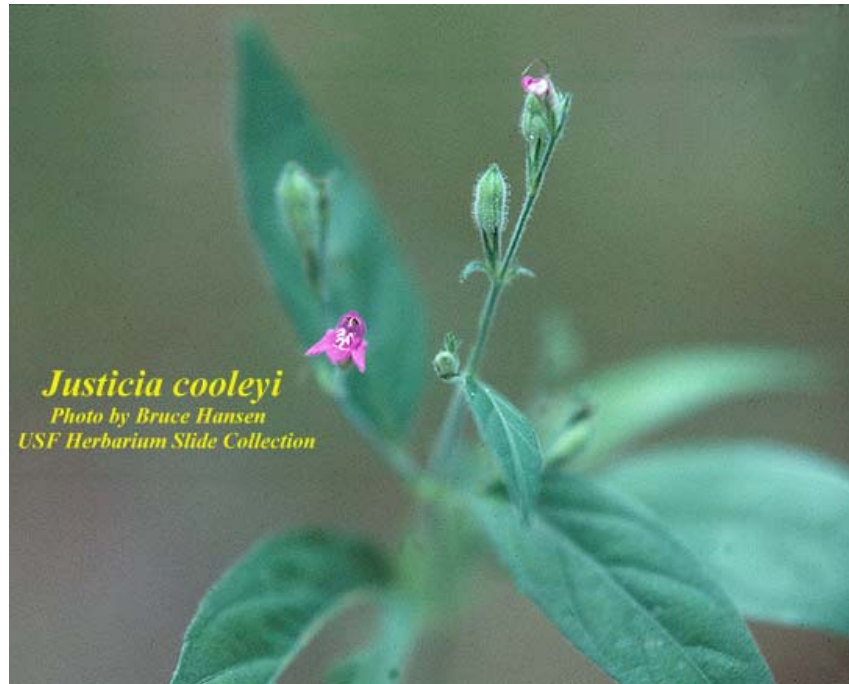


## Cooley's Water-willow (*Justicia cooleyi*)

### 5-Year Review: Summary and Evaluation



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

†Please see Addendum 1 at the end of this, our original 5-year review document. The Addendum provides limited new information we have gathered for our second 5-year review for this endangered plant that was initiated in the Federal Register (May 7, 2018 83 FR 20092) and the analysis we have shared to explain the basis for continuing to recommend no change in status for this species.

## **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listing this species under the Endangered Species Act (Act); the recovery plan; peer reviewed scientific publications; unpublished field observations by the U.S. Fish and Wildlife Service (Service), State, and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists.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, 1991 (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  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](mailto: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](mailto: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.

**Cooley's Water Willow (*Justicia cooleyi*)**

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



Photo: Colleen Werner, Withlacoochee State Forest

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

**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW OF COOLEY'S WATER WILLOW**  
*(Justicia cooleyi)*

**Addendum 1. Summary of new information obtained since the 2010 5-year review**

The *Federal Register* notice announcing the initiation of this 5-year review was published on May 7, 2018 (83 FR 20092). No comments were received during the 60-day public comment period following this notice.

**I. GENERAL INFORMATION**

There are limited updates to this section since completion of the 2010 5-year review (U.S. Fish and Wildlife Service [Service] 2010). Updated information is presented below, only to those sections where we had new information. Peer review was not conducted since there was limited data on this species and its threats.

