

**Alabama Leather Flower
(*Clematis socialis*)**

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



Photo by M. Scott Wiggers, USFWS.

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**U.S. Fish and Wildlife Service
Southeast Region
Mississippi Field Office
Jackson, Mississippi**

5-YEAR REVIEW

Alabama Leather Flower (*Clematis socialis*)

I. GENERAL INFORMATION

A. Methodology used to complete the review: In conducting this 5-year review, we relied on the best available information pertaining to historical and contemporary distributions, life histories, genetics, habitats, and threats of this species. We announced initiation of this review and requested information in a published *Federal Register* notice with a 60-day comment period (81 FR 59650). We received no public comments during the 60-day open comment period. We used a variety of information resources, including data housed at State natural heritage programs, internet searches, and knowledgeable individuals associated with academia, Federal, State, and non-governmental conservation organizations. Specific sources included the final rule listing this species under the Endangered Species Act (ESA) (51 FR 34420); the Recovery Plan (Service 1989); the last 5-year review (Service 2010); peer reviewed scientific publications; unpublished field observations by Federal, State, and other experienced biologists; unpublished studies and survey reports; and notes and communications from other qualified individuals. The completed draft review was sent to affected U.S. Fish and Wildlife Service field offices and five peer reviewers for review. Comments were evaluated and incorporated into this final document as appropriate (see Appendix A).

B. Reviewers

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

Lead Field Office: Mississippi Ecological Services Field Office, M. Scott Wiggers, (228) 475-0765 ext. 104

Cooperating Field Offices: Daphne Ecological Services Field Office, Shannon Holbrook, (251) 441-5837; Georgia Ecological Services Field Office, Michele Elmore, (706) 544-6428.

C. Background:

- 1. Federal Register Notice citation announcing initiation of this review:** August 30, 2016. 81 FR 59650.
- 2. Species status:** Stable. Of eight natural populations known from Alabama (seven populations) and Georgia (one population), six are considered extant (compared to five known extant populations in 2010 for the Service's last 5-year review [see Service 2010]). One small population was discovered in St. Clair County, Alabama in 2016 (Chuck Byrd, The Nature Conservancy – Alabama, Land Steward, personal communication [pers. comm.] 2016a, 2016b, Thompson 2016). However, recent site visits indicate that at least one population in Etowah County, Alabama has recently been extirpated due to habitat conversion, while the status of one other population in this county is uncertain, but has likely been recently extirpated by incompatible habitat management (Alfred Schotz, Alabama Natural Heritage Program, Botanist and Community Ecologist, pers. comm. 2014, Byrd 2016c). Two natural populations

receive permanent protection by state or non-profit conservation organizations. One of these populations is owned by the Georgia Department of Transportation (GDOT) and managed by the Georgia Department of Natural Resources (GDNR) (in Floyd County, Georgia) and the other is owned by The Nature Conservancy (in St. Clair County, Alabama) (Georgia Natural Heritage Program [GNHP] data, Byrd 2016a). Part of one population in Etowah County, Alabama has also recently received enhanced protection with the erection of a fence, establishment of a management plan, and receipt of some habitat management activities (City of Gadsden 2012, Byrd 2016a). Several of Alabama's right-of-way sites receive conservation considerations via compatible mowing regimes and herbicide application prohibitions (Byrd 2016a). Further monitoring is needed at sites range-wide to better assess trends of individual populations and effects of habitat management. All populations continue to require active management to maintain suitable habitat.

3. Recovery achieved: 1 (0–25% species recovery objectives achieved).

4. Listing history

Original Listing

FR notice: 51 FR 34420

Date listed: September 26, 1986

Entity listed: Species

Classification: Endangered

5. Associated rulemakings: None.

6. Review History:

Recovery Plan: 1989

Each year, the U.S. Fish and Wildlife Service (Service) reviews and updates listed species information to benefit the required Recovery Report to Congress. Through 2013, we performed a recovery data call that included status recommendations, such as “Stable” for this plant. We continue to show this species’ status recommendation in 5-year reviews.

Five-year reviews:

November 6, 1991 (56 FR 56882)

In the 1991 review, multiple species were simultaneously evaluated with no species-specific, in-depth assessment of the five factors or threats as they pertained to each species’ recovery. In particular, no changes were proposed for the status of Alabama leather flower in the review.

July 12, 2010 (70 FR 34492)

This review noted that only two populations were permanently protected and that all sites needed continued monitoring and management. No changes in the species’ endangered designation were recommended.

7. Species’ Recovery Priority Number at start of review (48 FR 43098): 5

Degree of Threat: High
Recovery Potential: Low
Taxonomy: Species

8. Recovery Plan

Name of Plan: Recovery Plan for Alabama Leather Flower (*Clematis socialis*)
Date Issued: December 27, 1989

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) Policy

The ESA defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listing DPSs to only vertebrate species of fish and wildlife. Because the species under review is a plant, the DPS policy is not applicable.

