Cooley's Water-willow (*Justicia cooleyi*)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Jacksonville Ecological Services Field Office
Southeast Region
Jacksonville, Florida

5-YEAR REVIEW
Cooley's water-willow/*Justicia cooleyi*

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 history, and habitat of this species. The Service's lead recovery biologist for this species conducted the review. Our sources include the final rule listing this species under the Endangered Species Act (Act); the recovery plan; peer reviewed scientific publications; unpublished field observations by the U.S. Fish and Wildlife Service (Service), State, and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists. The public notice for this review was published on April 9, 2009 (74 FR 16230), with a 60-day public comment period. Public comments were received from three individuals from the following agencies or organizations: Florida Department of Agriculture and Consumer Services (FDACS), Florida Natural Areas Inventory (FNAI), and Bok Tower Gardens (BTG). The draft of this document was distributed for peer review (see Appendix A) and comments received were addressed.

B. Reviewers

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

Lead Field Office - Jacksonville, FL, Ecological Services: Annie Dziergowski, 904-731-3089

C. Background

1. FR Notice citation announcing initiation of this review: 74 FR 16230, April 9, 2009

2. Species status: Unknown (2009 Recovery Data Call). The most recent rangewide population survey was conducted in 1992. Cooley's water-willow is endemic to the Brooksville Ridge in north Central Hernando County, Florida. All known populations have been found in that area, except for one population found in Sumter County near Mascotte, Florida. There are several populations found on conservation lands, including the Florida Department of Forestry (FDOF) Withlacoochee State Forest and the U.S. Department of Agriculture (USDA) Plant Materials Center and Subtropical Agricultural Research Station (STARS). Threats include: limerock mining, clearcutting of hardwood forests, agricultural and residential development, road development, and competition from invasive plants. Management needs include a coordinated program to protect hardwood forest habitat, a thorough search to accurately determine the water-willow's distribution and abundance, eradication of invasive

plants, and monitor and protection of all known populations. Due to the lack of recent surveys, we are uncertain about the status of this species.

3. **Recovery achieved:** 1 (0-25% recovery objectives achieved)

4. **Listing history:**
Original Listing
FR notice: 54 FR 31190
Date listed: July 27, 1989
Entity listed: Species
Classification: Endangered

5. **Associated rulemakings:** None.

6. **Review History:**

A previous 5-year review for this species was noticed on November 6, l991 (56 FR 56882). In this review, many species were simultaneously evaluated with no in-depth assessment of the Act's five threat factors as they pertained to the individual species. The notices summarily listed these species and stated that no changes in the designation of these species were warranted at that time. In particular, no changes were proposed for the status of the species in this review.

Final Recovery Plan - 1994

Recovery Data Call – 2009, 2008, 2007, 2006, 2005, 2004, 2003, 2002, 2001, 2000, 1999, and 1998.

7. **Species' Recovery Priority Number at start of review (48 FR 43098):** 8. The "8" indicates a moderate degree of threat and high recovery potential.

8. **Recovery Plan:**

Name of plan: Recovery Plan for Brooksville Bellflower and Cooley's Water-Willow
Date issued: June 20, 1994

II. REVIEW ANALYSIS

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

1. **Is the species under review listed as a DPS?** No. The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife.

This definition limits listing of a DPS 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? No. New information on this species has been collected since the recovery plan was written in 1994. As a result, the recovery goals and criteria should be revised to address the recovery actions needed to reduce threats to this species.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)? No. Factor A (present or threatened destruction, modification, or curtailment of its habitat or range) was identified as the primary threat affecting the species when the recovery criteria were developed. Since then, deer predation and fungal or bacterial disease (Factor C) and inadequacy of existing regulatory mechanisms (Factor D) have been identified as potential threats to this species.

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. **For threats-related recovery criteria, please note which of the 5 listing factors are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.**

The recovery criteria identified for *Justicia cooleyi* in the 1994 recovery plan for the species are as follows:

To develop objective, measurable criteria, we need to better understand the distributions of this plant. Delisting of this species should become feasible as habitat is protected and new populations are (re)established.

Plausible criteria for recovery for Cooley's water-willow recovery would require at least 15 viable and self-sustaining populations, totaling at least

10,000 individuals. Population viability at recovery levels must be demonstrated for 10 consecutive years.

