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# Scrub Lupine

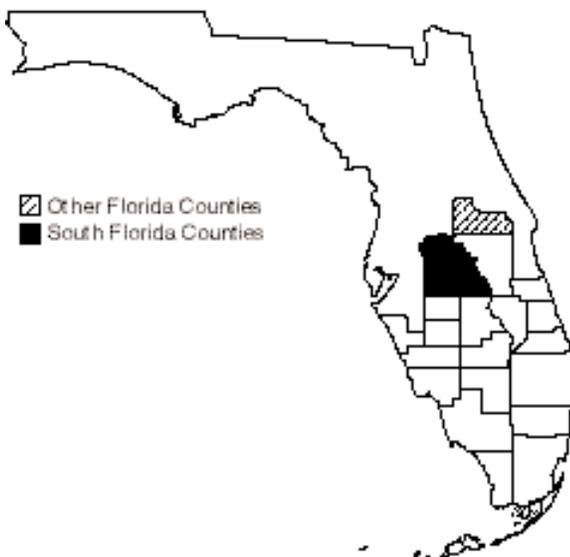
*Lupinus aridorum* (McFarlin ex Beckner) Isley

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Federal Status:	Endangered (April 7, 1987)
Critical Habitat:	None Designated
Florida Status:	Endangered
Recovery Plan Status:	Contribution (May 1999)
Geographic Coverage:	South Florida

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Figure 1. County distribution of scrub lupine.



*Lupinus aridorum* is an herb endemic to Orange and Polk counties, Florida. The species is unusual among central Florida scrub plants because it is absent from the Lake Wales Ridge. Like many other scrub species, however, it is threatened by loss of habitat due to land conversion for agriculture and residential construction. Habitat protection and management on public lands and acquisition of unprotected sites are important for the survival of this species in the wild.

This account represents South Florida's contribution to the existing recovery plan for the scrub lupine (FWS 1996).

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## Description

*Lupinus aridorum* is a woody, perennial herb, with sprawling stems up to 1 m long. The leaves are obovate-elliptic, 4 to 7 cm long and 2 to 4 cm wide. The base and end of the leaf are rounded with a sharp point at the leaf's end. The petioles are 2.0 to 4.5 cm long and the stipules are very small or absent. A silvery pubescence covers the leaves and stems. The flowers are a pale flesh-colored pink and are 4 to 5 cm long. The upper petal (standard) has a black center surrounded by a maroon area. They are arranged in racemes with stalks 4 to 13 cm long. Each raceme has 5 to 14 flowers, but up to 25 on occasion (Stout *in press*). *Lupinus aridorum* fruits are long, woody, and elliptical with a pointed end. It is differentiated from *L. villosus*, the only other pink flowering lupine, in that *L. aridorum* is not prostrate, has hairs on the leaves and stem, and is the only upright pink-flowering lupine in Florida.

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## Taxonomy

Until being named *L. aridorum* in 1982, this taxon was identified as *L. diffusus* and *L. westianus* (52 FR 11172). Isley (1986, 1990) evaluated the systematics of *L. aridorum* in his floristic treatment of the pea family (Fabaceae) in the Southeast and concluded that *L. aridorum* belongs to the same species as *L. westianus* of

the Gulf Coast of northwest Florida, which differs mainly in flower color (blue). Isley's taxonomic status for the central Florida plant is *L. westianus* var. *aridorum* (McFarlin ex Beckner) Isley. However, the former classification *L. aridorum* was used to list the species (52 FR 11172), and will be used here to maintain consistency.

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### Distribution

The scrub lupine was first collected in 1900 in Orange County, Florida. It was not collected again until it was found in Polk County in 1928 and 1937. Renewed survey efforts in the early 1970s and the early 1980s greatly expanded the knowledge of the species distribution in both Orange and Polk counties (Figure 1).

Scrub lupine is now known from two distinct areas. In western Orange County (Orlando area) it is found on the southern Mount Dora Ridge from the Apopka-Plymouth area south, past Lake Buena Vista. In South Florida it is found in north-central Polk County on the Winter Haven Ridge near Auburndale and Winter Haven.

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### Habitat

The scrub lupine grows primarily on well-drained sandy soils of the Lakewood or St. Lucie series (Wunderlin 1984). These soils are very dry and have very little organic accumulation (Lowe *et al.* 1990). The sands are white or occasionally yellow and generally support sand pine scrub (Wunderlin 1984). They are also quite acidic with a pH from 4.0 to 4.5 (J. Stout, University of Central Florida, personal communication 1996).

