

**Scrub Lupine**  
*(Lupinus aridorum)*

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

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

**5-YEAR REVIEW**  
**Species reviewed: Scrub lupine (*Lupinus aridorum*)**

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## **5-YEAR REVIEW**

### **Scrub lupine/*Lupinus aridorum***

#### **I. GENERAL INFORMATION**

**A. Methodology used to complete the review:** This review was completed by the U.S. Fish and Wildlife Service's (Service) lead recovery biologist for this species who is located in the Jacksonville Field Office, Florida. None of the review was contracted to outside parties. All literature and documents used in this review are on file at the Jacksonville Field Office and are cited in the Literature Cited section. We used peer-reviewed publications; interim and annual reports provided as part of local and Federal government contracts; data and information available on the internet; unpublished surveys; personal communication with land managers, biologists, and researchers; and personal observations from Service biologists. Public notice of this review was given in the Federal Register on April 26, 2007, and a 60-day comment period was opened. 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:** Michael Jennings, 904-232-2580

**Cooperating Field Office(s) – Vero Beach, FL, Ecological Services:** Marilyn Knight, 772-562-3909

#### **C. Background**

1. **FR Notice citation announcing initiation of this review:** 72 FR 20866, April 26, 2007.
2. **Species status:** Decreasing (2007 Recovery Data Call). Very few sites have been secured for conservation purposes, and threats continue throughout the remainder of the species range.
3. **Recovery achieved:** 2 (26-50% recovery objectives achieved), 2007 Recovery Data Call

4. **Listing history**  
Original listing:  
FR notice: 52 FR 11172  
Date listed: April 7, 1987  
Entity listed: species  
Classification: Endangered

5. **Associated rulemakings:** None

6. **Review History:**

The Service conducted a five-year review for the scrub lupine in 1991 (56 FR 56882). In this review, the status of many species was simultaneously evaluated with no in-depth assessment of the five factors or threats as they pertain to the individual species. The notice stated that Service was seeking any new or additional information reflecting the necessity of a change in the status of the species under review. The notice indicated that if significant data were available warranting a change in a species' classification, the Service would propose a rule to modify the species' status. No change in the scrub lupine's listing classification was found to be warranted.

1990, 1996, 1999 Recovery Plans (see below)

Recovery Data Call – 2007, 2006, 2005, 2004, 2003, 2002, 2001, 2000, 1999, 1998

7. **Species' Recovery Priority Number at start of review (48 FR 43098):** 2C. The "2" indicates a high degree of threat and high recovery potential; the "C" reflects a degree of conflict.

8. **Recovery Plan**

**Name of plan:** Recovery plan for nineteen Florida scrub and high pineland plant species

**Date issued:** June 20, 1996

**Date of previous plans:** Original plan date - January 29, 1990 (Recovery plan for eleven Florida scrub plant species)

**Name of plan:** South Florida multi-species recovery plan (identifies recovery contributions for the South Florida Ecological Service's office work area)

**Date issued:** May 18, 1999

## 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 wildlife. This definition limits listing DPS to only vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

### B. Recovery Criteria

The current recovery plan identifies three recovery criteria for scrub lupine: (1) protect sites in Polk and Highlands counties and establish a disturbance regime to create bare, sunny openings; (2) conduct demographic monitoring for the foreseeable future; and (3) manage and rehabilitate publicly-owned habitats in Orange County. All three recovery criteria were determined to be essential in preventing the extinction of scrub lupine. Factor A (present or threatened destruction, modification or curtailment of its habitat or range) was identified as the primary factor affecting scrub lupine at the time of listing and recovery criteria 1 and 3 address this threat.

Based on new information, Factor C (disease or predation) and Factor E (other natural or manmade factors affecting its continued existence) appear to be threatening scrub lupine. Under Factor C, recovery criteria should be established to address the extent and magnitude of the deleterious effects of wilt on scrub lupine recovery. For Factor E, recovery criteria should be developed to address potential genetic concerns related to small and fragmented scrub lupine populations and threats due to habitat degradation resulting from fire suppression.