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. The recovery criteria take into account threats to this species in association with the five listing factors, since the assurances that populations are viable and are protected from any foreseeable threats is part of the criteria.
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:**

Criteria: Reclassification to threatened when at least 10 geographically distinct, self-sustaining populations, occupying a minimum of 1 acre of habitat each, are known and protected from any foreseeable threats. Delisting will be considered when 20 such populations are secured. Viability of populations will be assessed through a periodic monitoring program for at least a 10-year period.

Status: These criteria have not been met. Of the eight populations of Alabama leather flower that have been found, only six are considered extant. In Alabama, one population was recently extirpated and the other has likely also been recently extirpated (Schotz pers. comm. 2014, Byrd 2016c). Additionally, in Alabama, one subpopulation is considered historical, having not been relocated since it was discovered (Boyd and Hilton 1992, Emmanuel 1998), and the status of another subpopulation is uncertain, but may have been negatively impacted by growth of

competing vegetation (Byrd 2016c). Most extant populations are small, occupying substantially less than 1 acre of habitat (Alabama Natural Heritage Program [ANHP] data, GNHP data, Wiggers 2014, Byrd 2016c). Only two of the extant natural populations—one in St. Clair County, Alabama and one in Floyd County, Georgia—are permanently protected (GNHP data, Byrd 2016c). Regular management is required to control aggressive competing vegetation and maintain suitable, open habitat conditions at all sites. A detailed demographic monitoring program has yet to be established at all sites to accurately assess population trends.

C. Updated Information and Current Species Status

1. Biology and Habitat

The Service reviewed information on the biology and habitat of Alabama leather flower in the species' recovery plan (Service 1989) and in the most recent 5-year review (Service 2010). Relevant information from the recovery plan has been included in this review, as necessary.

a. New information on the species' biology and life history:

Genetic sampling of populations in Alabama by Goertzen *et al.* (2011) revealed that individual genets (genetically distinct individuals) of Alabama leather flower can be quite large, spreading to at least 36 feet (ft.) (11 meters [m]) via underground rhizomes. The authors note that these genets may span greater distances than their sampling scheme detected. These data, coupled with earlier estimates that Alabama leather flower's rhizomes grow approximately 4 inches (10 centimeters [cm]) per year (Goertzen and Boyd 2007), indicate that the species is relatively long-lived and capable of living for at least 55 years.

b. Abundance, population trends, demographic features, or demographic trends:

Populations

Alabama leather flower was known from only two sites, one each in St. Clair and Cherokee counties, Alabama, at the time of listing in 1986 (Service 1986). However, surveys and fortuitous finds since listing have increased the number of known populations. Currently, eight natural populations are known from four counties in Alabama (three counties; seven populations) and Georgia (one county; one population) (see Fig. 1 and Table 1). However, only six of these populations are considered to be extant. One population was recently extirpated and the status of a second population is uncertain, but has likely been recently extirpated. Plants or groups of plants that are separated by at least 1 mile are considered to be distinct populations. This provisional population definition is based on potential flight distances of Alabama leather flower's known pollinators (cf. Wall *et al.* 2003), particularly the bumble bee *Bombus pensylvanicus*, whose flight distances are typically less than one mile (cf. Folkerts 1992, Heinrich 1977).

Because of the clonal nature of Alabama leather flower, individual populations can be thought of in terms of both genetically distinct individuals (genets) and clones (ramets). Genets are often composed of numerous ramets (clonal stems). As such, population assessments using numbers of stems alone can easily overestimate the actual population in terms of genets (Tepedino 2012). With respect to Alabama leather flower clonality, as noted above, genets have been documented to be at least 36 ft. (11 m) long (Goertzen *et al.* 2011). It is unknown how large individual Alabama leather flower genets can grow or how many ramets a given genet may produce. Similarly, no known study has attempted to characterize the number of genets found in an entire population of Alabama leather flower, let alone all populations of the species. In addition, ramets from individual genets grow intermixed with each other (Service 1989), further complicating population estimates using aboveground stem counts. Given these challenges, stem counts/estimates can be considered to represent maximum ramet population sizes, but are likely to overestimate the actual genet population size.

State Population Summaries

Population summaries are presented in Table 1.

Alabama

Seven natural populations are historically known from three counties in Alabama: Cherokee, Etowah, and St. Clair (Alabama Natural Heritage Program [ANHP] data). The Nature Conservancy (TNC) continues to monitor several populations in the state, including one population that is found on lands mostly owned by them (Byrd 2016c).

Historically, Cherokee County had three known Alabama leather flower populations, but only one population is currently confirmed to be extant. This extant population—which is also the county’s largest known population—occurs in two subpopulations. One subpopulation occurs along a roadside right-of-way that receives periodic mowing and has signage barring herbicide application (Wiggers 2014, Byrd 2016c). Recent efforts to monitor locate the smaller subpopulation located in a nearby pasture margins along a forested area have been hampered by lack of access, although the site is apparently becoming overgrown by woody vegetation (Byrd 2016c). This subpopulation is in need of active management to control growth of competing vegetation. Of the county’s two remaining populations, one has recently been extirpated by conversion to row-crop agriculture, while the second may have been extirpated by incompatible roadside right-of-way maintenance (Schotz pers. comm. 2014, Byrd 2016c). Recent mowing along the right-of-way may have limited the ability to find any extant plants at the time that this population was visited (Schotz pers. comm. 2014) and, given such uncertainty, additional visits are needed confirm the status of this roadside population.