**A. Reviewers**

**Lead Region:** Southeast Region, Kelly Bibb (404) 679-7131

**Lead Field Office:** North Florida Field Office, Katie Conrad (904) 731-3056

**B. Background**

- 1. Species Status:** Unknown. Systematic counts have not been completed for any of the populations since the last 5-year review (Werner, WSF pers. comm. 2018) and a range-wide survey has not taken place since 1992 (Chicardi 1992). There are eleven extant populations of this species. However, one population is on private land and another is threatened by a road-widening project. This species is found in three counties: Hernando, Citrus, and Sumter. Since there is limited data on the number of plants in each population, it is difficult to determine the species' status. Ten out of eleven extant populations are on public land within the Withlacoochee State Forest (WSF), which is managed by the Florida Forest Service. These populations are Annutteliga (Hernando), Cason (Hernando), Citrus (Citrus), Headquarters (Hernando), Croom (Hernando), T.G. Lee (Sumter), Baird- Island (Sumter), Baird-North (Sumter), Baird- SR 50 (Sumter), and Baird- Cedar Lodge Hammock (Sumter). The new populations since the 2010 5-year review are Cason, T.G. Lee, Baird- Island, and Baird- Cedar Lodge Hammock populations. The Annutteliga and Citrus populations were documented a few years before 2010 but were not mentioned in the previous 5-year review. Four populations were discovered in 2009, likely after the data for 5-year review was already compiled: Cason, Croom, Baird- Island, Vulcan Mine (the only privately owned site). During herbicide treatments to manage invasive exotic plant species, WSF documents *J. cooleyi*'s presence but does not complete

systematic counts. Seven of the ten public WSF sites have received herbicide treatment for invasive exotic plant species, four of these sites annually since 2009. The only private property containing an extant population is the Vulcan Mine site, where 150 plants were documented during a survey in 2009. There are four historic populations on public land that have not been surveyed since the 1980s or 1990s: Chinsegut Hill Wildlife and Environmental Area (Florida Fish and Wildlife Conservation Commission), Chinsegut Hill- Conference Center (University of South Florida), Brooksville Plant Materials Center (United States Department of Agriculture), and Baird- East (Withlacoochee State Forest). Seven historic populations documented on private land have not been surveyed since the last 5-year review. One property discovered in the 1950s is now a lime mine and it is unlikely that habitat remains. Two other populations have likely been paved over due to a road expansion project on Cortez Blvd/SR- 50. The status of the historic populations is unknown because they have not been surveyed for at least 18 years. Threats to this species include competition from invasive exotic plant species, habitat destruction by feral hogs (*Sus scrofa*), off-roading, development, road-widening projects, and overbrowsing by deer. Management is needed to control exotic invasive plant species, feral hogs, and deer populations. Annual monitoring of known populations and surveying potential sites for introductions and unknown populations is necessary to quantify abundance and extent of this species. Without regular habitat maintenance of known sites, it is possible that this species could disappear. Due to the lack of recent surveys and regular monitoring on other sites, the status of this plant species cannot be determined.

## II. REVIEW ANALYSIS

### A. Updated Information and Current Species Status

#### 1. Biology and Habitat

Data on abundance, population trends, distribution, biology, ecology, and habitat were summarized in the 2010 5-year review (see original document above this addendum). There is some new information on the species' biology and distribution and threats, which is additive to the last 5-year review and is summarized below.

#### Biology and Life History

This species is mainly found in mesic hammocks near rock outcrops and along property edges and roadways. There are many state endangered rare plants associated with mesic hammock habitats that co-occur with *J. cooleyi*. These species are widespread polypody (*Pecluma dispersa*), comb polypody (*Pecluma ptilota* var. *bourgeauana*), plume polypody (*Pecluma plumula*), Florida pinkroot (*Spigelia loganioides*), spiked crested coralroot (*Hexalectris spicata*), and gray ladiestresses (*Mesadenus lucayanus*) (Werner, WSF pers. comm. 2018).

During the last systematic count conducted by Landry in 1995, it was discovered that the species is rhizomatous (Landry 1995). The monitoring protocol has been to count all of the above ground stems, but several stems may belong to the same plant. The monitoring protocol has not changed.

### Abundance and Population Trends

Since the last 5-year review, no surveys have been conducted, but additional populations have been found while conducting invasive exotic plant eradication work within WSF (Werner, WSF pers. comm. 2018). Rangewide surveys have not been completed since 1992 (Chichardi 1992). Although more populations have been discovered, annual systematic counts of existing populations is necessary to determine the abundance of this species.

