

Scrub Lupine
(*Lupinus aridorum*)

Status Review:
Summary and Evaluation



Scrub lupine plant, Lake McLeod National Wildlife Refuge, Polk County. Photo Todd Mecklenborg

U.S. Fish and Wildlife Service
South Atlantic-Gulf and Mississippi Basin Region
Florida Ecological Services Office
Gainesville, Florida

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STATUS REVIEW Scrub Lupine (*Lupinus aridorum*)

GENERAL INFORMATION

Current Classification: Endangered

Lead Field Office: Florida Ecological Services Office, Todd Mecklenborg 727-892-4104

Reviewers:

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Date of original listing: April 7, 1987 (52 FR 11172)

Methodology used to complete the review:

In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a status review is to assess each threatened species or endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants ([50 CFR 424.11](#)). The U.S. Fish and Wildlife Service (Service) evaluated the biology, habitat, and threats of the scrub lupine (*Lupinus aridorum*) to inform this status review.

We announced initiation of this review in the Federal Register on July 14, 2021 (86 FR 37178) with a 60-day comment period. The primary sources of information used in this analysis were the 1987 final listing rule (52 FR 11172), the *Recovery Plan for Nineteen Florida Scrub and High Pineland Plant species* (1996), previous 5-year reviews, research project reports, peer reviewed scientific publications, unpublished field observations, and personal communications. This review was completed by the U.S. Fish and Wildlife Service, Florida Ecological Services Office, Gainesville, Florida. All literature and documents used for this review are on file. All recommendations resulting from this review are the result of thoroughly reviewing the best available information on *Lupinus aridorum*.

We have not received significant new information, interpreted previously reviewed information in a new, significant light since the last review of the species and the level of public interest is low and non-controversial; therefore, no peer review was conducted.

FR Notice citation announcing the species is under active review: July 14, 2021 (86 FR 37178)

Species' Recovery Priority Number at start of 5-year review ([48 FR 43098](#)): 2C. The “2” indicates a high degree of threat and high recovery potential; the “C” reflects a degree of conflict with development and growth.

Review History: Previous 5-year reviews conducted include (FR Notice Citation): 1991 (56 FR 56882), 2007 (72 FR 20866) and 2014 (79 FR 56821). The previous 5-year reviews completed in 1991, 2007, 2016 recommended no change in status.

REVIEW ANALYSIS

Listed Entity

Taxonomy and nomenclature

A change has occurred in taxonomy from *Lupinus aridorum* (McFarlin ex Beckner) to *Lupinus westianus* var. *aridorum* (McFarlin ex Beckner) Isely. The Service will continue to reference the taxonomy as when the species was listed under the Endangered Species Act of 1973, as amended, per the Federal Register. The rationale is as follows.

When the Service published its review of plant taxa considered for listing as endangered or threatened in 1980, *L. aridorum* had not been named although it was considered a unique species by McFarlin in 1935. Becker described the morphological differences in *L. aridorum* and designated it as a unique species in 1982 (Palmer 2006). In 1984 and again in 1985, the Service's 12-month finding determined that listing of *L. aridorum* was warranted. The Service published the proposed rule listing *L. aridorum* as endangered on 24 April 1986. During this same year, dissension among other taxonomists argued *L. aridorum* is a disjunct population of *L. westianus* having only flower color as the single morphological difference (Isely 1986). *Lupinus westianus* includes two allopatric groups: *L. westianus* var. *westianus* and *L. westianus* var. *aridorum*. The Service's final rule in 1987 listed the species as *L. aridorum*.

Recent genetic research revealed a close relationship among *Lupinus aridorum*, *L. westianus*, and *L. diffusus* (Bupp 2013). The results indicate that *L. aridorum* and *L. westianus* are different genetically. Bupp noted the similarities between the two species could be the result of phenotypic plasticity from inhabiting similar upland scrub environments or retention of ancestral genotypes. Additionally, Internal Transcribed Spacer (ITS) sequence data (Bok Tower Gardens, unpub. data) showed taxonomic separation of *L. aridorum* and *L. westianus*, with *L. diffusus* suggested as a close congener of *L. aridorum* (Bupp et al. 2016).

Although the Service recognizes that there is suggested new taxonomic information related to the species, this information is relatively new and has not had time to undergo thorough review by the field of experts or supported by additional research. At this time, the remainder of the review will address the entity as it was listed under the Act. We will review these taxonomic changes again as more science becomes available.

Distinct Population Segment (DPS)

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 and wildlife. The definition limits listing DPS to vertebrate species of fish and wildlife and because this species is a plant, the DPS policy does not apply.