Etowah County is home to one extant population. The City of Gadsden has erected a fence that partially encloses this population and prepared a

management plan for the site (City of Gadsden 2012, Byrd 2016c). In addition, staff and volunteers with the Birmingham Botanical Garden and TNC have begun clearing competing vegetation from this site (Byrd 2016c).

St. Clair County is home to three extant populations. One population is comprised of several small subpopulations, the largest of which is found on a preserve owned by TNC (Wiggers 2014, Byrd 2016c). This TNC preserve protects the site where the species was originally discovered (i.e., the type location). Plants are found along a road and small power line right-of-way and in adjacent woodlands. TNC has recently partnered with the Birmingham Botanical Garden to assist with the preserve's management (Byrd 2016c). Plants within the road/power line right-of-way were damaged in 2013 by installation of silt fencing for associated road improvement work (Byrd 2016c). Rutting by mowing tractors during wet periods has also impacted Alabama leather flower plants in this right-of-way. Two small subpopulations near this preserve are privately owned, receive limited management, and are monitored by TNC (Byrd 2016c). One of these subpopulations is found in woodlands along a small drainage and the other is found in a power line right of way and adjacent woodlands managed for timber production. Plants within the timber production stand have not been relocated since 2009 and the status of this subpopulation is uncertain (Byrd 2016c). Growth of competing vegetation may have obscured these plants or may have reduced plant growth and vigor at this site. Rutting from unauthorized ATV use of the adjacent power line right-of-way has also damaged Alabama leather flower plants (Emanuel 2000). A second, privately owned, population occurs within the same watershed as the first population and is also monitored by TNC (Byrd 2016c). This population was once comprised of two subpopulations, one of which has not been relocated since its discovery along a pipeline right-of-way (Boyd and Hilton 1992, Emmanuel 1998) and is now considered a historical occurrence. The second subpopulation was impacted by clear-cutting in 2005 and is now being affected by growth of competing vegetation, although this subpopulation appears to remain robust with over 500 stems estimated (Wiggers 2014, Byrd 2016c). Continued shading from tree regrowth and growth of competing vegetation threaten the continued vigor of this subpopulation, however. The third and most recently discovered (found in 2016) population occurs on private timber lands. Limited information is available on this population, but it is reportedly small, comprised of approximately 50 plants (Byrd pers. comm. 2016a, b, Thompson 2016).

Georgia

Georgia's only known natural population—in Floyd County—is found in a state Natural Area. This site is owned by GDOT and is managed and monitored by the GDNR (Mincy Moffett, GNHP, Botanist, pers. comm. 2016, 2017). Recent searches and active management (e.g., prescribed fire) have expanded the known extent of this population from approximately 1/16th acre (0.025 hectare) to approximately one acre (0.4 hectare) (GNHP data, Moffett

pers. comm. 2017). This site is also partially fenced (Moffett pers. comm. 2017), which increases the site's protection, while fencing has been erected around some individual plants to deter herbivores (Henning von Schmeling, Chattahoochee Nature Center, Senior Director of Operations, pers. comm. 2016).

The Georgia Plant Conservation Alliance (GPCA) and its affiliated organizations have coordinated propagation and transplantation of Alabama leather flower within the state (Moffett pers. comm. 2016). These efforts have involved attempts to augment the existing natural population and establish a new population on lands protected by a conservation easement held by TNC (see Table 1). Parent plant material used for these efforts originated from the state's natural population. To date, these transplantation efforts have met with mixed success, particularly on TNC's conservation easement property, possibly due to selection of inadequate planting sites (GNHP data, Chattahoochee Nature Center [CNC] 2010, Goldstrohm 2011, 2012, Malcolm Hodges, The Nature Conservancy – Georgia, Director of Stewardship, pers. comm. 2013, 2014, Moffett pers. comm. 2016, von Schmeling pers. comm. 2016). The limited success of transplant efforts at the TNC transplant site suggests that it is not currently a viable population for recovery of Alabama leather flower.

c. Genetics, genetic variation, or trends in genetic variation:

Several studies have focused on Alabama leather flower genetics since the 1990s. Recent genetic work by Goertzen *et al.* (2011) built upon earlier studies (i.e., Boyd *et al.* 1998, Goertzen and Boyd 2007) to further address genetic diversity and clonality of this species. Together, these studies of populations in Alabama and Georgia indicate that the species possesses a relatively high level of genetic diversity, despite recent disruptions to the species' populations and distribution. Goertzen *et al.* (2011) also found that the individual populations studied were genetically similar to each other. Further, the authors assert that the potentially large size (clonally spreading to at least 36 ft. [11 m]) and potential longevity (at least 55 years) of Alabama leather flower genets (genetically identical individuals) have likely slowed the loss of genetic diversity of the species and contributed to the lack of genetic differentiation between populations. The authors suggest that this information indicates that population losses and fragmentation have occurred relatively recently (i.e., 2–3 generations of Alabama leather flower).

