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# Crenulate Lead-plant

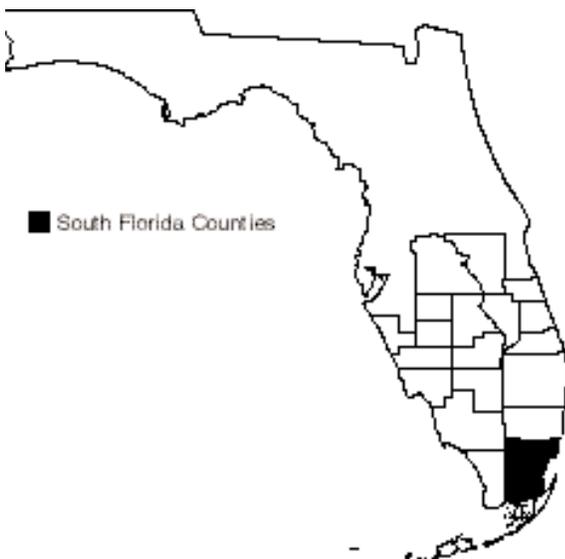
*Amorpha crenulata*

(=*herbacea* Walt. var. *crenulata* (Rydberg) Isley)

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<b>Federal Status:</b>	Endangered (July 18, 1985)
<b>Critical Habitat:</b>	None Designated
<b>Florida Status:</b>	Endangered
<b>Recovery Plan Status:</b>	Revision (May 18, 1999)
<b>Geographic Coverage:</b>	Rangewide

Figure 1. County distribution of the crenulate lead-plant.



The crenulate lead-plant is a perennial, deciduous shrub that inhabits marl prairies and wet pine rocklands in a small area of Miami-Dade County. This pine rockland community is maintained by periodic fires. Greater than 98 percent habitat loss, fire suppression, drainage, and exotic pest plant invasions threaten the species, which was federally listed as endangered on July 18, 1985.

This account represents a revision of the existing recovery plan for the crenulate lead-plant (FWS 1988).

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## Description

Also known as the Miami lead-plant, *A. crenulata* is a rhizomatous, deciduous, perennial shrub that grows to 1.5 m in height and is endemic to Miami-Dade County, Florida (DOT 1997). The branches of this plant are red/purple, and contain 25 to 33 leaflets borne on leaves that are 0 to 15 cm long, with petioles 1 cm long or less. The crenulate leaflets are grey/green above, paler and glandular dotted below, and 5 to 11 cm long. The racemes are terminal, 15 to 20 cm long, solitary or in clusters of two to three. The 8 mm-long flowers are held in loose clusters. The calyx is dark green or purplish, 3.2 to 4.0 mm long with the upper half glandular dotted. The showy white standard flower is 5.2 mm long, and 4.2 mm wide with long exerted stamens. The fruit is 6 to 11 mm long, laterally compressed, and glandular dotted on the upper two-thirds. The seeds produced in the fruit are 5 mm long and compressed.

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## Taxonomy

The crenulate lead-plant was described by Rydberg in 1919, citing his type specimen as J.K. Small and Percy Wilson #1898, May 9, 1904, "In hammocks, between Coconut Grove and Cutler" (New York Botanical Garden herbarium). Small (1933) followed this treatment. Isley (1986, 1990) argues that *A. crenulata* is an isolated variant of *A. herbacea*, distinguished only by the presence of crenulate leaf margins.

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He published the new combination as *A. herbacea* Walt. var. *crenulata* (Rydberg) Isley (Isley 1986). Synonyms: *Amorpha crenulata* Rydberg, *A. herbacea* auct. non. Walt.

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### Distribution

The crenulate lead-plant is known from a 20- square- mile area from Coral Gables to Kendall, Miami-Dade County. Its historic range was only slightly greater, extending south to Cutler (based on an entry of *Amorpha caroliniana* on an unpublished plant list by John Kunkol Small of Addison Hammock), and north to the Little River in northeast Miami-Dade County. This range encompasses an area 5 miles east to west and 12 miles north to south. Currently, eight locations are known for this plant (D. Garvue, *et al.* Fairchild Tropical Garden, personal communication 1998).

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### Habitat

The crenulate lead-plant occurs in plant communities that were historically associated with seasonally hydrated soils and frequent burning, including wet pinelands, transverse glades, and hammock edges. It can be found growing in poorly-drained Opalocka sands within pine rocklands or in wet prairies with Opalocka-rock outcrop complex soils. It requires open sun to partial shade. The type specimen (Small and Wilson #1898) cites the habitat as “In hammocks.” No recent collections have been seen from within hardwood hammocks. Many of Small’s specimen labels were pre-printed with habitat data and some species were collected and labeled as occurring in hammocks that were actually collected in habitats outside hammocks. It may be that crenulate lead-plant was never collected in hammocks.