Recovery Criteria

Recovery Plan or Outline

Lupinus aridorum is included in the following Recovery Plans:

- South Florida Multi-Species Recovery Plan (identifies recovery contributions for the South Florida Ecological Service's Field Office area of responsibility), May 18, 1999,
- Recovery Plan for Nineteen Florida Scrub and High Pineland Plant Species, June 20, 1996,
- Recovery Plan for Eleven Florida Scrub Plant Species, January 29, 1990.

Recovery plans are not regulatory documents and intended to provide guidance to the Service, States, and other partners on methods of minimizing threats to listed species and on criteria that may be used to determine when recovery is achieved. If the recovery criteria defined in the plan are still valid, meeting recovery criteria can indicate that the species no longer requires protections under the Act. However, when recommending whether a listed species should be delisted, the Service must apply the factors in section 4(a) of the Act ([84 FR 45020](#)).

To prevent extinction the 1996 recovery plan identifies three recovery criteria: (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. *Lupinus aridorum* is not known to occur in Highlands County; criterion # 1 erroneously lists Highlands County instead of Orange County.

The South Florida Multi-Species Recovery Plan (1999) defined a recovery objective to prevent extinction and then stabilize. To consider the species stabilized the existing populations within the historic range would need to be adequately protected from further loss, degradation, and exotic plant invasion. The sites must also be managed to maintain openings. Five broad recovery actions were noted; however, no metrics were assigned. The intent of the plan was the South Florida's contribution (as part of the South Florida Ecosystem Restoration effort) toward increasing populations, preventing extinction, and stabilizing of populations.

Biology and Habitat Summary

As detailed in previous 5-year reviews, life stage data indicate that the number of individuals present within a population can vary greatly from year to year. *Lupinus aridorum* is a short-lived perennial most likely with an average life span of 2 to 4 years. Many perish after the first year,

but most survive 2 to 3 years with 1 to 3 reproductive cycles. Plants have been recorded to flower at 6 to 7 years. Along with having varied annual seedling recruitment, the number of plants present in a given year is not a reliable indicator of population size or status; however, annual census data from the Lake McLeod National Wildlife Refuge is adequate to infer the population trend over several generations at this location. Unfortunately, very few other populations have on public lands have adequate data to determine with certainty whether the remaining populations are increasing, stable or decreasing - see Table 1. The genus is known to have seed bank resiliency (Zazula 2009, 10 yrs. not 10,000 yrs.). This species may have a resilient seed bank based on empirical data of known locations where the habitat degraded to a closed canopy condition and no plants were detected for many years during survey events. After clearing of the vegetation years after no detection and much longer than a typical life span for an individual plant, the species reappeared within the habitat prior to conversion to another land use.

The species historic range coincides with one of the fastest developing metropolitan areas in the state of Florida. Orlando has experience rapid growth dating back to the late 60's when the theme venues and parks began expanding and all of the supporting infrastructure converted vast amounts of native habitat to urban uses. The elimination of available habitat that supported native plant assemblages across a large landscape not only reduced the opportunity for populations to exist but compromised those that were not directly converted to other land uses the from the suppression of wildfires and applied prescribed fire management because of smoke management conflicts. Habitat degradation from lack of management continues to cause the majority of the remaining populations to decline or be extirpated, even on public lands not subject to land use conversion. The majority of the Element of Occurrence Records (EOR) on private lands no longer support populations (FNAI 2021); unfortunately, access is not granted to perform surveys for habitat assessments and plant counts on these lands.

The following discussion is the current species' representation on the Mount Dora Ridge (Orange County) and on the Winter Haven Ridge (Polk County) that occur on public lands. There are a total of 8 known sites having at least 1 plant in existence surveyed for this review in 2022. Four locations occur on each ridge within the 2 counties.

Mount Dora Ridge – Orange County

Fenton Street Conservation Area (EOR #40)

This is the largest population remaining on Mount Dora Ridge. There is a conservation easement under the control of a Homeowners Association (Kerina Corp HOA); however, active management is nonexistent. Dr. Jack Stout (University of Central Florida, Emeritus) has been conducting research at this location for over two decades. The population has fluctuated from 2 plants to an abnormally high year of 1,052 plants (no stage class data was available at the time of this analysis) within the study area from 2000 through 2022 with an estimated of 10 to 30 plants outside the study area in any given year. The long-term average is in a range of roughly 70 to 90 plants (excluding the high anomaly year). The last five years of data recorded 106 (2018), 1,052 (2019), 194 (2020), 225 (2021), and 46 (2022) plants observed in the study area. The population appears to be declining from historic numbers with increased sand pine (*Pinus clausa*) canopy

coverage and overall lack of management at the site continuing to degrade optimal conditions for the plants to flourish.