Genetic studies conducted to date have only examined some of Alabama leather flower's known populations. It is currently unknown whether genetic studies performed at these select sites are representative of the species as a whole. Expanding these assessments to include all known populations and further assess the amount of genetic variability within individual populations, and the species as a whole, is needed. This information will be important in assessing long-term chances of survival and minimum viable population parameters.

d. Taxonomic classification or changes in nomenclature:

Originally described by Dr. Robert Kral in 1982 (Kral 1982), the taxon is currently recognized as valid by the Integrated Taxonomic Information System (ITIS) (ITIS 2017), as well as national and regional floras (e.g., *Flora of North America* [Pringle 1997] and *Flora of the Southern and Mid-Atlantic States* [Weakley 2015]).

e. Spatial distribution, trends in spatial distribution, or historical range:

Alabama leather flower's known range has expanded from two Alabama counties (St. Clair and Etowah) at the time of listing (see Service 1986) and completion of the recovery plan (see Service 1989). Currently, the species is known from eight natural populations—six extant, one extirpated, and one uncertain (likely extirpated)—in northeastern Alabama's Cherokee, Etowah, and St. Clair Counties and northwestern Georgia's Floyd County (see Fig. 1). The species' entire known range spans less than 90 miles (145 kilometers [km]), with individual populations typically separated by 30 or more miles (48 km) from their nearest neighbors. All known populations occur within the Valley and Ridge physiographic province (see Fig. 1).

f. Habitat or ecosystem conditions:

No new information on Alabama leather flower's habitat or ecosystem requirements has become available since completion of the previous 5-year review (i.e., Service 2010).

g. Other:

Propagation Studies

Various studies have focused on propagation of Alabama leather flower. To date, neither of the two known seed germination studies has successfully produced seedlings in either greenhouse (study by Dr. Joe Eakes, referenced in Garrett 2004, p. 3) or field (Timmerman-Erskine and Boyd 1999) settings. Such observations indicate that seed collections alone may not be adequate to meet potential future propagation needs of this species. Studies of alternative propagation techniques have focused on the use of stem cuttings (e.g., Bruner *et al.* 2001, Johnson 2006, Thompson 2014) and *in vitro* propagation (a cloning technique using plant tissue cultures; Pence *et al.* 2007, Trusty *et al.* 2009, Dr. Valerie Pence, Cincinnati Zoo and Botanical Garden, Director of Plant Research, pers. comm. 2013). In addition, staff at CNC has successfully used plant divisions to propagate the species for transplanting (CNC 2010). These alternatives may represent promising techniques for mass-producing cloned individuals, should future needs arise; however, care must be given to the maintenance of adequate and representative genetic diversity in any such future activities intended for population augmentation and/or establishment (*sensu* Fant *et al.* 2016).

Ex Situ (Off-site) Conservation Efforts

Alabama leather flower is vulnerable to extinction due to its small number of extant populations. Limited efforts to safeguard this species *ex situ* have been implemented using a variety of techniques, including *in vitro* propagation and cryopreservation (Trusty *et al.* 2009, Pence pers. comm. 2013), live plants maintained in cultivation (CNC 2010, Hodges pers. comm. 2013, Thompson 2016), and seed banking (Michael Kunz, North Carolina Botanical Garden, Conservation Ecologist, pers. comm. 2013). However, current *ex situ* collections are not representative of all known populations and may not be representative of genetic diversity within individual populations (*sensu* Hoban and Schlarbaum 2014, Hoban and Strand 2015). As such, *ex situ* conservation efforts for Alabama leather flower need to be expanded to represent all known extant populations as well as a broad spectrum of the species' genetic diversity.

Population Augmentation and Establishment

Several attempts to augment and establish populations of Alabama leather flower have had limited success. An attempt to augment Georgia's only known natural population (in Floyd County) has had some success (GNHP data, CNC 2010). In addition, a small number of Alabama leather flower plants were transplanted to a tract of land protected by a conservation easement held by TNC in northwest Georgia with limited success, possibly due to unsuitable planting site selection (GNHP data, CNC 2010, Goldstrohm 2011, 2012, Hodges pers. comm. 2013, 2014, Moffett pers. comm. 2016, von Schmeling pers. comm. 2016), indicating the need to further assess and define habitat requirements for Alabama leather flower. Given the currently limited success of this transplanted population, it is not yet considered one of the populations necessary to recover this species.

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

a. Present or threatened destruction, modification or curtailment of its habitat or range:

Habitat Destruction and Conversion

Habitat for this species has been reduced through development and conversion to agriculture and pine plantations. Logging operations have degraded the habitat at two sites in Alabama (ANHP data, Byrd 2016c). The use of heavy equipment has adversely impacted these sites by creating ruts and promoting erosion, and has destroyed several plants. In addition, soil disturbance has fostered invasion by exotic and weedy species, further reducing habitat integrity and species viability. One population, in Cherokee County, Alabama, has been repeatedly impacted by disking for row-crop agriculture and has recently been extirpated by conversion to a soybean field (Schotz pers. comm. 2014, Byrd 2016c). One subpopulation in St. Clair County, Alabama was damaged by silt fencing installation for road improvement work (Byrd 2016c). Road improvements (e.g., widening, repaving)

could jeopardize the continued viability of plants in adjacent rights-of-way if such activities are not conducted in an appropriate manner and coordinated with the Service. Rutting by ATVs and mowing equipment also pose threats to plants in rights-of-way (Emanuel 2000, Byrd 2016c). Development, particularly for residential purposes, has been identified as a significant threat to at-risk species associated with privately owned forested lands (Stein *et al.* 2010), such as Alabama leather flower. Within the southeastern United States, the urban footprint has been projected to more than double by 2060 compared with 2009 (Terando *et al.* 2014), thus putting further development pressure on Alabama leather flower and its habitats. Development and associated land use changes on unprotected sites could negatively impact or destroy populations if precautions are not taken.