The recovery criteria may be considered subjective or not measurable, since "self-sustaining" and "viable" can be difficult to define. It is our recommendation to revise the current recovery plan to include objective and measurable recovery criteria, as well as new information on the biology of this species.

Of the five listing factors, habitat loss from development due to urbanization and habitat alteration, which includes the introduction of invasive plant species, has resulted in the loss of sites where this plant was formerly found (Factor A). This species is only known to occur at possibly six sites in Hernando and Sumter Counties; the exact number of sites is uncertain due to a lack of recent surveys. Although not identified in the existing recovery criteria, deer predation and fungal and bacterial disease (Factor C) and inadequacy of regulatory mechanisms (Factor D) have been identified as potential threats to this species. Factors B and E have not been documented as threats at this time.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Abundance, population trends, demographic features, or demographic trends: *Justicia cooleyi* has not been consistently monitored since it was originally found near Mascotte in Sumter County in 1925 (USFWS 1994). Additional surveys were conducted in the 1980s and confirmed the presence of this species at several of the historical locations (Wunderlin et al. 1980). The most recent rangewide surveys were conducted in 1992, which also confirmed the presence of this species at several of the historic locations (Chichardi 1992). Landry (1995) did conduct additional surveys on the USDA sites in 1995. Current surveys are needed throughout Hernando and Sumter Counties to determine the abundance of this species.

J. cooleyi is found at two sites on two properties owned and operated by the USDA (i.e., Plant Materials Center and STARS), both in Hernando County. Surveys conducted in 1995 found three sites at the Plant Materials Center with a total of approximately 1500 plants (Landry 1995). During his research at these sites, Landry (1995) determined that this species is rhizomatous with two to three above ground stems

per plant. This made it difficult to determine if the observed above ground stems were from one or more plants.

In the 2001 Withlacoochee State Forest Management Plan (FDOF 2001), this species was documented at two sites within the forest boundaries: McKethan Lake Recreation Area at the Headquarters Tract and the Baird Tract. The 2001 surveys at the Baird Tract found a larger population than originally thought. At the Headquarters site, *J. cooleyi* has been removed out of an area planned for a parking lot and transplanted elsewhere on the property. These plants have done well with the relocation at the new site. Both of these sites have invasive species such as skunk vine (*Paederia foetida*) and air-potato (*Dioscorea bulbifera*) that are in competition with *J. cooleyi.* Invasive control is in place to manage this threat and had shown to be effective.

J. cooleyi has also been at two sites found along Highway 50 in Sumter County and Highway 98 in Hernando County, and on private lands bordering both roadways in both counties. The Florida Department of Transportation (FDOT) has maintained both of these sites by mowing and herbicide treatments to control invasive species in areas occupied by *J. cooleyi.*

Seed collection and cuttings have been made at several locations throughout the years in Hernando County. Seeds were collected in 1991 and then stored at the National Center for Genetic Resources Preservation in Fort Collins, CO. The germination rate was 92% when checked in 1991. The seeds were placed into liquid nitrogen cryogenic storage (Campbell, BTG, personal communication 2009). Recently BTG has been working on the development of a germination protocol for this species and has found a high germination rate, in which the fresh seed germinated in a short period of time (Campbell, BTG, personal communication 2009). The results of the germination research being conducted by BTG may provide justification for exploring the potential for future reintroductions of this species at protected sites within its historic range.

b. Genetics, genetic variation, or trends in genetic variation: No new genetic information is available for this species.

c. Taxonomic classification or changes in nomenclature: None. The Integrated Taxonomic Information System (ITIS 2010) was checked while conducting this review.

d. **Spatial distribution, trends in spatial distribution, or historic range:** *Justicia cooleyi* was first collected off Highway 50 near Mascotte in Sumter County in 1925 and documented again in the 1950s around Chinsegut Hill area in Hernando County (Wunderlin et al. 1980). Wunderlin et al. (1980) confirmed the historical occurrences in his report for the Service. Surveys conducted in 1992 and 1995 confirmed the presence of this species at most of the historical locations along roadways and at both the USDA Plant Materials Center and USDA STARS in Hernando County (Chicardi 1992, Landry 1995). Most of these sites are found in the Annutiliga Hammock northwest of Brooksville.