For this 5-year review, populations were defined as plants that were separated by less than 0.6 miles and within a single contiguous mesic hammock or along the same roadway. Populations were considered extant if plants have been found within the past ten years. Using this definition, there are currently eleven extant populations: Annutteliga, Cason, Citrus, Headquarters, Croom, T.G. Lee, Baird- Island, Baird- North, Baird- SR 50, Baird- Cedar Lodge Hammock, and Vulcan Mine. The Vulcan Mine population is the only population not on public land.

The Service's 2010 5-year review identified six populations: USDA Plant Materials Center, STARS, Headquarters, Baird, Highway 50, and Highway 98. USDA Plant Materials Center and STARS are now considered historic because they have not been surveyed in the past 10 years. The STARS population is referred to as two sites in this 5-year review, Chinsegut Hill and Chinsegut Hill Conference Center because they are separated by more than 0.6 miles and the ownership of the property has changed from STARS to the State. Baird referred to Baird- East, now considered a historic population because plants have not been documented for more than ten years, and Highway 50 referred to Baird- SR 50. Highway 98 referred to two sites along Highway 98 on private land that would now be considered two historic populations since they have not been documented in more than ten years and are separated by more than 0.6 miles.

The new populations since the 2010 5-year review are Cason, T.G. Lee, Baird- Island, and Baird- Cedar Lodge Hammock populations. The Annutteliga and Citrus populations were documented before 2010 but were not mentioned in the previous 5-year review. Four populations were discovered in 2009, likely after the data for 5-year review was already compiled: Vulcan Mine, Cason, Croom, and Baird- Island.

Ten out of the eleven extant populations are within WSF: Annutteliga, Cason, Headquarters, Citrus, T.G. Lee, Croom, Baird- SR 50, Baird- Cedar Lodge Hammock, Baird- Island, and Baird- North. The Annutteliga, Cason, Headquarters, and Croom populations are located in Hernando County. The Citrus population is located in Citrus County and the T.G. Lee and the Baird populations are located in

Sumter County. *J. cooleyi* is documented by WSF staff while conducting surveys for invasive exotic plant species. Herbicide treatments were conducted to help improve habitat for *J. cooleyi* and associated state endangered species found in rock outcroppings in hardwood hammocks. During these field visits, any obvious threats are noted such as off-roading, erosion, invasive plants, or natural disturbances. WSF receives funding for these treatments from the Florida Fish and Wildlife Conservation Commission (FWC) Invasive Plant Management Section, the FFS Forest Health Section, and section 6 grants under the ESA (FFS 2015).

The Annutteliga population was first documented in 2005. The Annutteliga population has received annual treatments for invasive exotic plants from 2013-2018. The major invasive exotic plant species affecting *J. cooleyi* within WSF are air potato (*Dioscorea bulbifera*), Japanese climbing fern (*Lygodium japonicum*), skunk vine (*Paederia foetida*), sword fern (*Nephrolepis cordifolia*), coral ardisia (*Ardisia crenata*), and camphor tree (*Cinnamomum camphora*) (FFS 2015). All of these species are classified as Category I invasive species by the Florida Exotic Pest Plant Council (FLEPPC 2019). This population is also threatened by extensive rooting by feral hogs (Werner, WSF pers. comm. 2018). Feral hogs have been documented trampling, rooting, and tearing up *J. cooleyi* plants. It is unknown whether the hogs eat *J. cooleyi*. Hunting is not allowed on this tract (Werner 2019b).

The Cason population was first recorded in 2009. It received herbicide treatments for exotic invasive plant species in 2009 and 2014-2017 (Werner, WSF pers. comm. 2018). Feral hogs are degrading habitat and destroying plants at this site. Off-roading is an issue in Cason because there are many entrances into the park and vehicles do not remain on the designated roads (Werner WSF pers. comm. 2019). There have been no direct impacts to plants as of yet, but off-roading has torn up vegetation near populations of *J. cooleyi* (Werner 2019b).