- b. Overutilization for commercial, recreational, scientific, or educational purposes:** Collection is not known to be a threat at this time. There was concern at the time of listing that publicity from its listing as an endangered species would generate an increased demand for this species, resulting in over-collecting in the wild. Indications, thus far, are that this has not materialized as a significant threat to this species.
- c. Disease or predation:** Disease and predation are not known to threaten Alabama leather flower. Herbivore browsing damage has been observed in Georgia and fencing has been erected to deter herbivores around some plants (von Schmelting pers. comm. 2016). Accounts of such herbivore damage to Alabama leather flower are rare, indicating that this may be a localized rather than widespread phenomenon. One study identified a species of carpenter bee, *Xylocopa virginiana*, exhibiting nectar-robbing behavior on Alabama leather flower (Boyd and Wall 1998, Wall *et al.* 2003); however, the authors noted that given the apparently low visitation rates of this nectar-robbing bee, its effects on Alabama leather flower reproduction is likely small. It has also been suggested that deer mice (*Peromyscus* sp.) may be seed predators of Alabama leather flower (Timmerman-Erskine and Boyd 1999), which may potentially limit seedling recruitment. However, given the species' clonal nature (i.e., its ability to spread locally without seedling recruitment), it is unlikely that seed predation by deer mice alone presents a substantial threat to Alabama leather flower. Furthermore, as noted by Goertzen *et al.* (2011), Alabama leather flower's relatively high genetic diversity indicates that sufficient sexual reproduction is occurring within the species, despite low apparent seedling recruitment.
- d. Inadequacy of existing regulatory mechanisms:** No State laws in Alabama protect Alabama leather flower and its habitat. In Georgia, the species is State protected as endangered under the Wildflower Preservation Act of 1973, O.C.G.A. 12-6-170. This law authorizes rules for the collection, transport, sale, and listing of protected plants within the State. In addition, no protected plants may be collected without landowner approval and no transport within the state is allowed without a State-issued permit (Patrick *et al.* 1995). Otherwise, protections are afforded to this species under sections 7 and 9 of the ESA. Two

populations are considered protected from outright habitat destruction or adverse habitat modification due to their protection on a TNC preserve (in Alabama) and on lands set aside as a state Natural Area by the State of Georgia (in Georgia). In Georgia, state-designated Natural Areas are managed by GDNR to conserve natural communities and rare species (GDNR 2017). In addition, part of one population has received some habitat protection and management by the City of Gadsden, Alabama.

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

Inadequate/Incompatible Habitat Management

Inadequate management—e.g., lack of mowing, prescribed fire, and/or hand clearing—remains a persistent concern for Alabama leather flower populations. At least one subpopulation in St. Clair County, Alabama has not been relocated, in part, due to growth of encroaching plants (Byrd 2016c), which has obscured plants and/or suppressed their growth. Plants at this site have not been observed since 2009 and it is unknown if they still exist. Three other subpopulations in St. Clair and Cherokee Counties are in need of management activities to reduce competing understory and woody vegetation (Wiggers 2014, Byrd 2016c).

Portions of two populations occur along highway rights-of-way in Alabama. The entirety of one additional population, in Cherokee County, may have been recently extirpated by road right-of-way maintenance activities (Schotz pers. comm. 2014). Alternatively, mowing prior to the site visit may have limited the ability to find the plants. Additional site visits are needed to confirm the status of this population. One subpopulation occurred within a pipeline right-of-way, but plants have not been relocated since their discovery in 1992 (Emanuel 1998) and, as such, this site is considered historical. Alabama Department of Transportation (ADOT) and Alabama Power Company have cooperated in the protection and management of Alabama leather flower within their rights-of-way by adhering to compatible mowing schedules and avoiding herbicide application. Furthermore, signs have been placed at two roadside sites—one of which is part of a TNC preserve—under the jurisdiction of the ADOT in an effort to prevent herbicide application that may jeopardize the continued viability of Alabama leather flower these sites (ANHP data, Emanuel 1998, Wiggers 2014, Byrd 2016c). Plants are also found within a power line right of way maintained by Alabama Power Company (ANHP data, Emanuel 1998, Byrd 2016c). This site is periodically mowed. Plants within rights-of-way remain susceptible to incompatible mowing regimes and errant herbicide application, particularly those sites without appropriate signage.