Withlacoochee State Forest has also reported *J. cooleyi* at two sites: McKethan Lake Recreation Area at the Headquarters Tract and Baird Tract (FDOF 2001). The plants at the Headquarters Tract were relocated to another area within the same Tract for the construction of a parking lot.

This species has also been located along Highway 98/50 in Hernando and Sumter Counties, and on private lands bordering this road.

e. **Habitat or ecosystem conditions:** *Justicia cooleyi* has mainly been found in the hardwood or hardwood pine forests in north central Hernando County (including Chinsegut Hill) and one known hardwood forest in Sumter County (USFWS 1994, Landry 1995). Soils range from moist to seasonally wet fine sandy loam to silty clay loam, usually underlain by limestone, occasionally with limestone outcroppings (Landry 1995).

The overstory where this species is found is mainly hardwood species, including southern magnolias (*Magnolia grandiflora*), black gum (*Nyssa sylvatica*), cabbage palm (*Sabal palmetto*), pignut hickory (*Carya glabra*), laurel oak (*Quercus laurifolia*), live oak (*Quercus virginiana*), water oak (*Quercus nigra*), winged elm (*Ulmus alata*), sweetgum (*Liquidambar styraciflua*), and sugarberry (*Celtis laevigata*) (Wunderlin et al. 1980). The understory is made up of American hornbeam (*Carpinus caroliniana*), eastern hophornbeam (*Ostrya virginica*), dwarf palmetto (*Sabal minor*), beautybush (*Callicarpa americana*), and yaupon holly (*Ilex vomitoria*) (Landry 1995). There are also many herbaceous species of plants including ferns, grasses, and sedges that occur in these areas. This species is also found along roadways among various species of grasses and herbs (USFWS 1994).

Invasive nonnative species such as skunk vine (*Paederia foetida*), air-potato (*Dioscorea bulbifera*), cogon grass (*Imperata cylindrica*), and coral ardisia (*Ardisia crenata*) form dense ground cover that excludes native plants such as *J. cooleyi* (Landry 1995). Control of these invasive nonnative species is needed before they spread into areas occupied by *J. cooleyi*.

f. **Other:** No new information.

2. Five-Factor Analysis

a. Present or threatened destruction, modification or curtailment of its habitat or range: Habitat destruction remains the greatest threat to *J. cooleyi*. The loss of hardwood forest to residential and agricultural development was the primary threat impacting the species and resulting in the need for its listing under the Act (USFWS 1994). It is unknown how much occupied habitat for this species has been lost due to development since a complete survey of the historic range has not been completed since 1992. Although lands that FDOF and USDA manage are being protected, there are still private lands throughout the species' historic range where the species may still occur that could be lost due to habitat destruction or degradation.

Most of the suitable habitat for this species in Hernando County was lost by the mid-1970s to limestone mining that took place between 1883 and 1966. Aerial photography from the 1980s shows that most of the *J. cooleyi* habitat had been destroyed or reduced around the Brooksville Quarry (Chicardi 1992). In 1992, there was no access to the mining property, however, we have not attempted to access the site since 1992 and do not know if this species still occurs at this site in areas where mining has not occurred (Chicardi 1992, USFWS 1994).

Another threat that impacts the species' habitat is the lack of controlling invasive plants in areas where they are encroaching J. *cooleyi* habitat, which has negatively affected this species throughout its range. Invasive plant species have become a recent threat with their spread throughout Hernando County. Both skunk vine and air-potato are found on USDA lands, Withlacoochee State Forest, and along roadways where *J. cooleyi* is found. Skunk vine forms dense ground cover and excludes native species. Air-potato can be more severe in the exclusion of species since it can occur in large numbers along

roadways (Chicardi 1992). The introduction of cogon grass along the right-of-ways, as well as on adjacent sites occupied by this species, has reduced the amount of suitable habitat for this species. Coral ardisia has been found at the Headquarters Tract in the Withlacoochee State Forest, which becomes thick and excludes native plants from growing (USFWS 1994).