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### Reproduction

Little is known of the life history of crenulate lead-plant. In two years of life-history monitoring of one population, no seedlings were observed. Plants showed little to no growth and flowered primarily following human disturbance. Crenulate lead-plant is semi-deciduous, about 70 percent of plants losing most or all leaves between December and February. Pollinators or dispensers have not been observed (DERM 1993). New sprouts, when observed, have been identified as primarily adventitious roots (DOT 1997). In addition, the viability of germplasm is not known (DOT 1997). This species is relatively easy to cultivate, indicating that the lack of reproduction in the wild may not be due to a lack of viable seeds (A. Herndon, personal communication 1998).

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### Relationship to Other Species

The pine rocklands where the crenulate lead-plant occurs are characterized by a canopy of slash pine (*Pinus elliottii* var. *densa*), a shrub canopy of saw palmetto (*Serenoa repens*), wax myrtle (*Myrica cerifera*), poison wood (*Metopium toxiferum*), and willow bustic (*Sideroxylon salicifolium*). Common

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**Crenulate lead-plant.**  
Original photographs by  
Steve Shirah.



herbaceous associates include *Schizachyrium sanguineum* var. *sanguineum*, *S. gracile*, *Aster adnatus*, and *Acalypha chamaedrifolia*. Other typical species associates of crenulate lead-plant include cabbage palm (*Sabal palmetto*), southern sumac (*Rhus copallina* var. *leucantha*), bluestem (*Schizachyrium rhizomatum*), wild-petunia (*Ruellia succulenta*), *Paspalum monostachyum*, and blueheart (*Buchnera americana*).

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### Status and Trends

Crenulate lead-plant was listed as endangered on July 18, 1985 because of the loss of pine rockland habitat from residential and commercial development. Vegetative communities within the historic range of crenulate lead-plant have been almost entirely eliminated by agricultural, urban, and commercial development. The transverse glades where crenulate lead-plant occurs were among the first areas in Miami-Dade County to be farmed, because their marl soils were better suited to conversion to farmland than the limestone rock of the adjacent pinelands. By 1984, 98 to 99 percent of Miami-Dade County pine rocklands had been destroyed, and development continues today. In addition, fire suppression, invasion by exotic plant species, and drainage threaten the survival of the crenulate lead-plant. Flowering and seed production may not occur as a result of these disruptions.

The crenulate lead-plant is currently known from eight sites (D. Garvue *et al.*, Fairchild Tropical Garden, personal communication 1998). Four sites are located in parks owned by the Miami-Dade County Parks Department. One site is located in the Bird Road railroad right-of-way. The three remaining sites are located in the vicinity of Snapper Creek and Old Cutler Road, Red Road and SW 8th Street, and Schoolhouse Road. Fairchild Tropical Gardens, in

cooperation with Miami-Dade County Parks Department, has also introduced a population of 108 plants to a pine rockland habitat adjacent to Addison Hammock at the Charles Deering Estates (J. Maguire, Miami-Dade County Parks Department, personal communication, 1998 and D. Garvue, *et al.* Fairchild Tropical Garden, personal communication 1998).

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## Management

The pine rocklands of Miami-Dade County have evolved and adapted to frequent fires (Snyder *et al.* 1990). Presumably, crenulate lead-plant is also adapted to the natural fire regime of the pine rocklands, but this has never been studied. Under two to three decades of fire suppression these areas mature into tropical hammocks with a few pines in the canopy (Snyder *et al.* 1990). A fundamental question concerning the fire ecology of pine rocklands is how frequently they should burn and at what season of the year. Snyder *et al.* (1990) inferred the historic burn regimes by looking at the time it takes for the herbaceous layer to be excluded from an area by shading (maximum time between fire) and the point when enough fuel is available to carry a fire (minimum time between fires). The minimum fire regime they found was 2 to 3 years and the maximum was 15 years. This wide range in fire frequencies would result in different forest structures and dynamics. This would suggest that a mosaic of burns should be used in the management of pine rocklands. Presently the recommended burn regime is 3 to 7 years with summer fires generally preferred to winter. Summer fires are preferred because most of the lightning strikes (the historical cause of fires) occur in the summer months. In areas where fires have been suppressed for many years, the reintroduction of fire may have to be done in step-wise fashion. In some areas it may even include manual removal of some fuel to prevent a very hot fire and reduce residual smoke problems. Any prescribed fire management should include a monitoring program to determine the effectiveness of the prescription. Monitoring should include the species distribution (presence/absence), quantitative assessment of abundance or condition, and demographic information on individual plants (Menges and Gordon 1996). There should also be a component to the monitoring that captures the health of the community and species that occur in association with crenulate lead-plant. Fairchild Tropical Garden is currently doing such monitoring at several sites where crenulate lead-plant occurs (C. Kernan, Fairchild Tropical Garden, personal communication 1996).