Competition from Encroaching Species

Alabama leather flower is an apparently poor competitor, as it is most vigorous in open areas with little competing vegetation and open canopies. Indeed, low light levels have been associated with increased flower abortion (Timmerman-Erskine and Boyd 1999). The species also benefits from occasional, limited disturbance

(such as periodic mowing or prescribed fire) which reduces encroachment of competing vegetation. However, Alabama leather flower can apparently remain dormant for some time as evidenced by its appearance in openings created in woods that were selectively logged (Service 1989). Even though the increased light initially benefited Alabama leather flower, it also stimulated more aggressive competing vegetation including the exotic Japanese honeysuckle (*Lonicera japonica*). All populations of Alabama leather flower need active management (e.g., thinning overstory trees, mowing, prescribed fire) due to shading and competition from more aggressive vegetation.

Small Population Size and Small Number of Populations

Attempts to locate additional Alabama leather flower populations since completion of the species' original Recovery Plan in 1989 (e.g., Boyd 1991, Boyd and Hilton 1992, Govus 1999, Ware 1999, Garrett and Schotz 2005) have had some success thus far, with eight natural populations now known for the species. Of these populations six are extant (ANHP data, GNHP data, Byrd 2016c, Byrd pers. comm. 2016a, b, Thompson 2016), one may have been extirpated (Schotz pers. comm. 2014, Byrd 2016c), and one has been extirpated (Schotz pers. comm. 2014). Only three populations are considered to be large (1,000+ stems), while two are of moderate size (400–500 stems) (GNHP data, Wiggers 2014, Byrd 2016c).

Alabama leather flower's limited number of extant populations and relatively small local population sizes increase the species' vulnerability to anthropogenic and environmental perturbations. In addition, small population sizes increase the risks posed by inbreeding and genetic drift, which may limit the species' adaptive capacity and ability to cope with future stressors (Ellstrand and Elam 1993). However, the unexpectedly high level of genetic diversity maintained within Alabama leather flower populations studied thus far (Boyd *et al.* 1998, Goertzen and Boyd 2007, Goertzen *et al.* 2011), may limit some of the genetic threats posed by the species small number of populations and overall small population size. Attempts to augment existing and establish new populations have been made in Georgia, but these efforts have had limited success (GNHP data, CNC 2010, Hodges pers. comm. 2013, 2014, von Schmeling pers. comm. 2016). As such, the one known established population is not yet considered a viable population for recovery.

Climate Change

The precise magnitude and impacts of climate change on the southeastern United States are uncertain, but models have projected that climate change in the region may include increased temperatures of 2 to 4°C (3.6 to 7.2°F) and reduced average annual precipitation by the end of the century (Joyce *et al.* 2011, Ingram *et al.* 2013). Specific effects of climate change on populations of Alabama leather flower are poorly understood; however, a variety of effects are possible. Climate change has the potential to affect distribution and abundance of plants by influencing seasonal weather patterns, frequency and timing of severe weather

events, and myriad plant physiological responses (Hawkins *et al.* 2008). Davenport (2007) suggested that Alabama leather flower may be negatively impacted by climate change within Alabama if available habitat becomes constricted under drier conditions. In addition, climate change may disrupt plant-pollinator interactions via phenological shifts in flowering and/or pollinator activity (Memmott *et al.* 2007, Hawkins *et al.* 2008), which may thereby reduce sexual reproduction of Alabama leather flower. Given that only two primary pollinators have been identified for Alabama leather flower, Wall *et al.* (2003) suggested that such asynchrony between flowering and pollinator activity may be particularly severe for this species. Given the variety and complexity of climate change's potential effects (cf. Hawkins *et al.* 2008, Walther 2010), more research is needed to assess its potential long-term impacts on Alabama leather flower populations and habitats.

D. Synthesis

Alabama leather flower is an extremely rare species that was known from only two sites at the time of listing in 1986. Despite intensive surveys since that time, the species is currently known from only eight natural populations: seven populations in Alabama and one in Georgia. Of these eight populations, only six have been confirmed to be extant in recent years. At least one population in Alabama has recently been extirpated and the status of one of the state's populations is uncertain, but has likely been extirpated. In addition, portions of two populations (i.e., two subpopulations) are of historical or uncertain statuses, as plants have not been relocated in recent years. Only two of the six extant natural populations are permanently protected from outright habitat destruction (e.g., conversion to agriculture or development), while one additional population receives limited protection from habitat destruction. Three populations are apparently large (1000+ stems) and two of are of moderate size (400–500 stems). An attempt to establish one population and augment another population in Georgia has been made, but success has been limited, particularly at the population establishment site; therefore, this population is not considered to contribute to the total number of populations needed to recover the species at this time. Progress has been in recovering this species; however, there remain many unanswered questions that need to be addressed relative to possible limiting factors for this species (see “Recommendations”). Furthermore, all populations continue to face some form of threat, primarily from habitat destruction and/or modification or the loss of plants and fitness from inadequate habitat management. At this time, Alabama leather flower continues to meet the definition of an endangered species under the Act.