First documented in 2006, the Citrus population was not mentioned in the previous 5-year review. Invasive exotic plant species near this site have been treated yearly from 2009 to 2018. Feral hogs and off-roading are also threats to this population (Werner, WSF pers. comm. 2018). The FWC manages hunting on this tract (Werner 2019b).

The Headquarters population was transplanted because a parking lot was built on the site. It is still doing well and since the transplanting and spread to private land to the east of SR 41. This is the only population that is threatened by overgrazing by deer. There is also disturbance from feral hogs and invasive exotic plants. Invasive exotic plants have been treated annually from 2009 to 2018 (Werner pers. comm. WSF 2018). WSF is working with the Wounded Warrior Project to help control the deer and hog populations on this tract but it is not open for hunting otherwise (Werner WSF, pers. comm. 2019).

Discovered in 2009, the Croom population has been treated annually for exotic invasive plant species. There is extensive damage, such as plants run-over and ripped up, to the Croom Tract from off-roading vehicles but off-road vehicles have not

affected *J. cooleyi* plants (Werner, WSF pers. comm. 2018). Feral hogs are also a threat and the FWC manages hunting on this tract (Werner 2019b).

The T.G. Lee population was first documented in 2015. It has not received treatments for invasive exotic plant species. *J. cooleyi* was documented while small populations of exotic invasive plant species were being mapped. Feral hogs are a threat (Werner, WSF pers. comm. 2018).

The Baird- Island population was discovered in 2009, but no monitoring or invasive species treatment has been conducted since. The population is located on a hardwood hammock island and may be protected from exotic invasive plant species (Werner 2019a). Feral hogs are not a threat to this population, but hunting is allowed on this tract and is managed by the FWC (Werner 2019b).

First documented in 1991, the Baird- SR 50 population is considered separate from the Baird- Cedar Lodge Hammock population because the points that make up this population are along the same roadway and are under the same management. The Florida Department of Transportation (FDOT) has been maintaining this site by mowing and applying herbicide to kill exotic invasive plants (Werner, WSF pers. comm. 2019). This management does not seem to be negatively affecting the population and the extent of the population has expanded since the previous 5-year review. The FDOT has been using standard mowing procedures, maintaining the grass length between five and twelve inches. Herbicide is used to treat exotic invasive vegetation when it consists of more than 25% of the vegetation cover (Maggio 2019). The Baird- SR50 population is under threat from a road-widening project, which is still in the designing phase and is not yet funded. US 98/SR 50 will be widened from four lanes to six lanes from SR 35 (US 301) to CR33, encompassing Hernando, Sumter, and Lake Counties. The Florida Department of Transportation (FDOT) is working with Florida Forest Service on a plan for transplanting *J. cooleyi* and other rare species that may be affected by the road-widening project to other areas within the WSF (Lyon 2019). Feral hogs are not a threat to this population, but hunting is allowed and is managed by the FWC (Werner 2019b).

First documented in 2014, the Baird- Cedar Lodge Hammock population has received the most recent concentrated effort to treat invasive exotic plant species. In 2018, FFS spent a total of \$81,713 to treat invasive species from a combination of in-house funds and FWC Invasive Plant Management funds (Werner, WSF pers. comm. 2018). Feral hogs is a threat to this population, but hunting is allowed and is managed by the FWC (Werner 2019b).

The only population to be surveyed on private lands since the last 5-year review is the Vulcan Mine site off SR 98 in Hernando County, surveyed in 2009. This site likely still has *J. cooleyi* plants but is threatened by invasive exotic plant species. The site has not been surveyed since 2009 (Werner, WSF pers. comm. 2018).