The natural habitat for *L. aridorum* is believed to be sand pine and rosemary scrub (J. Stout, University of Central Florida, personal communication 1996). Scrub lupine probably existed in sunny gaps until succession of the scrub resulted in excessive shading and closure of open, sunny patches. After long periods without disturbance, gap specialists usually become less common in scrub communities. Regrowth of *L. aridorum* after fire or other disturbances occurs from seedbanks stored in the sand.

Most of the sites where *L. aridorum* is now found are moderately to severely disturbed by soil scraping, road construction, land clearing, or off-road vehicles (Stout *in press*). With these disturbances and associated vegetative responses, it is difficult to determine what the "natural" vegetative cover may have been. However, Wunderlin (1984) found the predominant overstory for this species to be sand pine (*Pinus clausa*), longleaf pine (*Pinus palustris*), and occasionally turkey oak (*Quercus laevis*). The shrub layer tends to be sparse at *L. aridorum* sites; however this may be a result of manmade disturbances to the soil. Shrub species most frequently found in association with *L. aridorum* include rosemary (*Ceratiola ericoides*), scrub live oak (*Quercus geminata*), rusty lyonia (*Lyonia ferruginea*), *Palafoxia feayi*, tallowwood (*Ximenia americana*), and an occasional cabbage palm (*Sabal palmetto*). The herbaceous layer is mostly wiregrass (*Aristida beyrichiana*).

**Scrub lupine.**

Original photograph by Steve Shirah; original flower photograph by R. Wunderlin.

**Reproduction**

The scrub lupine has been found in bloom between March and May. The seed pods mature by June, and the seeds fall off the plant and take root nearby or remain in a long-lived seedbank (T. Race, Bok Tower Gardens, personal communication 1996, J. Stout, University of Central Florida, personal communication 1996). Recent information indicates the plant may bloom from one to three times throughout its life, though few seeds are produced the first year (J. Stout, University of Central Florida, personal communication 1996). Pollinators of this species are unknown.

**Relationship to Other Species**

The scrub lupine is found in open disturbed areas in sand pine and rosemary scrub communities of central Florida. Other federally listed species found in association with *L. aridorum* are Florida bonamia (*Bonamia grandiflora*), papery whitlow-wort (*Paronychia chartacea*), sandlace (*Polygonella rnyriophylla*), and scrub plum (*Prunus geniculata*) (52 FR 11172). The scrub lupine will not grow near rosemary (*Ceratiola ericoides*) because of rosemary's allelopathic effects (J. Stout, University of Central Florida, personal communication 1996).

**Status and Trends**

Like many other Florida scrub endemics, *L. aridorum* has suffered from habitat loss due to urban and agricultural expansion. Currently, most of the estimated 1,000 individuals of this species occur in habitats that have already been highly-modified or are threatened by future land clearing for residential housing; road construction and maintenance; pedestrian, horse, and off-road vehicles; and conversion to pasture land. Throughout much of its range, the scrub lupine is

afforded little protection; it occurs on fewer than 2 ha of public land (excluding road rights-of-ways) (Stout *in press*). The limited distribution of *L. aridorum* makes it especially vulnerable to loss of habitat. As a result of these threats, this species was federally listed as an endangered species on April 7, 1987 (52 FR 11172).

In South Florida, only six sites are inhabited by *L. aridorum*. They are in Polk County, near Winter Haven and Auburndale. The sites near Auburndale are threatened by land clearing to support a rapidly growing human population. Presently only small tracts of scrub remain among expanses of residential development. Polk County sites total only about 380 ha (Christman 1988). Although they are not in South Florida, the status of the 10 sites inhabited by *L. aridorum* in Orange County are important to evaluate the pressures on this species. All 10 sites are between the City of Orlando and Walt Disney World. Orlando has been, and continues to be, one of the most rapidly growing cities in Florida. The portion of the species' range in western Orange County is largely urbanized, with many of the remaining sites composed of small remnants of the original scrub, including vacant residential lots and the right-of-ways of the Florida Turnpike. These are also rapidly expanding communities whose human population growth threatens the continued existence of *L. aridorum*.