III. RESULTS

A. Recommended Classification:

 X No change is needed

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Work with federal and state entities, non-governmental organizations, and private individuals to permanently protect and manage existing habitats and populations, including the development and implementation of management plans.
- Conduct surveys to locate additional populations.
- Conduct studies to determine the number and distribution of populations required to maintain the species' genetic diversity.
- Conduct studies into the species' life history, biology, habitat, and ecology to inform future population searches, management, and potential population augmentation and (re)establishment efforts.
- Investigate efficacy of habitat management techniques (e.g., fire). Update and improve monitoring and habitat management methods.
- Develop and implement long-term demographic monitoring to track population trends and evaluate management efforts.
- Expand *ex situ* conservation efforts to include plants from all known extant populations.
- Update the species' recovery plan to reflect current knowledge (e.g., distribution, habitats) and needs (e.g., data/knowledge deficiencies, management).

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Table 1. Population summaries of all known Alabama leather flower populations.

County, State	Location Name	Population Type	Habitat Type	Population Size (# Stems)	Last Observed	Owner	Current Status
St. Clair, AL	Dry Creek	Natural	Right-of-way & Woodland	≥1,852	2015	<i>TNC</i> ¹ ; Private	Extant
St. Clair, AL	Ashville	Natural	Right-of-way & Woodland	≈500	2015	Private	Extant
St. Clair, AL	St. Clair	Natural	Wetland Margin	50–100	2016	Private	Extant
Cherokee, AL	Moshat	Natural	Right-of-way & Pasture	≥10,000	2014	Private	Extant
Cherokee, AL	Ball Flat	Natural	Right-of-way	0	2014	Private	Possibly Extirpated
Cherokee, AL	Ellisville	Natural	Pasture	0	2014	Private	Extirpated
Etowah, AL	Gadsden	Natural	Woodland	1,000–5,000	2015	<i>City of Gadsden</i>	Extant
Floyd, GA	Little Dry Creek	Natural & Transplant	Woodland	≥400 (100) ²	2013 (2007 & 2008)	<i>GDOT</i>	Extant
Floyd, GA	Coosa Prairie	Transplant	Woodland	(200)	(2008)	<i>Private</i>	Extant ³

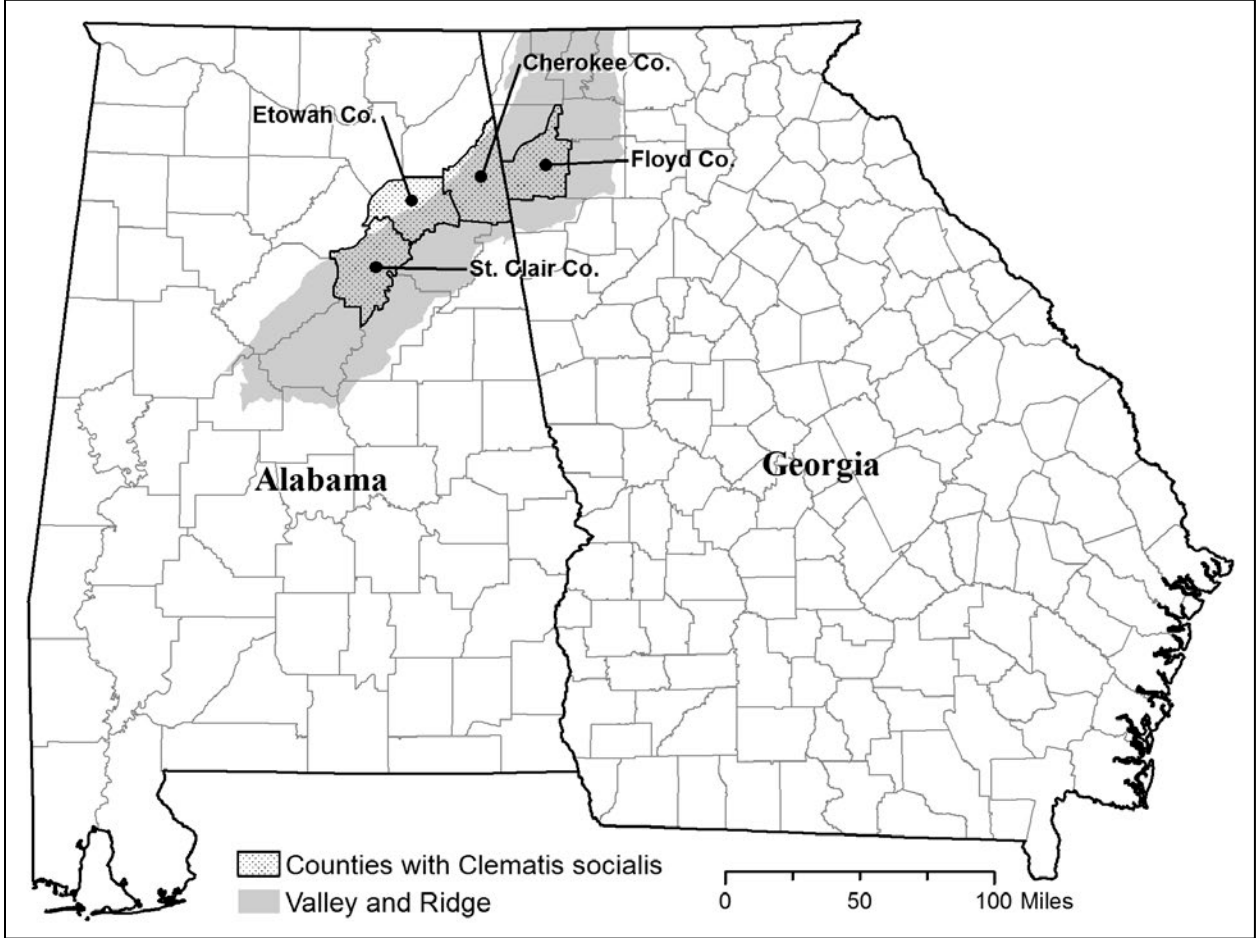
Notes: Sources include ANHP data, GNHP data, CNC 2010, Hodges pers. comm. 2013, 2014, Schotz pers. comm. 2014, Wiggers 2014, Byrd pers. comm. 2016a, b, Byrd 2016c, Thompson 2016, Moffett pers. comm. 2017.