Several populations have not been documented in more than ten years and are considered historic. Five populations are at least partially on public land: Chinsegut Hill- FWC (Hernando), Chinsegut Hill- Conference Center (Hernando), USDA Plant Materials Center (Hernando), and Baird- East (Sumter). Six populations on private land in Hernando County likely no longer exist.

The Chinsegut Hill- FWC population (formerly known as STARS) likely no longer has *J. cooleyi* because the property is overrun with invasive exotic plant species. The species was last observed in 1983 and the land is managed by the Florida Fish and Wildlife Commission (Werner, WSF pers. comm. 2018). The population was found on the edge of the state-owned tract.

The Chinsegut Hill- Conference Center population (formerly known as STARS) encompasses two properties owned by the University of South Florida and the United States Department of Agriculture (USDA). It is possible the site still has plants but likely has a problem with invasive exotic plant species. Over 1,000 plants were documented in 1995, but surveys have not been conducted since.

The USDA Plant Materials Center population was last observed in 1995 and could still have plants. Surveyors estimated approximately 1,500 plants in 1995 (Landry 1995). The population is on property owned by the USDA Plant Materials Center north of SR 41 and on private property south of SR 41. These properties likely have invasive exotic plants.

The Baird- East population (formerly known as Baird) is located along the edge of the Baird Tract. It was last monitored by WSF in 1990. The site may still have plants but is likely overgrown with exotic invasive plant species and is threatened by feral hogs (Werner, WFS pers. comm. 2018).

Seven populations on private land that have been developed or are considered no longer extant because they have not been surveyed in more than ten years. One population was developed as a mine and two others were likely paved over with road expansion projects. Three others were last observed in 1992. The remaining population was last observed in 2001. It is unknown whether plants still exist at these sites.

### Genetics

One preliminary genetics study has been conducted by Bok Tower Gardens (BTG). Samples from three populations from each county were collected and analyzed. The Citrus county population was found to be genetically unique (Peterson, BTG pers. comm. 2018). A more in-depth study using microsatellites is necessary to determine whether a certain population's genetics should be conserved. This information would be useful in determining where relocated plants should be placed and which populations should be used to source seed for introductions.

It is possible that *J. cooleyi* could hybridize with other *Justicia* species (native and non-native) that are grown as ornamentals in Florida (Peterson, BTG pers. comm. 2018). For example, Summer Sun Justicia (*J. corumbensis*) and Mexican honey suckle (*J. spicgera*) are available at plant nurseries in Florida and are grown for their bright orange flowers (Dave's Garden 2019).

According to genetic studies of the genus conducted by Rancho Santa Ana Botanic Garden (RSABG), the closest relative of *J. cooleyi* is *J. galapagana*, a species endemic to the Galapagos Islands (Kiel, RSABG pers. comm. 2018). Ongoing studies are investigating whether this is the case.

#### Taxonomic Classification

None. The Integrated Taxonomic Information System (ITIS 2019) was checked while conducting this review.

#### Population Augmentation and Establishment

When the Headquarters population was transplanted due to the construction of a parking lot, it is suspected that the local native plant society kept plants or seeds and sold them at local plant sales (Werner, WSF pers. comm. 2018). It is unknown whether the plants from the native plant society sales have been planted in other locations where they could affect the genetic diversity of the species by mixing with genetically distinct wild populations. The plants may also naturalize and spread to habitats that are not a part its historic range.

#### Ex Situ (Off-site) Safeguarding

There have been no seed collected for this species since 2010 and seed from as far back as 1988 is still in storage at the National Center for Genetic Resources Preservation in Fort Collins, Colorado. One germination trial was performed in 2010 with 49 fresh seeds that were collected from one plant grown at the BTG. The germination rate was 82% (Peterson 2019). After the germination trial, volunteer plants from dropped seed were sprouting in the greenhouse for five years (Peterson, BTG pers. comm. 2018).