1. **Does the species have a final, approved recovery plan containing objective measurable criteria?** No. Although the recovery plan is approved and final, two of the three recovery criteria for this species are not objective and measurable. One criterion indicates that demographic monitoring should be undertaken for the foreseeable future, but provides no guidance about how many populations should be evaluated or for how long. Another criterion calls for the protection of scrub lupine sites in Polk and Highlands counties. This criterion erroneously lists Highlands County as within the range of the species, but the recovery plan does not list scrub lupine occurrences in this county (Service 1996) and subsequent surveys have not found plants in Highlands County (TNC 1999). Consequently, as written, this criterion cannot be met.

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. Although current data are limited, additional information is available on genetics, demography, habitat degradation, and the effects of drought.
- 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. Disease (Factor C) and drought and fire suppression (Factor E) are known to be current threats to scrub lupine and these factors are not currently addressed in the recovery criteria.

C. **Updated Information and Current Species Status**

1. **Biology and Habitat:**

**a. Abundance, population trends, demographic features, or demographic trends:** A 1998 census of 40 locations where scrub lupine had previously been reported and five additional locations reported to contain scrub lupine, but not recorded in the Florida Natural Areas Inventory (FNAI) database, found individual plants at 19 sites (TNC 1999). Thirteen of the 40 historic sites had been developed for commercial or residential uses and contained no scrub lupine.

At the time of the 1998 census, an estimated 1,054 non-seedling plants and 474 seedlings were known to exist. This is higher than the 936 non-seedling plants (includes the maximum number of individuals reported at any specific location) and 30 seedlings previously recorded in the FNAI database. However, comparison of these data is difficult because actual numbers were not recorded for some localities in the FNAI database (e.g., some locations contained “some”, “many” “>100”, or “unknown” as the reported number of individuals). Comparing only locations where FNAI records contained discrete numbers of individual plants resulted in 324 non-seedling plants and 30 seedlings (FNAI) versus 596 non-seedling plants and 154 seedlings found at these same locations in 1998 (TNC 1999). Much of the increase in numbers of non-seedling plants and seedlings is attributed to two locations, one of which is a managed conservation parcel. Combined, the two locations accounted for 566 (54 percent) of the 1,054 non-seedling plants and 142 (30 percent) of the seedlings known to have existed in 1998.

Kane (2003) subsequently conducted a rangewide census between 2002 and 2003 and, although she was unable to compare her findings with all

historic locations, she did count 1,019 non-seedlings and 236 seedlings in 2002 and 980 non-seedlings and 4,919 seedlings in 2003 within 10 extant lupine populations (11 extant populations were cited but one location was excluded because it was not visited in 2002). The Service's Lake McLeod Tract of the Lake Wales Ridge National Wildlife Refuge (LWRNWR) had the largest number of non-seedlings and seedlings counted during 2002 and 2003 (Kane 2003).

J. Stout (University of Central Florida, personal communication (pers.comm.), 2005) indicated that long-term monitoring at seven sites on the Lake McLeod Tract of the LWRNWR showed an increase in the number of seedlings. However, comparison of the number of non-seedling plants between 2003 and 2007 at the Lake McLeod Tract showed a decline from 511 to 357 plants and the distribution of plants on this parcel declined as well (B. Blihovde, Lake Wales Ridge NWR, pers. comm., 2007).

Long-term monitoring has also been conducted at one site in Orange County that is held in a conservation easement (J. Stout, pers. comm., University of Central Florida, 2007). Since 1990, around 45 non-seedling plants have persisted, but drought conditions since about 1998 have resulted in low or no recruitment in this population.

In summary, the abundance and range-wide population trend of scrub lupine is declining due principally to habitat loss. The number of known lupine populations has declined from a historical record of 40, to 19 in 1998 and 11 in 2003. Seedling recruitment varies annually; therefore the number of seedlings present is not a good indicator of population size or status.

**b. Genetics, genetic variation, or trends in genetic variation:** Scrub lupine populations have low numbers of alleles per locus, low variation within populations and high variation among populations (R. Dolan, personal communication, cited in TNC 1999). However, there is no clear evidence of inbreeding depression among studied populations.

**c. Taxonomic classification or changes in nomenclature:** None.

**d. Spatial distribution, trends in spatial distribution or historic range:** Scrub lupine was historically found in two areas of central Florida - western Orange and extreme northwestern Osceola counties on the southern Mount Dora Ridge and in north-central Polk County on the Winter Haven Ridge (Service 1996). A total of about 2,940 acres were thought to encompass all known populations (Service 1996). Scrub lupine has been historically reported from a total of 40 locations within this nearly 3,000 acre area.