¹Italics indicate populations receiving some level of protection (e.g., TNC preserve, public ownership, or conservation easement).

²Total numbers of transplants planted and years transplanted are shown in parentheses.

³Transplant population not currently considered part of populations needed for recovery.

Figure 1. Alabama leather flower distribution.



**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Alabama Leather Flower (*Clematis socialis*)**

Current Classification: Endangered.

Recommendation resulting from the 5-Year Review:

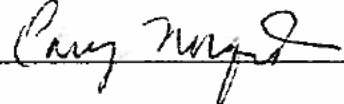
- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: Not applicable.

Review Conducted By: M. Scott Wiggers, Mississippi Field Office.

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve:  Date: 8/1/2017

In 2014, Southeast Region Field Supervisors were delegated authority to approve 5-year reviews that do not recommend a status change.

Appendix A. Summary of peer review for the 5-year review of Alabama leather flower (*Clematis socialis*)

A. Peer Review Method: Peer review was coordinated by the Service's Tennessee Ecological Services Field Office. Five peer reviewers were selected by the Service for their knowledge of and expertise with Alabama leather flower. Individual responses were received from one of the six of the invited peer reviewers.

Peer Reviewers: Dr. T. Wayne Barger, State Botanist, Alabama Department of Conservation and Natural Resources, State Lands Division, Natural Heritage Section, Montgomery, Alabama; Dr. Robert Boyd, Professor and Undergraduate Program Officer, Department of Biological Sciences, Auburn University, Alabama; Dr. Leslie R. Goertzen, Associate Professor, Department of Biological Sciences, and Director of the John D. Freeman Herbarium, Museum of Natural History, Auburn University, Alabama; Dr. Mincy Moffett, Botanist/Vegetation Management Ecologist, Georgia Department of Natural Resources, Wildlife Resources Division, Nongame Conservation Section, Social Circle, Georgia; Dr. Jennifer Trusty, Principal, Folius Consulting, Camp Hill, Alabama.

B. Peer Review Charge: See attached text from the peer review invitation letter.

C. Summary of Peer Review Comments: Only Dr. Robert Boyd accepted the peer review invitation and submitted comments. Dr. Boyd noted that the review appropriately incorporated and applied the best available scientific information for Alabama leather flower and accepted the Service's conclusions.

D. Response to Peer Review: We thank Dr. Boyd for his review and comments. Dr. Boyd's comments were supportive of the information used in and conclusions of the review; therefore, no revisions to the review are necessary as a result of these comments.

Peer Review Invitation Letter Text

On August 30, 2016, the U.S. Fish and Wildlife Service published a notice in the *Federal Register* (81 FR 59650) announcing a five-year review of 22 federally listed species, including Alabama leather flower (*Clematis socialis*). The purpose of five-year reviews is to ensure that the classification of species as threatened or endangered is accurate and reflects the best available information.

Following Service current policy and guidelines on the process to conduct independent peer review, we are assisting our Mississippi Field Office to complete peer review of the science in the 5-year review for Alabama leather flower. You have provided data used to review the status of Alabama leather flower and are knowledgeable about it. Therefore, in order to ensure that the best available information has been used to conduct this five-year review, we now request your peer review of the attached document. Specifically we ask for comments on:

- Have we assembled the best available scientific and commercial information?
- Is our analysis of this information correct and properly applied?
- Can you identify any additional new information on Alabama leather flower that has not been considered in this review?

Please note that we are not seeking your opinion of the legal status of this species, but rather that the best available data and analyses were considered in reassessing its status.

As part of the peer review process, we must evaluate the potential for conflicts of interest with the subject species or the action. We therefore ask that you fill out the enclosed Conflict of Interest form and return it to this office with any notes, comments, or questions that you are willing to provide as your review.

We appreciate your interest in furthering the conservation of rare plants and animals by becoming directly involved in the review process of our Nation's threatened and endangered species. Your review and comments will become a part of the administrative record for this species, and you can be certain that your information, comments, and recommendations will receive serious consideration.

We hope that you view this peer review process as a worthwhile undertaking. Please give me a call (931-525-4983) or send me an e-mail (geoff_call@fws.gov) if you have any questions on this peer review. We have enclosed additional guidance to help you in this evaluation. Please share your response by email or letter by July 14, 2017. Thank you in advance for your assistance.