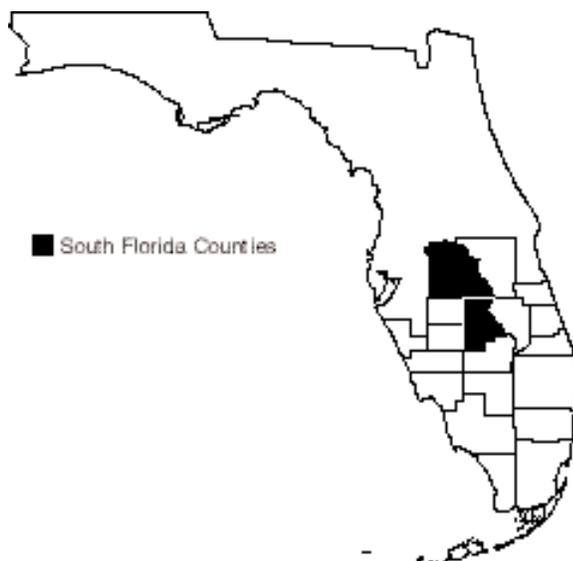

Avon Park Harebells

Crotalaria avonensis (K.R. DeLaney and Wunderlin)

Federal Status:	Endangered (April 27, 1993)
Critical Habitat:	None Designated
Florida Status:	Endangered
Recovery Plan Status:	Revision (May 18, 1999)
Geographic Coverage:	Rangewide

Figure 1. County distribution of Avon Park harebells.



The principal cause of decline of the scrub community of central Florida's Lake Wales Ridge is conversion of high pineland and scrub for agricultural purposes (principally citrus), and for commercial, residential, and recreational purposes. *Crotalaria avonensis* is one of the many scrub species that have suffered loss of habitat. As a result, it was federally listed as an endangered plant in 1993.

This account represents a revision of the existing recovery plan for the Avon Park harebells (FWS 1996).

Description

Avon Park harebells (*Crotalaria avonensis*) is a spreading, perennial herb with one to three moderately hairy, flowering stems that may grow 2 to 10 cm above the surface. It has a large taproot, up to 14 mm thick and 40 cm long. The leaves of this plant are 8 to 19 mm long, broadly elliptic or round, somewhat succulent, and coated with white or yellowish-white hairs. The stems terminate in flowering racemes. Flowering is from March until June. The flower, shaped like a typical pea flower, has a yellow corolla 8 to 9 mm long. The seed pods are inflated and 14 to 25 mm long. These pods are tan to grey or maroon, and can be nearly as long as the upright stems that hold them in place. The pods contain up to 18 seeds, chestnut to maroon in color and 3.4 to 3.8 mm long by 2.4 to 2.6 mm wide. The plant generally appears to resemble clusters of fuzzy grayish leaves hugging the ground and sometimes appears bushy (DeLaney and Wunderlin 1989).

Taxonomy

C. avonensis is a member of the pea family (Fabaceae/Leguminosae). This small herb with large seed pods was not named until 1989, evidently because very few specimens had ever been collected and they had not been examined by taxonomists. This species is most closely related to *C. rotundifolia*, a variable species that ranges

from Virginia to Panama (DeLaney and Wunderlin 1989). *Crotalaria* is a very large, mostly tropical genus that includes a number of robust annual weeds, all with inflated “rattlebox” seed pods. It has been suggested that this endemic is a relic of the Miocene on the southern Lake Wales Ridge (DeLaney and Wunderlin 1989).

Distribution

Avon Park harebells is one of the most narrowly distributed of the Lake Wales Ridge endemics, having only been identified at three sites in Polk and Highlands counties (DeLaney and Wunderlin 1989, The Nature Conservancy 1991) (Figure 1). Specifically, its distribution includes the Avon Park Lakes acquisition area and the Saddleblanket Lakes State Preserve in Polk County, and the Carter Creek acquisition area in Highlands County.

Habitat

This species inhabits scrub communities found on the Lake Wales Ridge where it typically grows in full sun, on bare white sand, or in association with clumps of *Cladonia* lichens. However, it may also occur in the partial shade of other plants (DeLaney and Wunderlin 1989). It may also grow along trails, open edges, or previously disturbed roadbeds. The soils associated with this species have been classified as Archbold and Satellite sands (The Nature Conservancy 1991). Like other small scrub endemics, it appears to depend on bare patches of sand to become established.