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

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

Habitat degradation and destruction are the main threats to this species' eleven extant populations and is mainly caused by invasive species: exotic plants and feral hogs. Other threats to this species include development and off-roading.

WSF has been very active in attempting to control invasive species, including exotic plant species and feral hogs, within its borders and on adjacent lands. As time and funding allows, WSF conducts outreach to private landowners that border WSF to help control invasive species. WSF also participates in two Cooperative Invasive Species Management Areas (CISMAs): Green Swamp and Nature Coast. CISMAs are an alliance of stakeholders addressing invasive species management in defined geographic regions (FFS 2015).

Invasive exotic plant species was a secondary threat in the previous 5-year review and are now considered the most prominent threat for all but one of the extant populations (Baird- Island) (Werner, pers. comm. WSF 2018). Since *J. cooleyi* grows in hardwood hammocks, the main method of controlling invasive exotic plant species is herbicide and sometimes hand pulling. Fire would destroy hardwood habitat and biological control has not been developed for the invasive species present. WSF receives invasive species treatment funding from FWC Invasive Plant Management Section, the FFS Forest Health Section, and section 6 ESA grants to purchase herbicides and contract applicators (FFS 2015). From 2012 to 2016, WSF worked to control invasive exotic plant species with several sources of funding, including section 6 funding totaling \$16,973 (Werner, WSF pers. comm. 2018). The goal of this project was to reduce heavy woody invasive plant infestations to a maintenance level that would allow the work to be completed by WSF staff in-house. The project was successful at reducing the invasive species to sparse seedlings that can now be controlled with minimal effort (Werner 2016).

The major invasive plant species affecting *J. cooleyi* are air potato (*Dioscorea bulbifera*), Japanese climbing fern (*Lygodium japonicum*), skunk vine (*Paederia foetida*), sword fern (*Nephrolepis cordifolia*), coral ardisia (*Ardisia crenata*), and camphor tree (*Cinnamomum camphora*) (FFS 2015). All of these species are classified as Category I invasive species by the Florida Exotic Pest Plant Council (FLEPPC 2019).

Invasive exotic plant species such as Japanese climbing fern and air-potato can be spread by ground disturbing activities. WSF encourages policies that avoid spreading invasive species, such as cleaning equipment before it is used in a different area (FFS 2015). Skunk vine can create dense canopies that damage or kill native species by blocking out sunlight. It also can grow along the ground, smothering low growing plants like *J. cooleyi*. Skunk vine is increasing within WSF (FFS 2015). Coral ardisia has become a major threat to *J. cooleyi* at WSF, occupying over 300 acres. However, management is decreasing the number of acreage affected within WSF. Forestry biologists treat the species in the winter, which is when it would not be effective to treat other non-native species (FFS 2015).

Another invasive exotic species, feral hogs, have been documented trampling, uprooting, and tearing up *J. cooleyi* plants. It is unknown whether the hogs eat *J. cooleyi* (Werner 2019b). Feral hogs were not mentioned as a threat in the previous 5-year review. Feral hogs are now considered a threat for nine extant populations: Headquarters, Croom, T.G. Lee, Baird-N, Annutteliga, Cason, Baird- Island, Baird- Cedar Lodge Hammock, and Citrus (Werner 2019a). FWC has issued an administrative feral hog-trapping permit to FFS for all state forests, which allows FWS to issue trapping permits to individuals to remove feral hogs on certain tracts or in specific areas (FFS 2015). Hunting takes place on all WSF tracts containing populations of *J. cooleyi* except for Annutteliga.

In the previous 5-year review, habitat conversion to residential, agricultural, or mining development was the primary threat. At that time, there were only six extant populations, one of which was on private land. Since there are now eleven extant populations, ten of which are on public land, the threat of development has been reduced. However, two populations are under threat of development. The Baird- SR 50 population, even though it is on public land, is being threatened by a road-widening project and some plants will likely have to be relocated. In addition, the Vulcan Mine site, the only extant site on public land, could be developed.