A range-wide census conducted in 2002-2003 found non-seedling lupine at 11 sites (one in Polk County and ten in Orange County (Kane 2003). The ten Orange County sites had a combined area of about 42 acres, of which an estimated 7.4 acres were occupied by lupine. The single site in Polk County was about 26 acres in size and about 6.4 acres were estimated to be occupied by lupine (Kane 2003). No lupine were found at the only known locality record for scrub lupine in Osceola County (Kane 2003). All extant lupine populations were found within the broad geographic area depicted by the Service in the recovery plan as containing potential habitat. However, Kane (2003) was the first to quantify area of occupancy of scrub lupine based on soil types and concluded that the amount of available habitat declined from about 3,040 acres in 1990 to 67 acres in 2003. These data indicate that the spatial distribution of scrub lupine has declined substantially.

Since the 2002-2003 survey, scrub lupine has reportedly been extirpated from two or three sites (C. Peterson, Historic Bok Sanctuary, pers. comm., 2007). Additionally, only one individual plant is known to exist from the 12 areas along the Florida Turnpike that historically had lupine. The remaining individual plant will be destroyed in the near future due to infrastructure development and Historic Bok Sanctuary intends to harvest seeds from this individual plant prior to destruction (C. Peterson, Historic Bok Sanctuary, pers. comm., 2007). FNAI is currently conducting a range-wide survey, but these data will not be available until 2008.

There has been a documented decline in the spatial distribution and historic range of scrub lupine. As of 2003, the historical records of 40 populations had declined to 11 extant lupine populations occupying about 23 acres. Three or four of these populations have been extirpated since 2003, leaving six to seven scrub lupine populations.

**e. Habitat or ecosystem conditions:** Scrub lupine evolved in fire-maintained vegetative communities (scrub and sandhill). Many of the remaining locations where lupine is found are private properties that are not managed. As a result, vegetation density and canopy cover are high and bare sandy patches are small or non-existent.

Several lupine populations occur on public lands. Orange County Parks and Recreation Division maintains Shadow Bay Park (formerly Lake Cane-Marsha Park), but this site is not currently managed for scrub lupine and is principally used for active and passive recreation. Orange County does not use prescribed fire in this park because of urban interface concerns (A. Eidam, Orange County Parks and Recreation Division, pers. comm., 2007). Mechanical management is proposed at this site in the future. Orange County also holds a conservation easement on a parcel that



contains about 45 mature plants. This site is not actively managed, but is currently in relatively good condition due to ongoing experiments evaluating the effects of grass and tree removal on scrub lupine survival (J. Stout, University of Central Florida, pers. comm., 2007).

In Polk County, the Lake Wales Ridge National Wildlife Refuge contains scrub lupine in areas where historic off-road vehicle use created informal trails and other bare sandy patches that persist today. Vegetative density and canopy closure are not currently limiting lupine where it occurs. Lupine seeds may be stored in soils in other areas of the refuge but have not germinated because competing vegetation is too dense in these areas. Recent burning of brush piles may enhance habitat locally and result in additional recruitment of seedlings (S. Morrison, TNC, pers. comm., 2007)

All other known locations are either in private ownership and are not managed or are owned by local government and could be targeted for development.

Exotic or native invasive such as bahia grass and dog fennel were identified as threatening scrub lupine at four sites (TNC 1999) and along much of the Florida Turnpike right-of-way (Florida Department of Transportation 1998) when a census was completed in 1999. Threats due to exotic or invasive plants are not currently known from the 11 extant locations where scrub lupine is found.

**f. Other:** Historic Bok Sanctuary has begun investigating the molecular characterization of soil symbionts found in scrub lupine root nodules (Historic Bok Sanctuary 2006). Identification of symbionts will aid in *ex situ* propagation of this species which may enhance availability of individual plants for transplant to protected sites.

Scrub lupine plants suffer high mortality when transplanted. This fact has limited out plantings of seedlings produced at Historic Bok Sanctuary and is considered one of the primary obstacles to reintroduction of scrub lupine to suitable, natural habitat. Recently, however, seeds have been germinated in native soil mixes in peat pots and transplant success of seedlings grown in these mixtures has been promising. Additional experimentation is underway to refine substrates and containers to maximize germination and early seedling survival (Historic Bok Sanctuary 2006).