Reproduction

Flowering begins in mid-March and continues profusely until June. After flowering, this deciduous plant enters a vegetative phase, forming clusters of stems that give a clumped or rosette appearance. They are then dormant from late fall or early winter until March (DeLaney and Wunderlin 1989). Demographic information on pollinators, seed dispersers, and seed viability is lacking for this species.

Relationship to Other Species

Avon Park harebells are found in association with clumps of *Cladonia* lichens (DeLaney and Wunderlin 1989). It seems immune to allelopathic effects from shrubs, and it invades disturbed areas (K. DeLaney, personal communication 1995). Other plants *C. avonensis* may be found in association with include *Chionanthus pygmaea*, *Bonamia grandiflora*, *Calamintha ashei*, *Conradina canescens*, *Liatris ohlingerae*, *Paronychia chartacea*, *Hypericum cumulicola*, *Polygonella basiramia*, and *P. myriophylla* (DeLaney *et al.* 1990).

In addition to these plant associates, galls have been observed on the stem tip of this species (The Nature Conservancy 1991), however, the causative organism has not been identified.

Avon Park harebells. *Original photograph by George Jenkins.*



Status and Trends

The principal cause of decline of central Florida's upland vegetation is conversion of high pineland and scrub for agricultural purposes (principally citrus groves), and for commercial, residential, and recreational purposes. Peroni and Abrahamson (1985) used aerial photography to determine that in Highlands County, 64.2 percent of the xeric vegetation (scrub, scrubby flatwoods, and southern ridge sandhills) present before settlement had been destroyed by 1981. An additional 10.3 percent of the xeric vegetation was moderately disturbed, primarily by road construction for residential subdivisions. The total remaining xeric vegetation was approximately 9,713 ha. Similar conditions are present in Polk County. Christman's (1988) estimate of scrub habitat loss for the Lake Wales, Lake Henry and Winter Haven Ridges indicated that approximately 11,129 ha out of the original 31,000 ha of scrub vegetation remain in this area. This number has, undoubtedly continued to decrease in the last 10 years, and should be viewed as an optimistic estimate of remaining scrub habitat on these ridges.

It has been stated that a population of *C. avonensis* should have 100 or more plants in appropriate habitat (The Nature Conservancy 1991). One population measured had a density of 0.016 plants/m², and densities as high as

20 plants/m² have been recorded. At the protected Saddleblanket Lakes site, the *C. avonensis* population was estimated by Doria Gordon (The Nature Conservancy, personal communication 1995) at 200 plants. Avon Park Lakes, a platted subdivision, is developing fast enough to make land acquisition difficult and was excluded from the Lake Wales Ridge NWR acquisition program for this reason. In addition, the area is invaded by cogon grass (*E. Menges*, Archbold Biological Station, personal communication 1995). Difficulties in land acquisition also hamper protection efforts for the Carter Creek site.

Avon Park harebells are threatened by residential and agricultural development. Road-side soil stabilization through the placement of shell or sod may preclude the establishment of *C. avonensis*. Illegal trash dumping in scrub habitat may also eliminate open areas that could be colonized by this species. Off-road vehicle traffic has already damaged the Avon Park Lakes population, and will continue to be a problem until the sites are protected.

Management

Avon Park harebells are maintained at Bok Tower Gardens in the national endangered plant collection. It is known to occur at only three sites where protection is feasible. All three sites are targeted for land acquisition, and one, Saddle Blanket Lakes, is substantially protected already. Protected sites need to be free from exotic plant species invasion and soil disturbance.

This plant has been successfully propagated in *ex situ* collections and should be a good candidate for population reestablishment. The population at Saddleblanket Lakes is currently being monitored with permanent plots; however, more information on seed viability and recruitment is needed.

Monitoring of the status of this species is essential. So little is known on the ecology of *C. avonensis* that formulating appropriate management plans may be difficult. The fact that it will invade slightly disturbed areas may be advantageous for its continued survival.

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Recovery for the Avon Park Harebells

Crotalaria avonensis (K.R. DeLaney and Wunderlin)

Recovery Objective: PREVENT EXTINCTION, then stabilize.

Recovery Criteria

The Avon Park harebells will, most likely, never reach a level at which reclassification could be possible. The objective of this recovery plan is to increase existing populations and prevent extinction. This species may be considered stabilized when existing populations, within the historic range, are adequately protected from further habitat loss, degradation, exotic plant invasion, and fire suppression. These sites must also be managed to support *C. avonensis*.