Off-roading was not documented as a threat in the previous 5-year review. Off-roading currently threatens three extant populations: Cason, Croom, and Citrus (Werner, pers. comm. WSF 2018). Off-road vehicles have not been documented damaging plants, but have destroyed nearby vegetation. These populations are located within WSF tracts with multiple entrances and trail systems. Although not allowed to go off the trail, off-roading is a common occurrence because it is hard to enforce. It is only a matter of time before *J. cooleyi* plants are run-over by off-road vehicles.

Although WSF's efforts to address the invasive exotic plant species and feral hogs are benefiting *J. cooleyi* populations, continuous management is necessary to prevent habitat degradation and destruction. Development is considered a lesser threat because it only affects two extant populations. Off-roading have not directly affected any extant populations but could in the near future.

**b. Overutilization for commercial, recreational, scientific, or educational purposes:**

Not known as a threat at time of listing or at present. Ten out of the eleven extant sites are on State conservation lands and impacts should be minimal.

**c. Disease or predation:**

Overbrowsing by deer has been documented at the Headquarters tract. WSF is working with hunting groups to help control the deer population (Werner, WSF pers. comm. 2018).

A fungal or bacterial disease was found affecting the plants at the USDA Plants Materials Center (Landry 1995). There have still been no attempts to identify the pathogen to determine the best treatment for this species or determine whether other populations are affected.

**d. Inadequacy of existing regulatory mechanisms:**

Existing Federal and State regulations prohibit the removal or destruction of listed plant species on public lands. The Florida Administrative Code 5B-40 (Preservation of Native Flora in Florida) provides the Florida Department of Agriculture and Consumer Services with limited authority to protect these plants (primarily from the standpoint of illegal harvest) on state and 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.

Ten out of the eleven *J. cooleyi* populations are located on State conservation lands and one on private land. 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:**

Hybridization with exotic and other native *Justicia* species is a concern. *Justicia* species (native and non-native) are grown as ornamentals in Florida (Peterson, BTG pers. comm. 2018). As the human population within this area grows, the chance of hybridization increases. *J. cooleyi* occurs in the Central Region of Florida, which is projected to experience the greatest population growth in the state in the near future. By 2070, the percentage of developed land is expected to double from 25% in 2010 to almost 50% (Carr and Zwick 2016).

Transplanting *J. cooleyi* before genetic studies can determine whether populations are distinct could endanger the genetic diversity of the species. The local native plant society has sold plants derived from the Headquarters population. It is unknown whether these plants have been planted in other locations where they could affect the genetic diversity of the species by mixing with genetically distinct wild populations. The plants may also naturalize and spread to habitats that are not a part of its historic range.

Of the five listing factors, habitat loss and degradation (Factor A) is the primary threat to *J. cooleyi*. There are also concerns regarding Factor C, D, and E. Fungal and bacterial disease and overbrowsing by deer (Factor C) have been isolated to one population each. The inadequacy of existing regulatory mechanisms (Factor D) and hybridization with other *Justicia* species and between populations (Factor E) may negatively affect this species. Factor B is not considered a threat at this time.

### C. Synthesis

As stated in the 2010 5-Year Review, the recovery plan needs to be updated to include new information about the species distribution and biology, which should then be used to update the recovery criteria and actions. The current recovery or delisting criteria are objective and measurable, stating that at least 15 viable and self-sustaining populations are necessary totaling at least 10,000 individuals (USFWS 1994). Currently, the species does not meet the recovery criteria because there are 11 known populations and the number of individuals within each population is unknown. Annual monitoring data is necessary to determine the status of this species. Surveys of suitable habitat on public land would be useful to discover new populations or potential introduction sites. Seed collection needs to resume since it is unknown how long seed can remain viable and stored seed is at least nine years old.

