional needs for this species.