Shadow Bay Park (EOR #23)

The Service's Partners for Fish and Wildlife funded a habitat management effort in 2015 to mechanically reduce vegetation for a "restoration area" followed by prescribed fire application in the restoration area and in the overgrown habitat where the natural population occurs. Fire was never applied to the landscape so current habitat conditions continue to degrade and negatively affect the *Lupine aridorum* population.

A total of 41 plants were counted (representing all stage classes) during the April 2022 survey. The 2014 census for the previous 5-year review recorded 360 plants. Post survey of the natural population in April of 2022, 14 plants were introduced in the restoration area south of the natural area under a powerline easement.

Bill Fredrick Park (EOR #39)

No plants were detected during the April 2022 survey event in the natural area (257 plants in 2015); however, 7 plants still occur (144 plants in 2015) at an introduction location within the park in a restoration area.

Springs Community – Rock Springs Elementary School (EOR # 50)

One seedling was observed in an overgrown area boarding the two properties. The main population previously occurred in the Springs Community development but was eliminated with the expansion of a parking lot and water retention area. There were 62 plants as late as 2014.

Winter Haven Ridge – Polk County

Lake McLeod National Wildlife Refuge (EOR #37)

The refuge location is the largest and possibly only stable long-term population remaining in the species range. Census data between 2002 and 2022 suggests an average of 515 plants, excluding seedlings less than one year old, occur on this managed and secure site. The population has ranged from a low of 318 plants to a high of 702 plants during this timeframe. Lake McLeod NWR is one of the four tracts within the Lake Wales Ridge NWR that was established in the 90's for the protection of endangered and threatened plants.

CSX (EOR #55)

The CSX population occurs on three different properties that will be referenced as east, central, and west. The east portion of the population occurs in a pasture grazed by livestock that is in private ownership. The central portion is the active CSX rail line and associated swale and shoulder habitat. The west portion is an overgrown tract of habitat owned by the City of Winter Haven Water Resources. The 2022 surveys detected the majority of the plants occurring in the

pasture (east - 11 plants). Six plants (mainly seedlings) occurred along the entry road accessing the water resource parcel (west) and three plants within the CSX rail line area (central).

Lake Blue Scrub (EOR #56)

Lake Blue Scrub is located in an urban setting and managed by Florida Fish and Wildlife Conservation Commission. The site is currently overgrown because of the management challenges associated with the surrounding land uses. The most recent survey data available for the naturally occurring population were 2 plants in 2016. There was also an introduction effort to augment the population beginning in 2008 through 2010. Over 1,000 plants were introduced; however, the 2022 survey reported only 44 plants.

MacKay Gardens and Lakeside Preserve

This population was an experimental introduction beginning in 2011 and continuing through 2014 with over 600 plants introduced during this time frame. The last year the site was surveyed, one plant remained. The site is a sandhill restoration area so it's not ideally appropriate for *Lupinus aridorum* persistence

Table 1. Number of extant *Lupinus aridorum* populations on public lands and plant counts.

Site	County	2014	2022	Difference
Fenton Street	Orange	11	46	+ 35
Shadow Bay Park (Natural)	Orange	360	41	-319
Shadow Bay Park (Introduced)	Orange		14	
Bill Fredrick Park (Natural)	Orange	257 (2015)	0	-257
Bill Fredrick Park (Introduced)	Orange	144 (2015)	7	-137
Springs Community	Orange	62	1	-61
Lake McLeod	Polk	599 (2015)	681 (2021)	+82
CSX	Polk	4 (2015)	20	+16
Lake Blue Scrub (Natural)	Polk	9	0	-9
Lake Blue Scrub (Introduced)	Polk	1,217	44	-1173
MacKay Gardens	Polk	196	1	-195

We are not aware of any additional new biology or habitat information since the most recent species review that impacts the status of the species and all of information provided in the previous 5-year reviews remain valid (refer to Review History).

Threats (Five-Factor Analysis) Summary

The status of a species is determined from an assessment of factors specified in section 4 (a)(1) of the Act, including: Factor A: the present or threatened destruction, modification, or curtailment of its habitat or range; Factor B: overutilization for commercial, recreational, scientific, or educational purposes; Factor C: disease or predation; Factor D: the inadequacy of existing regulatory mechanisms; Factor E: other natural or manmade factors affecting its continued existence. A summary of this assessment is detailed below.

Factor A. This remains the greatest threat to the remaining populations of *Lupinus aridorum*. The vast majority of the habitat throughout its historic range has been eliminated on both of the ridges where it occurs. Not only are habitat destruction, modification, and degradation the primary reason for population declines and extirpations on private lands, but lack of management on public lands has resulted in population declines and extirpations from habitat degradation throughout the remaining range on these lands as well. Fire suppression and habitat conversion to urban uses continues to negatively affect the species.