Although the species is not abundant or well-distributed, the seeds of *L. aridorum* may be numerous in many locations in which it historically grew. This species may persist only in the form of a seed bank in many heavily vegetated scrubs (J. Stout, University of Central Florida, personal communication 1996). In most known localities, *L. aridorum* grows aggressively following soil disturbance, because of the open patches of bare sand resulting from these disturbances. Since fire and other sources of disturbance have been excluded from many scrub sites, succession and the subsequent growth of other scrub vegetation probably have out-competed *L. aridorum* in many historic localities. Even though seed sources may be available in many of these locations, vegetative surveys rarely locate seeds, and these potential sources of plants are overlooked and rarely considered when reviewing areas for acquisition or protection needs.

The scrub lupine is short-lived and declines after flowering (Beckner 1982, J. Stout, University of Central Florida, personal communication 1996). This reproductive cycle, combined with the susceptibility of the plant to root rot both in the wild and when cultivated, limits conservation options (FWS 1996). Furthermore, the species does not transplant well, even when very young (FWS 1996), but it can be propagated from seed sown *in situ*. The same characteristics that make conservation of this species difficult, make it unprofitable in the horticultural trade. However, collection of the plants' showy, pink flowers may be a potential problem in some areas.

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## Management

The small number of sites from which the scrub lupine is known make it particularly vulnerable to disturbance, habitat degradation, and natural disasters. The scrub lupine is known only from early successional stages of sand pine scrub, indicating that it is intolerant of competition. It is apparent that management

actions must provide for open, early successional patches of habitat in sand pine scrub in order for this species to persist. Natural sand pine scrub historically was subjected to intense, infrequent burns roughly every 30 to 80 years. Unfortunately, many of the sites now occupied by *L. aridorum* occur in human-disturbed sites from which fire has been excluded and, therefore, cannot readily be managed by fire. These sites lack enough ground level fuel to carry fire or are in the vicinity of residential areas where fire management would be difficult. Although we believe fire would be an important management tool, we have no examples of the effects of fire on *L. aridorum* (Stout *in press*).

The scrub lupine would probably benefit from fire or mechanical clearing because these activities would reduce competition by creating areas of bare sand and sunny open patches favored by this species. Based on our rudimentary knowledge of the fire dynamics of scrub vegetation, we believe that the most appropriate prescribed burning schedules for this species will be those that eliminate woody plant competition, but not frequent enough to impair the fire sensitive scrub lupine. In situations where use of prescribed fire is not possible, mechanical clearing (primarily mowing) of overgrowth may be suitable to manage for scrub lupine. Mechanical clearing can probably be used more frequently than fire since this technique is less likely to disturb herbs, forbs and low-growing shrubs, including the scrub lupine.

In addition to implementation of the management techniques described above, we believe that introduction of *L. aridorum* into suitable but unoccupied habitat will be required to ensure recovery of this species. Since scrub lupine is susceptible to root rot and does not transplant well, we suggest that population augmentation include only direct sowing of seed at suitable sites. In some cases, augmentation may only require that naturally occurring stored seeds be disturbed in order to stimulate germination (I. J. Stout, University of Central Florida, personal communication 1996).

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# Recovery for the Scrub Lupine

*Lupinus aridorum* (McFarlin ex Beckner) Isley

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**Recovery Objective:** PREVENT EXTINCTION, then stabilize.

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**South Florida Contribution:** PREVENT EXTINCTION, then stabilize.

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## Recovery Criteria

The scrub lupine may never reach a level at which reclassification could be possible. The objective of this recovery plan is to contribute toward increasing existing populations and preventing extinction. This species may be considered stabilized when existing populations, within the historic range, are adequately protected from further habitat loss, degradation, and exotic plant invasion. These sites must also be managed to maintain openings to support *L. aridorum*.

This recovery objective is an interim goal because of the limited data on the biology, ecology, and management needs of this species. The recovery objective will be reassessed annually based on new research, management, and monitoring information. Reclassification criteria may be refined if new information identifies ways of re-establishing populations of this species to expand its current distribution within its historic range.

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## Species-level Recovery Actions

- S1. Determine current distribution of *L. aridorum*.** This species has an extremely restricted range. In South Florida, it is found only in northern Polk County off the Lake Wales Ridge. This species is found in a fast growing urbanizing area and essentially all of its habitat has been converted from the natural state.
- S1.1. Conduct surveys for additional populations of *L. aridorum*.**
- S1.1.1. Survey scrub habitat in scrub communities having the Lakewood or St. Lucie soil series.** This is the only listed scrub endemic that does not occur on the Lake Wales Ridge. Adequate survey work has not been conducted off the Lake Wales Ridge; therefore, occupied sites for this species may exist. Areas with new disturbance or road sides may reveal a hidden seedbank.
- S1.1.2. Continue surveys on protected lands.** New sites for listed species are still being found on protected lands. This survey work should be continued to catalog all existing protected sites and new sites as they are acquired.