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 developed if new information identifies ways of re-establishing populations of this species to expand its distribution within its historic range.

Species-level Recovery Actions

- S1. Determine current distribution of *C. avonensis*.** This species' known distribution is isolated to Polk and Highlands counties. Additional surveys of scrub habitat with appropriate soils should be conducted in these two counties. A geographic information systems database should be developed 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 and in land acquisition activities.
- 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 residential development. The remaining habitat is fragmented into small parcels and in many cases, isolated.
- S2.1. Protect populations on public lands.** Develop land management plans that incorporate prescribed burning, invasive/exotic vegetation control, and controlled off-road vehicle access.
- S2.2. Continue *ex situ* conservation.** Collections held *ex situ* will be instrumental for preserving the genetic diversity, evaluating the ecological requirements, and preventing the loss of *C. avonensis*.
- S2.3. Conserve germ plasm.**

- S2.4. Enforce available protective legislation.** State, Federal, tribal and local regulations should be used to protect this species from overcollection and damage from off-road vehicle use. Regulations should also be used to protect xeric vegetative communities where *C. avonensis* is found.
- S2.4.1. Initiate section 7 consultation when applicable.** Section 7 of the Endangered Species Act applies to Federal activities that may affect listed species.
- S2.4.2. Encourage implementation of management plans.** Federal agencies are obligated under section 7(a)(1) of the ESA to use their authorities to further the purposes of the Act. For example, an agency could develop a conservation program which incorporated prescribed burning to improve habitat for the benefit of listed species.
- S2.4.3. Continue to enforce take and trade prohibitions.** This species is protected by take provisions of the Endangered Species Act (including its prohibition 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, or 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.** 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 species demographics.** Additional information is needed on the number of populations this species has in the wild, and factors which influence its survival such as recruitment, dispersal, growth, and mortality. Data on pollinators, herbivory, disease and injury are also lacking.
- S3.2. Develop population viability and risk assessment.** The demographic information collected from research should be used to develop models to evaluate spatial distribution and population size necessary to ensure persistence of the species.
- S3.3. Conduct research to assess management requirements of *C. avonensis*.** Evaluate management practices (*e.g.*, prescribed burning, mowing, exotic plant control) for their effects upon this species. Provide the results to land managers.
- S4. Develop standardized monitoring.** Standardized monitoring needs to be developed for this and other listed scrub species to determine the effect of management actions.
- S4.1. Collect existing and historical data, and place in a central location.** Contact former and present researchers for historical data, gather information from herbaria and museums, and compile the data for placement in a geographic information system database. The South Florida Field Office could maintain the database. This location would allow all researchers access to both historic and current data, and provide the FWS with a means to monitor the success of recovery tasks.

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- S5. Provide public information about *C. avonensis*.** It is important that governmental agencies, conservation organizations, and private land owners be appropriately informed about this species.
- S6. Establish reclassification criteria.** Once the population is stabilized, research and monitoring results may provide data necessary to develop reclassification criteria.
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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. To date, there is only one protected site for *C. avonensis* in South Florida.
- H1.1. Secure habitat through acquisition, landowner agreements, and conservation easements.** Little xeric scrub habitat remains for this species; any method of securing land to protect populations should be sought.
- H1.2. Manage and enhance habitat.** Manage habitat to maintain *C. avonensis* populations by preventing competition from exotic or invasive species, off-road vehicles, over-collection. 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. The frequency of fire return and seasonality are important to mimic the natural fire regime. The scrub landscape 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 areas supporting populations of *C. avonensis* compared to other areas in South Florida. Without control however, exotic or invasive plants may become a threat to the survival and recovery of this species.
- H1.2.3. Evaluate the effects of off-road vehicles on sensitive lands and limit access where damage to the habitat is documented.**
- H1.2.4. Restore areas to suitable habitat.** Native habitats that have been disturbed and have the appropriate soils may be prime candidate sites for restoration.
- H1.2.5. Monitor habitat/ecological processes.** Monitor the effects of land management actions, such as prescribed fire, exotic plant control, *etc.*, on the habitats where *C. avonensis* occurs.
- H2. Provide public information about scrub and its unique biota.** Educational programs, especially those conducted by Archbold Biological Station, have been successful. Without these efforts, the Lake Wales Ridge National Wildlife Refuge would not have been created. The State's system of biological preserves depends on a broad base of public understanding and support for its funding and future success.