Both the Withlacoochee State Forest and FDOT have been using herbicides to eradicate invasive species at the Baird Tract and along roadways. The FDOT has been maintaining these roadways by mowing, which controls invasive plants, but needs to be conducted outside of the flowering/reproductive cycle (October to December) (Landry 1995). More research is needed to determine if mowing does in fact have a positive or negative effect on this species. FDOT has also been applying herbicide treatments in areas where exotic species such as cogon grass (*Imperata cylindrica*) occur. This treatment needs to take place outside of the reproductive cycle. Control of these invasive species is needed to prevent the loss of this species at most of the sites where it is known to occur. However, more monitoring is needed to determine the effects of herbicides on this species.

b. **Overutilization for commercial, recreational, scientific, or educational purposes:** Not known as a threat at the time of listing or at present.

c. **Disease or predation:** Deer herds have been documented browsing heavily on *J. cooleyi* at the Headquarters Tract in the Withlacoochee State Forest (FDOF 2001). This predation has resulted in reducing the size and density of this plant at this site. More information is needed to determine if the threat of vertebrate predation on this species has increased beyond what has naturally occurred and is causing a decline in the populations.

A fungal or bacterial disease has been found and is affecting the plants at the USDA Plant Materials Center (USFWS 1994, Landry 1995). There have been no attempts to identify the pathogen to determine the best treatment for this species.

d. **Inadequacy of existing regulatory mechanisms:** *Justicia cooleyi* is listed as endangered by the State of Florida on the Regulated Plant Index (Florida Department of Agriculture and Consumer Services Rule 5B-40). This law regulates the taking, transport, and sale of listed plants. It does not prohibit

private property owners from destroying populations of listed plants on their property nor require landowners to manage habitats to maintain populations. Existing Federal and State regulations prohibit the removal or destruction of listed plant species on public lands. However, such regulations afford no protection to listed plants on private lands. The ESA only protects populations from disturbances on Federal lands or when a 'Federal nexus' is involved for other lands, meaning any action that is authorized (e.g. permitted), funded or carried out by a Federal agency. In addition, State regulations are less stringent than Federal regulations toward land management practices that may adversely affect populations of listed plants on private land.

J. cooleyi is located on State conservation lands and USDA lands in Hernando County. *J. cooleyi* is also found along roadways and private lands at several sites in Hernando and Sumter Counties. In the absence of protections provided under the Act, we believe existing State regulatory mechanisms described above are inadequate to protect this species.

e. Other natural or manmade factors affecting its continued existence: Not a threat at this time.

Of the five listing factors, habitat loss and degradation (Factor A) are the only known threats to *J. cooleyi*. There are potential concerns regarding both deer predation and fungal or bacterial disease (Factor C), and inadequacy of existing regulatory mechanisms (Factor D) that may affect populations of this species. Factors B and E have not been considered threats at this time.

D. Synthesis

The current recovery criteria for *J. cooleyi* are objective and measurable; however, not all known threats are addressed by the recovery criteria. Therefore, the recovery goals and criteria should be revised to better address the recovery actions needed to reduce threats to this species. In addition, the recovery plan should be revised to include more updated information about the species and its management needs.

J. cooleyi is only known to occur at possibly six sites in Hernando and Sumter Counties. The exact number of sites is uncertain due to lack of a rangewide survey since 1992. Additional information is needed on the distribution of this species throughout its historic range.

The primary threats to *J. cooleyi* have been from habitat loss and competition with invasive plant species. Habitat destruction remains the greatest threat to *J. cooleyi.* The loss of hardwood forests to residential and agricultural development was believed to be the most significant threat impacting the species at the time of its listing. However, limestone mining that has occurred for the past 40 years in Hernando County has potentially decreased the amount of suitable habitat for this species as well.

Invasive plants are encroaching into areas occupied by *J. cooleyi* and are continuing to negatively affect this species throughout its range. However, both FDOF and FDOT have been using herbicide treatments to eliminate invasive species (such as skunk vine and cogon grass) in areas where *J. cooleyi* occurs. However, the timing of these herbicides needs to take place outside of the flowering/reproductive cycle of *J. cooleyi*. More invasive plant control is needed to prevent the loss of this species at these sites, as well as monitoring the effects of herbicide treatments on this species.