- S1.2. Maintain distribution of known populations and suitable habitat in a geographic information system database.** Use the database to map existing populations and to assess the species' status and trends over time. The database should contain information on locations, population sizes, and status. This information should also be used for project review, in land acquisition activities, and to coordinate updates with the Florida Natural Areas Inventory database. Currently, the Lake Wales Ridge Ecosystem Working Group and Archbold Biological Station are proposing to map the entire central ridge. This information would show potential habitat for scrub endemics based on their habitat needs.
- S2. Protect and enhance existing populations.** Much of the native xeric uplands on the Lake Wales Ridge and surrounding counties have been converted to agriculture or urban development. The remaining habitat is fragmented into small parcels and in many cases, isolated. For this reason, existing populations are in need of protection from a variety of threats.
- S2.1. Protect habitat through acquisition, conservation easements, or agreements with landowners.**
- S2.2. Protect populations on public lands.** Develop management guidelines that allow for a fire regime that includes a mosaic of successional stages.
- S2.3. Use local or regional planning to protect habitat.** Utilize available regional and county planning processes to encourage protection of suitable, unoccupied, and occupied habitat of *L. aridorum*.
- S2.4. Continue *ex situ* conservation.** *Ex situ* collections are important for preserving genetic diversity, preventing extirpation, and determining ecological characteristics and habitat management needs. These collections will be instrumental in the recovery of *L. aridorum*.
- S2.4.1. Conserve germ plasm.** The seed for this species is not presently in long-term storage.
- S2.4.2. Obtain an *ex situ* collection.** Disease makes an *ex situ* population for this species very difficult. However, plans for such a population should not be discarded because the information received from a cultivated population is often valuable to the recovery of listed species.
- S2.5. Develop protocol for evaluating reintroduction sites and methodology for introducing this species.** (Re)introduction for this species may be necessary for its continued survival. It grows readily from seed and may already be present in certain overgrown scrub sites in the form of a seed bank.
- S2.6. Enforce available protective measures.** Use local, State and Federal regulations to protect this species from overcollecting and damage from off-road vehicle use. Regulations should also be used to protect xeric vegetative communities where *L. aridorum* is present.
- S2.6.1. Initiate section 7 consultation when applicable.** Initiate section 7 consultations when Federal activities may affect this species.
- S2.6.2. Enforce take and trade prohibitions.** This species is protected by take provisions of the Endangered Species Act (including prohibitions against removing and reducing to possession any endangered plant from areas

under Federal jurisdiction; maliciously damaging or destroying any such species on any such area; or removing, cutting, digging up any such species), by the Preservation of Native Flora of Florida Act, and by the Florida rules regarding removal of plants from state lands.

- S3. Conduct research on life history characteristics of *L. aridorum*.** Much of the basic biology and ecology of this species remains poorly understood. To effectively recover this species more specific biological information is needed.
- S3.1. Continue research to determine demographic information, such as number of sites and populations, numbers of individuals in a population, recruitment, dispersal, growth, survival, and mortality.** These kinds of data exist from one site in western Orange County. A second population near Winter Haven is now under study.
- S3.2. Once demographic data are known, conduct population viability and risk assessment analysis.** These analyses will determine the numbers of plants, sites, and subpopulations/populations, and the spatial distribution needed to ensure persistence of the species.
- S3.3. Conduct research to assess management requirements of *L. aridorum*.** Determine which natural populations can be stabilized or increased by habitat management. Surveys, research, and monitoring information will provide factors contributing to any declines at each site. Monitoring of populations should be in reference to various habitat management practices. Site-specific management guidelines should be provided to land managers. Close coordination among land managers is essential in the development of adaptive management techniques. All known populations of *L. aridorum* are associated with soil-surface disturbances; not a single site has experienced fire in over 50 years. Thus direct observations of the species' response to fire cannot be made under present conditions. Fire must have been the means by which openings in the scrub were established, yet frequent fire could be damaging to a population. More information is needed on the response to management activities for this species.
- S4. Monitor existing populations of *L. aridorum*.**
- S4.1. Develop monitoring protocol to assess population trends for *L. aridorum*.**
- S4.1.1. Monitor to detect changes in demographic characteristics, such as reproduction, recruitment, growth, dispersal, survival and mortality. Also monitor for pollinators, herbivory, disease and injury.**
- S4.1.2. Monitor the effects of various land management actions on *L. aridorum*.** Assess any changes in demographic characteristics of *L. aridorum* in response to land management activities, such as prescribed fire, exotic plant control, *etc.*
- S4.2. Develop a quantitative description of the population structure of *L. aridorum*.** This description will provide a baseline for monitoring population dynamics in response to natural environmental changes and management treatments. Data recorded should include morphology, survivorship, mortality, and reproduction for individual plants. Data about each plant's microsite (vegetation cover, litter depth, substrate, and closest neighbors) may provide insight for management.