2. **Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)**
  - a. **Present or threatened destruction, modification or curtailment**

**of its habitat or range:** Habitat destruction remains the greatest threat to the scrub lupine. Only one site (Lake McLeod Tract of the Lake Wales Ridge NWR in Polk County) out of 40 historic sites exists where long-term protection is certain. Since listing, 29 known locations of lupine have been destroyed or plants have been extirpated. Two extant locations occur on public lands, but these sites are not currently managed for the scrub lupine. The remaining populations occur on private property or are owned by local governments and are susceptible to destruction due to development.

The Service is aware of proposed development on one private parcel containing three mature plants. Development plans are preliminary and it is not currently known if the plants can be maintained on-site. A conservation parcel held in easement by Orange County is susceptible to land use changes despite its current protected status. In 2004, this easement was modified to release about 9.6 acres for development of recreational facilities, but no scrub lupine plants were affected by this modification. Orange County School District owns one parcel containing scrub lupine and there are plans to construct a school and related facilities on the property in the future (A. Eidam, Orange County Parks and Recreation Division, pers. comm., 2007).

- b. **Overutilization for commercial, recreational, scientific, or educational purposes:** Overutilization is not known to be a threat to scrub lupine at this time.
- c. **Disease or predation:** Wilt has been reported in scrub lupine populations grown in green house conditions and only recently has been suspected in the extirpation of one wild population (A. Eidam, Orange County Parks and Recreation Division, pers. comm., 2007). The bacterial pathogen *Xylella fastidiosa* is responsible for wilt affecting scrub lupine (Stout *et al.* 2001). Disease is likely a threat to scrub lupine, but more work is needed to determine risks. Predation is not thought to pose a risk to scrub lupine at this time.
- d. **Inadequacy of existing regulatory mechanisms:** 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 scrub lupine from illegal harvest on State and private lands. However, this regulatory mechanism does not prevent destruction of habitat due to land use changes.

The National Wildlife Refuge System Administration Act (NWRAA) represents organic legislation that set up the administration of a national network of lands and water for the conservation, management, and restoration of fish, wildlife, and plant resources and their habitats for the benefit of the American people. Amendment of the NWRAA in 1997 required the refuge system to ensure that the biological integrity, diversity, and environmental health of refuges be maintained.

Several lupine populations occur on private lands and are afforded little protection. The Service's Partners for Fish and Wildlife and recovery programs are working with several partners within the historic range of scrub lupine to develop habitat restoration and management plans. At this time, however, existing regulatory mechanisms do not appear to be adequate.

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

*Drought:* Successful recruitment appears to decline during prolonged periods of drought. In one well-studied population, recruitment of seedlings has been low since 1998 and is attributed to drought conditions (J. Stout, University of Central Florida, pers. comm., 2007). In May 2007, many mature and seedling plants were in poor condition at Orange County's Shadow Bay Park and drought conditions were suspected in the decline of this population as well (A. Eidam, Orange County Parks and Recreation Division, pers. comm., 2007).

*Fire Suppression:* Scrub lupine requires open sandy patches with high exposure to sunlight. Where fire has been suppressed for long periods, pine and oak canopy cover increases and understory vegetation density reduces open sandy patches (Stout 2004). Under these conditions, scrub lupine is outcompeted by surrounding vegetation. The majority of sites containing scrub lupine are degraded due to fire exclusion or lack of mechanical vegetative management. Except for Lake Wales Ridge National Wildlife Refuge and possibly Orange County's Shadow Bay Park, there are no plans elsewhere to use prescribed fire or mechanical vegetative management techniques to maintain or enhance scrub lupine habitat.

**D. Synthesis**

Two of the three current recovery criteria for the scrub lupine are not objective and measurable and not all currently known threats are addressed by recovery

criteria. Consequently, the recovery criteria should be revised to address these needs and updated to reflect current scientific information.

The most recent range-wide survey (circa 2002-2003) for this species indicated that the number of scrub lupine sites declined due to habitat destruction. Currently, one site is perpetually protected on Federal land and another occurs on County land under a conservation easement. One site in county ownership is used for recreation. The majority of all remaining scrub lupine sites occur on private property and these are susceptible to habitat degradation and destruction due to land use changes.