Factor C – charcoal root rot (*Macrophomina phaseolina*), black leaf spot (*Diplocarpon rosae*), an unknown black fungus, bacteria-induced wilt, and moth predation (*Uresiphita reversalis*) – remain to be stressors for the species because of the limited redundancy and resiliency of the species.

Factor E. The effects of climate change may be positive, neutral, or negative and they may change over time. The Service is not aware of any climate change information specific to the habits or habitat of *Lupinus aridorum* that would indicate what potential effects climate change and increasing temperatures and rainfall, or extended drought conditions may have on this species.

The National Climate Assessment (NCA 2014) reports that the average precipitation has decreased in central Florida since 1900; however, heavy downpours are increasing in frequency and intensity since 1970. Future projected precipitation changes in seasonality for central Florida indicate 0 to +10% in winter, 0 to -10% in spring, -10 to -20% in summer, and +10 to +20% in fall will occur. Statewide annual rainfall is projected to increase from 0 to +20% by 2100.

Consecutive dry days are expected to increase 10 to 20% for most of Florida. Predictions of increased drought frequency, intensity, and duration could result in plant losses due to prolonged drought conditions. However, this plant and other scrub species are relatively drought-resistant, but seasonality changes may affect seedling recruitment and general phenology of the species. The Service has no evidence that climate changes observed to date have had any adverse impact on the species, or its habitat nor is there information suggesting that the species, will not be able adapt to predicted changes in drought conditions.

There is no indication that Factors B and D poses a significant threat for the species. Factors A, C and E threats remain ongoing, severe, and occur throughout the species range. These threats are anticipated to continue in the future.

Synthesis

The range-wide numbers of extant populations continue to decline. Little is known about the long-term adverse effects from fungus, wilt, or moth predation on *Lupinus aridorum* populations. *Lupinus aridorum* remains in danger of extinction throughout its entire range; specifically habitat loss and degradation remain significant. Permanent protection and management are necessary to conserve this species. Only one natural population (Lake McLeod NWR) is assured long-term management and protection. No change in the status of *Lupinus aridorum* is recommended.

RECOMMENDED FUTURE ACTIVITIES

- Collaboration with conservation land managers to increase habitat suitability of occupied habitat by promoting beneficial management options to increase population persistence.
- Actively engage landowners to protect, manage, and monitor occupied habitat.
- Continued research on biology and ecology: genetics, seed germination (soil-microbial interactions), fungus and bacteria stressors.
- Conduct studies of soil seed banks across the range on different habitat and seasonality for the restoration of degraded ecosystems and understanding the type of seed bank: transient, persistent, or transient: short-term and long-term persistent.

RESULTS / SIGNATURES

U.S. Fish and Wildlife Service Status Review of Scrub Lupine (*Lupinus aridorum*)

Status Recommendation:

On the basis of this review, we recommend the following status for this species. A 5-year review presents a recommendation of the species status. Any change to the status requires a separate rulemaking process that includes public review and comment, as defined in the Act.

- Downlist to Threatened
- Uplist to Endangered
- Delist:
 - The species is extinct*
 - The species does not meet the definition of an endangered or threatened species*
 - The listed entity does not meet the statutory definition of a species*
- No change needed

FIELD OFFICE APPROVAL:

Lourdes Mena*, Division Manager, Classification and Recovery, Florida Ecological Services
Field Office

Approve: _____

* In 2021, the Classification and Recovery Division Manager in the Florida Ecological Services Field Office was delegated authority to approve 5-year reviews that do not recommend a status change.

REFERENCES

- Bupp, G. 2013. Cytogenetic and population genetic analysis of the endangered scrub lupine (*Lupinus aridorum*). Unpublished Master Thesis. Florida Institute of Technology, Melbourne, Florida. 74 pages.
- Bupp, G., A. Ricono, C.L. Peterson, C.L. Pruett. 2016. Conservation implications of small population size and habitat fragmentation in an endangered lupine. *Conservation Genetics*, DOI 10.1007/s10592-016-0883-9.
- Florida Natural Areas Inventory (FNAI). 2021. Element occurrence GIS database, February 2022.
- NCA 2014. Climate change impacts in the United States: the third national climate assessment. U.S. Global Change Research Program. Washington D.C.
- Palmer, T. 2006. Notes on the life and work of James Brigham McFarlin, Florida Botanist. *SIDA Contributions to Botany* 22:607-613.
- Zazula, G.D., C.R. Harington, A.M. Telka, F. Brock. 2009. Radiocarbon dates reveal that *Lupinus arcticus* plants were grown from modern not Pleistocene seeds. *New Phytologist* vol 182 issue 4 pages 788-792.