- S5. Provide public information about *L. aridorum*.** It is important for the recovery of this species that governmental agencies, conservation organizations such as the Florida Native Plant Society, and private land owners be appropriately informed about this species. Care is needed, though, to avoid revealing specific locality information about where *L. aridorum* is found.

Public outreach efforts must also continue to address the increasing concern that horticultural demand for this and other rare species may not benefit conservation of threatened and endangered species. The public should be informed that commercial production and horticultural uses of endangered species provide little benefit to species, since the recovery of *L. aridorum* and other rare species requires a self-sustaining, secure, number of natural populations.

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### Habitat-level Recovery Actions

- H1. Prevent degradation of existing habitat.** Extensive habitat loss, degradation, and fragmentation have already occurred throughout the range of this species. Both urbanization and fire suppression have decreased the available habitat. There is one newly acquired site for *L. aridorum* in Polk County, at the Lake Wales Ridge NWR. More sites must be protected to ensure the safety of this species.
- H1.1. Secure habitat through acquisition, landowner agreements, and conservation easements.** With so little xeric scrub habitat left, any method of securing protected populations should be sought.
- H1.2. Manage and enhance habitat.** Preventing habitat damage by off-road vehicle use and overcollection, and provide proper management of habitat, including prescribed fire.
- H1.2.1. Conduct prescribed burns.** Fire is a necessary and integral characteristic of the scrub community. A variable interval in fire return and in season is important to mimic the natural fire regime. In addition, spatial variation in fire intensity and unburned patches are necessary to construct a natural fire landscape. The scrub is naturally made up of islands of suitable and unsuitable habitat. To repeat this landscape pattern, sites should be burned to create a mosaic when possible to allow for variation.
- H1.2.2. Control and eliminate exotic and invasive plants and animals.** Exotic plant and animal species are not yet a major threat in Florida scrub as compared to other communities in South Florida. However, in isolated areas, exotic species are becoming established. Without control, exotic/invasive plants may become a threat to the survival and recovery of *L. aridorum*.
- H1.2.3. Control access to areas where listed plants are growing.** Collection, trampling, and off-road vehicles can severely threaten individual populations.
- H2. Restore areas to suitable habitat.** Native habitats that have been disturbed or that have experienced a long history of fire suppression may be good candidates for future reserves.
- H2.1. Restore natural fire regime.** Long periods without fire can change the species

composition and the ability of the site to carry fire. Rehabilitation of a site may be a lengthy process, but with fewer and fewer sites remaining, these sites may become more valuable for future recovery. On these sites, a seed bank may exist that could include rare endemic species.

- H2.2. Enhance sites with native plant species.** Because of logging or long periods without fire, certain native plant species that were present historically may now be absent from the natural composition of the community. These species can be reintroduced if natural colonization is not possible.
- H3. Conduct habitat-level research projects.** Study the response of *L. aridorum* to various land management practices, such as prescribed fire regimes, vegetative thinning, and control of exotic/invasive vegetation with herbicides.
- H4. Monitor habitat/ecological processes.** Monitor the effects of land management actions, such as prescribed fire, exotic plant control, *etc.*, on the habitats where *L. aridorum* occurs.
- H5. Provide public information about scrub and its unique biota.** Educational efforts, especially those conducted by Archbold Biological Station, have been successful. Without these successful efforts, the Lake Wales Ridge NWR would not have been created. Florida's system of biological preserves depends on a broad base of public understanding and support for its funding and future success. In addition to past and ongoing educational efforts by The Nature Conservancy, Bok Tower Gardens, and Archbold Biological Station, future efforts by these organizations, and the Florida Park Service, the Florida Division of Forestry, the South Florida Water Management District, the Florida Native Plant Society, and local garden clubs are crucial for increasing public appreciation of scrub and high pine communities, and their associated plant species. The Arbuckle Appreciation Day sponsored by the Florida Division of Forestry has been especially successful in disseminating knowledge about these unique communities.