Almost all of the populations are threatened by invasive exotic plant species and feral hogs (a new threat). In addition, two extant populations are under threat by development, Vulcan Mine to potential development since it is on private land and Baird- SR 50 due to a road-widening project. Off-roading is a new threat and could negatively affect *J. cooleyi* populations in the near future.

Limited progress has been made on the recovery of this species since the last 5-year review. WSF has been able to document the species, control invasive exotic plant species on known sites, and increase hunting for feral hogs. This management needs to continue to maintain *J. cooleyi* populations.

In summary, *J. cooleyi* continues to be threatened primarily by habitat degradation and destruction but disease and predation, the inadequacy of existing regulatory mechanisms and hybridization with other *Justicia* species and between populations (Factor E) may negatively also affect this species. The increase in number of populations on public land has reduced the threat of habitat loss, but habitat management is necessary to maintain suitable habitat. There are eleven extant populations, but we do not know if they are viable and self-sustaining because there have been no quantitative surveys of the number of plants making up these populations.

## III. RESULTS

**A. Recommended Classification:** No change is needed.

#### IV. RECOMMENDATIONS FOR FUTURE ACTIONS

The previous 5-year review included a list of recommendations to improve recovery of the species. Accomplishments towards these recommended actions are summarized below.

- A. 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.
- B. Support further research on:
  1. Effects of mowing and predator control on this species– The SR-50 population has expanded since the previous 5-year review. The FDOT uses standard mowing procedures that maintain the grass between five and twelve inches and treats exotic invasive plant species with herbicide if they consist of more than 25% of the vegetation (Maggio 2019).
  2. Life history needs– No progress.
  3. Microhabitat requirements of this species– No progress.
  4. Identification and treatment of the pathogen causing the fungal or bacterial disease– No progress.
  5. Genetics of this species– Limited genetics information has been collected, showing that the Citrus population is distinct. A more in-depth study using microsatellites is necessary (Peterson, BTG pers. comm. 2018).
  6. Transplant experiments, long-term seed viability trials, and optimizing germination protocols– One germination trial was conducted in 2010 using freshly collected seed from one plant. Seed has not been collected since 2010 and seed from as far back as 1988 remains in long-term storage at the National Center for Genetic Resources Preservation in Fort Collins, Colorado.
  7. Continue working with public land managers to increase management efforts to benefit *J. cooleyi* on their lands– WSF’s invasive plant species management has maintained suitable habitat for the species at seven sites. Maintenance is necessary to control invasive exotic plant species. In addition, efforts to control feral hog populations and reduce overbrowsing by deer needs to be continued.
  8. Continue 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– Four new populations have been discovered since

the previous 5-year review due to WSF's efforts to map invasive exotic plant species. However, no systematic counts have been conducted.

9. Determine effective methods to control invasive species in areas where *J. cooleyi* occurs. Follow up with monitoring of herbicide treatment effects on this species—WSF has effectively controlled invasive exotic plant species where seven populations of *J. cooleyi* and will continue efforts at a low level to keep the invasive exotics in control.

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- Werner, C. 2019b. State Forest Biologist, Withlacoochee Forestry Center, Florida Department of Agriculture and Consumer Services- Forest Service, Brooksville, Florida. Email to K. Conrad RE: *Justicia cooleyi* ?s. August 12, 2019.

**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of *Justicia cooleyi***

**Current Classification:** Endangered

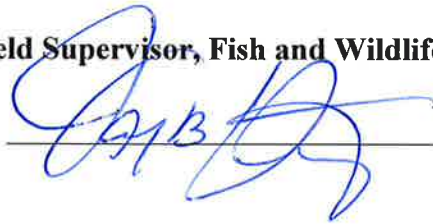
**Recommendation resulting from the 5-Year Review:** No change is needed

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

**FIELD OFFICE APPROVAL:**

**Lead Field Supervisor, Fish and Wildlife Service**

Approve



Date

8/23/2019