Scrub lupine is vulnerable to disease and drought. Impacts from these threats are not well understood, but are suspected in the recent extirpation of one population and declines in several others.

Scrub lupine exhibit genetic traits indicative of small, isolated populations, but genetic depression due to inbreeding has not been confirmed.

In summary, scrub lupine continues to be threatened by habitat loss and degradation. New information suggests that disease and drought may also adversely impact this species. Given the decline in the number of known scrub lupine populations and the fact that only one population is assured of long-term protection, this species remains in danger of extinction throughout all or a significant portion of its range. Therefore, no change in status of scrub lupine is recommended.

### III. RESULTS

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

### IV. RECOMMENDATIONS FOR FUTURE ACTIONS

(order does not indicate priority)

Update and revise the scrub lupine recovery plan and its criteria that are related to reducing and/or eliminating threats to scrub lupine.

Work with partners to acquire and/or obtain easements to secure remaining and historic scrub lupine locations on privately owned lands.

Update range-wide survey including location and population size. Current distribution information is needed to determine where plants currently exist and to prioritize acquisition/protection efforts.

Collect seeds from all remaining populations to protect genetic material and provide a source of seeds for reintroduction.

Work with partners to develop criteria for direct seeding of scrub lupine on protected and managed properties, including identification of appropriate sites and methodology for seed dispersal, need for supplemental watering, and follow up monitoring.

Use the Partners for Fish and Wildlife Program and other programs to encourage non-Federal agencies to develop and implement land management strategies that will benefit scrub lupine.

Encourage continued research to determine appropriate methodology to germinate seeds, grow seedlings under controlled situations, and successfully out-plant seedlings to native habitat in public ownership.

Evaluate the effects of habitat management techniques (fire and mechanical) on scrub lupine seed banks.

## V. REFERENCES

Florida Department of Transportation. 1998. Summary of inventory of *Lupinus aridorum* on Florida's Turnpike right-of-way in Orange County. On file, Fish and Wildlife Service, Jacksonville, Florida.

Historic Bok Sanctuary. 2006. Endangered and threatened native flora conservation grants program. Interim report to the Florida Plant Conservation Program of the Florida Department of Agriculture and Consumer Services. Contract 011298.

Kane S.R. 2003. Historical and current distribution and population status of *Lupinus aridorum* McFarlin ex Beckner. Unpublished M.S. Thesis. University of Central Florida, Orlando, Florida.

Stout, I.J. 2004. Interim report January 9 – July 20, 2004. Management of scrub lupine at Fenton Road, Orange County. Grant Agreement 401813F050. On file U.S. Fish and Wildlife Service, Jacksonville, Florida.

Stout, I.J., S.J. Woiak, and A.M. Bard. 2001. Population dynamics of the scrub lupine and some management implications. In D.P. Zattau, ed., Proceedings of the Florida scrub symposium 2001. U.S. Fish and Wildlife Service, Jacksonville, Florida.

The Nature Conservancy [TNC]. 1999. Conservation plan for *Lupinus aridorum*. Florida Department of Agriculture and Consumer Affairs, Division of Forestry, Contract 4759.

U.S. Fish and Wildlife Service [Service]. 1996. Recovery plan: nineteen Florida scrub and high pineland plant species. Atlanta, Georgia.

**5-YEAR REVIEW of Scrub lupine (*Lupinus aridorum*)**

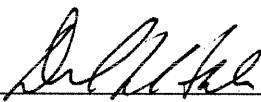
Current Classification: Endangered

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

Review Conducted By: Michael Jennings

**FIELD OFFICE APPROVAL:**

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

Approve  Date 11/27/07

**Lead Regional Director, Fish and Wildlife Service**

Approve  Date 11/27/07  
*acting* Assistant Regional Director  
Ecological Services

## APPENDIX A

### Summary of peer review for the 5-year review of scrub lupine (*Lupinus aridorum*)

**A. Peer Review Method:** Prospective peer reviewers were identified if they met one or more of the following criteria: (1) they had recent scientific publications related to scrub lupine biology, ecology, or conservation; (2) they had recently conducted research or monitoring of scrub lupine related to biology, ecology, or conservation; or (3) they had knowledge of lupine biology, ecology, or conservation because of their current professional position.