In summary, *J. cooleyi* continues to be threatened by habitat destruction and degradation, as well as competition with invasive plant species. Loss of habitat due to development and limestone mining is likely to continue to threaten *J. cooleyi* in Hernando County. Only two out of possibly six sites are in long-term protection, but 10 viable and self-sustaining populations are needed to meet the recovery criteria for reclassification to threatened status. This species remains in danger of extinction throughout all or a significant portion of its range.

III. RESULTS

A. Recommended Classification: No change is needed.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Revise the current recovery plan to include updated objective and measurable recovery criteria for reclassifying this species to threatened status and delisting that are related to reducing the threats identified in the recovery plan, as well as updated information on the species distribution and biology.

2. Support further research on:

   a. Effects of mowing and predator control on this species.

   b. Life history needs.

   c. Microhabitat requirements of this species.

   d. Identification and treatment of the pathogen causing the fungal or bacterial disease.

e. Genetics of this species.

f. Transplant experiments, long-term seed viability trials, and optimizing germination protocols.

3. Continue working with public land managers to increase management efforts to benefit *J. cooleyi* on their lands.

4. Conduct surveys at known sites of occurrence and expand surveys to other suitable areas in Hernando and Sumter Counties to provide distribution information needed to determine where plants currently exist and to prioritize recovery actions such as reintroductions at suitable sites.

5. Determine effective methods to control invasive species in areas where *J. cooleyi* occurs. Follow up with monitoring of herbicide treatment effects on this species.

V. REFERENCES

Campbell, C. 2009. Personal Communication. Summary of status of *Justicia cooleyi* (seed collections). Bok Tower Gardens, Lake Wales, Florida, to Jacksonville Field Office, Jacksonville, Florida.

Chicardi, E.J. 1992. Site evaluations and habitat management of *Justicia cooleyi* and *Campanula robinsiae.* Final report for Florida Natural Areas Inventory, Tallahassee, Florida.

Florida Division of Forestry. 2001. Withlacoochee State Forest Five-Year Management Plan. Office of Florida Department of Agriculture and Consumer Services, Tallahassee, Florida.

Landry, S. 1995. Monitoring plan for *Justicia cooleyi* at the USDA Plant Material Center, Hernando, Florida. Final Report to Florida Statewide Endangered and Threatened Plant Conservation Program, Tallahassee, Florida.

U.S. Fish and Wildlife Service. 1994. Recovery plan for Brooksville bellflower (*Campanula robinsiae*) and Cooley's water-willow (*Justicia cooleyi*). Atlanta, Georgia.

Wunderlin, R., D. Richardson, and B. Hansen. 1980. *Justicia cooleyi*. Status report prepared for U.S. Fish and Wildlife Service, Atlanta, Georgia.

U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of Cooley's water-willow (*Justicia cooleyi*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review: No change

Review Conducted By: Annie Dziergowski

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 7/14/10
David L. Hankla

REGIONAL OFFICE APPROVAL:

Acting
Lead Regional Director, Fish and Wildlife Service

Approve Aaron L Valenti Date 7-8-10

APPENDIX

Summary of peer review for the 5-year review of Cooley's water-willow (*Justicia cooleyi*)

A. Peer Review Method: See B. below.

B. Peer Review Charge: *On May 26, 2010, the following letter and Guidance for Peer Reviewers of Five-Year Status Reviews were sent via e-mail to potential reviewers requesting comments on the 5-year review. Requests were sent to Michael Jenkins (Florida Division of Forestry), Cheryl Peterson (Bok Tower Gardens), Amy Jenkins (Florida Natural Areas Inventory), and Vince Morris (Florida Division of Forestry).*

We request your assistance in serving as a peer reviewer of the U.S. Fish and Wildlife Service (Service) 5-year status review of the endangered Cooley's water-willow (Justicia cooleyi). The 5-year review is required by section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 et seq.). A 5-year review is a periodic process conducted to ensure the listing classification of a species as threatened or endangered on the Federal List of Endangered and Threatened Wildlife and Plants is accurate. The initiation of the 5-year review for the Cooley's water-willow was announced in the Federal Register on April 9, 2009, and the public comment period closed on June 8, 2009. Several comments were received on the notice for this species.