Prospective peer reviewers were notified electronically on July 24, 2007, and asked of their willingness to participate in the peer review and whether they would be able to complete their review by August 31, 2007, and follow peer review guidance (see B below).

Six prospective peer reviewers were notified: Dr. Jack Stout, University of Central Florida; Cheryl Peterson, Historic Bok Sanctuary; Nancy Bissett, The Natives, Inc; Steve Morrison, The Nature Conservancy; Amy Jenkins, Florida Natural Areas Inventory; and Sharon Kane, former graduate student researching scrub lupine.

**B. Peer Review Charge:** See Appendix B.

### **C. Summary of Peer Review Comments/Report:**

Dr. Stout indicated that the Recovery Criteria section erroneously states that scrub lupine's range includes Highlands County. He also provided new data regarding ongoing monitoring efforts he is undertaking in the Lake McLeod Tract of the Lake Wales Ridge National Wildlife Refuge. Dr. Stout recommended review of information in Kane's (see below) thesis to update section C.1.d. Under section C.2.c., Dr. Stout identified the pathogen resulting in lupine wilt. Soil disturbance is identified as a possible source of increased germination and Dr. Stout suggested that this observation be included under section C.2.e. With respect to our recommendations for future actions (section IV), Dr. Stout indicated that Kane's thesis work included a comprehensive survey of all known scrub lupine locations as of 2003. He implied that our recommendations for future actions may not need to address the status and distribution of scrub lupine. He also indicated that the cause of wilt is known and that there is no known practical means available to protect this species from this pathogen. As a result, this recommendation described under D. below may not be valid. Dr. Stout does not believe development and implementation of a supplemental watering program is practical. Finally, Dr. Stout indicated that he did not agree with our recommendation to fund research on seed germination, growing seedlings, and out planting seedlings. Rather, he would like to see limited funds used to protect habitat and direct-plant seeds collected from plants at Lake Wales Ridge National Wildlife Refuge.

Ms. Peterson indicated that more current information was available from Kane's thesis and summarized the loss of lupine populations. In addition, she indicated that additional populations have been lost since completion of Kane's thesis and that all previously known locations of lupine along the Florida Turnpike have disappeared, except for one plant. Furthermore, Ms. Peterson indicated that research conducted by Historic Bok Sanctuary which is summarized in

section C.1.f has been put on hold due to funding limitations. Ms. Peterson suggested that we include introductions of scrub lupine onto protected lands as a recommended future action.

Ms. Bissett recommended that future conservation actions include acquisition of unprotected sites containing scrub lupine and that these efforts should target historic locations where lupine occurred because there are likely large seed banks available in these areas. Ms. Bissett indicated Orange County has not been thoroughly surveyed and recommended that additional surveys be conducted in this county - additional sites containing lupine have apparently been found recently, but have not been reported to FNAI. She also suggested that lupine growing along the Florida Turnpike and the City of Winter Park's Water Department property should be managed better. Ms. Bissett indicated that additional research on the effects of habitat management on stored seeds and the response of lupine to fire is needed.

Mr. Morrison indicated that in section C.1.e. use of prescribed fire in urban settings should be justified and that Orange County could rely on existing staff or staff from other agencies to help implement prescribed fire. He indicated that recent burning of brush piles on the Lake McLeod Tract of the Lake Wales Ridge National Wildlife Refuge has likely enhanced habitat for scrub lupine. In section C.1.f., Mr. Morrison questioned the practicality of relying on transplanting seedlings to augment scrub lupine recovery efforts. He suggested focusing on direct planting of seeds instead. In our recommendations for future actions section (IV), Mr. Morrison suggested that we include provisions to assist public land managers in implementing prescribed fire; provide FDOT guidance regarding their mowing regime, if needed; develop criteria for introducing seeds to native habitat; and provide funding for such activities.

Ms. Jenkins indicated that there may be confusion in sections C.1.a. and C.1.d. because the number of historic locality records and observations appear to be different. Ms. Jenkins also reported that recent surveys by FNAI indicated that scrub lupine may not have been found at one of the previous locality record sites.

Ms. Kane suggested we review her 2003 Master's thesis for current information regarding the status and distribution of scrub lupine.

#### **D. Response to Peer Review**

Section B.1. clearly identifies the error of the existing recovery plan identified by Dr. Stout. We incorporated Dr. Stout's monitoring data into section C.1. Dr. Stout provided us an electronic copy of Ms. Kane's thesis and we have substantially revised the 5-year review to incorporate these new data. We updated section C.2.c. to include the known pathogen resulting in wilt in scrub lupine. We included Dr. Stout's observations of enhanced germination resulting from ground disturbance in section C.1. rather than in section C.2.e. as recommended by Dr. Stout. We have deleted from our recommendations for future actions the need to evaluate the cause of wilt since it is already known and is apparently difficult to manage. Although we agree that wide-spread use of supplemental watering would be impractical, we have opted to keep this recommendation in place and believe it will have value to enhance survival of seedlings resulting from direct seeding and out planted seedlings in some locations, particularly on public lands that have fire fighting watering trucks available. We have also retained our recommendation to fund



research on seed germination, cultivation of seedlings, and out-planting of seedlings grown *in situ*. We believe these efforts have application in the reintroduction of scrub lupines to areas where they have been extirpated or suitable habitat where they have not been recorded historically. We agree that direct dispersal of seeds may be an effective strategy to augment or restore scrub lupine populations, but the number of available donor plants is declining rapidly and may not be sufficient in the future to rely solely on this method. Furthermore, available information suggests that drought is a major factor in limiting successful recruitment of seedling scrub lupine. We envision that introduction or reintroduction efforts would rely on both strategies, where available.

As mentioned above, we have incorporated new data from Kane's Master's thesis into this 5-year review. Ms. Peterson also provided information about the loss of additional scrub lupine habitat following the completion of Kane's thesis. We have included these personal observations in section C.1.d. We agree that introductions and/or reintroductions of scrub lupine are needed to conserve this species and we have included this in our recommendations for future actions.

We have incorporated in our recommendations for future actions a task to update range-wide surveys as suggested by Ms. Bissett. We envision that any re-survey effort would also include searching for new, undocumented populations throughout the species range. The FDOT has adopted management guidance that avoids mowing areas known to contain scrub plants and previously engaged in active habitat management for lupine. These efforts have been in place for over 10 years and were originally developed in coordination with the Service. We do not believe that additional management opportunities exist along the Florida Turnpike. We intend to use our authorities to enhance lupine management opportunities, including efforts at the City of Winter Park's Water Department property. We have included in our recommendations for future actions several tasks that deal with Ms. Bissett's recommendation that more research be conducted on the effects of habitat management on seed banks and plants.

We agree with Mr. Morrison's statement that prescribed fire can be implemented in many urban landscapes when used with appropriate smoke management techniques. Unfortunately, at this time, we do not believe Orange County is willing to use prescribed fire and our authorities cannot mandate implementation of such management actions. As indicated in our recommendations for future actions, we will work within our authorities to assist Orange County and other land managers in developing effective prescribed fire management plans. The FDOT has adopted management guidance that avoids mowing areas known to contain scrub plants. This strategy has been in place for over 10 years and was originally developed in coordination with the Service. Accordingly, we do not believe that mowing of turnpike rights-of-way is responsible for recent declines of lupine along the turnpike. We discuss our position on *ex situ* germination and seedling cultivation efforts in response to Dr. Stout's comments. We agree with Mr. Morrison that efforts should be undertaken to develop a process to introduce seeds via direct seeding to reintroduction sites and have included this as a recommended future action.

With respect to Ms. Jenkins' comments, we have modified the text in sections C.1.a. and C.1.d. to minimize confusion. As of the date of this document, Ms. Jenkins has not confirmed the absence of scrub lupine from one historic locality. However, this observation may have already been captured by the personal observations of Ms. Peterson.

As indicated above, we have incorporated applicable data contained in Ms. Kane's 2003 Master's thesis.

## APPENDIX B

### **Guidance for Peer Reviewers of Five-Year Status Reviews** U.S. Fish and Wildlife Service, North Florida Ecological Services Office

March 6, 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 that appears not to have been used by the Service.
3. Not provide recommendations on the Endangered Species Act 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 Mike Jennings, U.S. Fish and Wildlife Service, at 904-232-2580, extension 113, email: michael\_jennings@fws.gov.