The enclosed draft of the status review has been prepared by the Service pursuant to the Act. In keeping with Service directives for maintaining a high level of scientific integrity in the official documents our agency produces, we are seeking your assistance as a peer reviewer for this draft. Guidance for peer reviewers is enclosed with this letter. If you are able to assist us, we request your comments be received in this office on or before June 17, 2010. Please send your comments to Annie Dziergowski at the address on this letter. You may fax your comments to Annie Dziergowski at (904)731-3045 or send comments by e-mail to Annie_Dziergowski@fws.gov.

We appreciate your assistance in helping to ensure our decisions continue to be based on the best available science. If you have any questions or need additional information, please contact Annie Dziergowski at (904)731-3089. Thank you for your assistance.

Sincerely yours,

David L. Hankla
Field Supervisor

Enclosures

Guidance for Peer Reviewers of Five-Year Status Reviews

U.S. Fish and Wildlife Service, Jacksonville Ecological Services Field Office

July 5, 2007

As a peer reviewer, you are asked to adhere to the following guidance to ensure your review complies with Service policy.

Peer reviewers should:

1. *Review all materials provided by the Service.*

2. *Identify, review, and provide other relevant data apparently not used by the Service.*

3. *Not provide recommendations on the Endangered Species Act (ESA) classification (e.g., endangered, threatened) of the species.*

4. *Provide written comments on:*
   - *Validity of any models, data, or analyses used or relied on in the review.*
   - *Adequacy of the data (e.g., are the data sufficient to support the biological conclusions reached). If data are inadequate, identify additional data or studies that are needed to adequately justify biological conclusions.*
   - *Oversights, omissions, and inconsistencies.*
   - *Reasonableness of judgments made from the scientific evidence.*
   - *Scientific uncertainties by ensuring that they are clearly identified and characterized, and that potential implications of uncertainties for the technical conclusions drawn are clear.*
   - *Strengths and limitation of the overall product.*

5. *Keep in mind the requirement that we must use the best available scientific data in determining the species' status. This does not mean we must have statistically significant data on population trends or data from all known populations.*

All peer reviews and comments will be public documents, and portions may be incorporated verbatim into our final decision document with appropriate credit given to the author of the review.

Questions regarding this guidance, the peer review process, or other aspects of the Service's recovery planning process should be referred to Annie Dziergowski, U.S. Fish and Wildlife Service, at 904-731-3089 email: annie_dziergowski@fws.gov.

C. Summary of Peer Review Comments/Report

A summary of peer review comments is provided below. The complete set of comments is available at the Jacksonville, Ecological Services Field Office, U.S. Fish and Wildlife Service, 7915 Baymeadows Way, Suite 200, Jacksonville, Florida 32256-7517.

Michael Jenkins, Florida Division of Forestry, Plant Conservation, Tallahassee, Florida: Mr. Jenkins suggested minor edits and comments with regards to the impending need for research.

Amy Jenkins, Florida Natural Areas Inventory, Tallahassee, Florida: Ms. Jenkins provided comments on various sections throughout the review. These comments included the need for monitoring and determining the effects herbicides treatments may have on this species. She suggests the need for additional funding to conduct follow-up to the herbicide treatments as well as having expert on site during herbicide treatments. She also commented on the use of mowing as a management tool. Additional comments were made on conducting a deer fencing experiment to see effects would benefit this species. She also supported the need to work with land managers to increase efforts to benefit *J. cooleyi*.

Cindy Campbell, Bok Towers Gardens, Lake Wales, Florida: Ms. Campbell provided comments and clarification in several sections. Minor edits were suggested.

D. Response to Peer Review:

The Service accepted all minor edits from peer reviewers. Overall reviewers felt the draft document adequately characterized the known information on the status and threats of the listed populations.

Michael Jenkins, Florida Division of Forestry, Plant Conservation, Tallahassee, Florida: All comments provided by Mr. Jenkins were incorporated.

Amy Jenkins, Florida Natural Areas Inventory, Tallahassee, Florida: All comments provided by Ms. Jenkins were incorporated. We also included recommendations on further research needs.

Cindy Campbell, Bok Towers Gardens, Lake Wales, Florida: All comments provided by Ms. Campbell were incorporated.