The hydric component of historic pine rocklands may have been a contributing factor to seed recruitment and seedling success. Rehydration experiments should be undertaken to see if they positively influence plant recruitment (J. Maguire, Miami-Dade County Parks Department, personal communication 1998).

Invasive exotic species, especially *Schinus terebinthifolius*, *Neyraudia reynaudiana*, and Queensland umbrella (*Schefflera actinophylla*) threaten crenulate lead-plant and other rare pine rockland plants, but this has never been

studied or documented. The control of exotic species in the pine rocklands is a very important part of maintaining the habitat, although it can be very costly once exotics are established in an area. In most cases the control of exotics includes the use of manual labor, herbicides, and prescribed fire. In heavily infested areas removal is very labor intensive, with a field crew pulling the plants by hand or cutting. Prescribed fire and herbicide treatments are then used to control the exotic plants. Once an area is cleared of exotics, proper management can reduce the costs of control and maintain the site relatively exotic free.

The management of pine rocklands in Miami-Dade County is complicated because most of the remaining habitat occurs in small fragmented areas bordered by urban development. Areas surrounding managed pine rocklands that have exotic species can act as a seed source for exotics to continue to invade the pine rockland. To effectively control invasive exotics, an active strategy is needed. This includes a multi-lingual outreach program in Miami-Dade County stressing the importance of prescribed fire management and invasive exotic control.

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# Recovery for the Crenulate Lead-plant

*Amorpha crenulata*

(=*herbacea* Walt. var. *crenulata* (Rydberg) Isley)

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

## Recovery Criteria

*Amorpha crenulata* 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. *Amorpha.crenulata* 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 maintain areas to support *A. crenulata*. Monitoring programs should demonstrate that populations of *A. crenulata* on these sites support sufficient population sizes, are distributed throughout the historic range, and are sexually or vegetatively reproducing a sufficient rate to maintain the population. Further, seedling establishment must be documented in the wild.

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. Conduct surveys to determine distribution of crenulate lead-plants.** Crenulate lead-plants on county-owned pine rockland sites have been thoroughly surveyed in Miami-Dade County. However, other populations may be noted during pine rockland purchase and restoration program implementation. Fire may eliminate litter concealing listed species, or enable seeds in the seed bank to germinate. For that reason, pine rocklands that did not contain listed species when unmanaged should be resurveyed after fire events.
- S2. Protect and enhance existing populations.** It is imperative for the stabilization of crenulate lead-plants that additional populations not be lost. The existing populations should be mapped, including obtaining GPS coordinates and developing GIS coverage. Herbarium voucher specimens should be collected and archived for all populations.
- S2.1. Augment natural populations of crenulate lead-plants, where appropriate.** Because many pine rockland plant species are in a precarious situation, *ex situ* collections exist for *A. crenulata*. If possible, additional collections should be established. These may be used to cultivate this species and augment sparse populations in protected areas. Experiments with reintroductions will be useful in the future, and could be essential for the recovery of the crenulate lead-plant species.

- S2.2. Continue work with *ex situ* propagation and seed storage banks.** Seeds should continue to be banked for all the listed species possible, and should be identified precisely as to collection location. Fairchild Tropical Garden has submitted seeds of crenulate lead-plant to the National Seed Storage Laboratory at Fort Collins, Colorado to initiate studies on seed storage potential and methods. Propagation and cultivation methods have been developed by Fairchild Tropical Garden (D. Garvue *et al.*, Fairchild Tropical Garden, personal communication 1998).
- S2.3. Continue to identify potential reintroduction sites and reintroduce pine rockland plants, where appropriate.** Sites identified as suitable for reintroduction within the known historic range should be surveyed and prepared to receive plants. Federal lands under proper management regimes may be good recipient sites. These sites should receive reintroduction stock.
- S2.4. Enforce available protective legislation.** State, Federal, and local regulations should be used to protect the pine rockland ecosystem and the listed plants. Use existing standard monitoring protocols.
- S2.4.1. Initiate section 7 consultation when applicable.** Section 7 of the ESA applies to Federal activities which might impact listed species, especially on Federal lands (former Richmond Naval Air Station lands, and the Perrine USDA site).
- S2.4.2. Encourage implementation of management plans.** Federal agencies are obligated under section 7(a)(1) of the ESA to conduct positive conservation programs for the benefit of listed species. Implementation of the Richmond Pine Rocklands Management Plan (DERM 1994) would constitute such a positive conservation program and should be implemented by the U.S. Army Reserve Center in Perrine, the U.S. Coast Guard site, the Department of Correction's Miami Correctional Center, and any other Federal agency property owner in this area.
- S2.4.3. Continue to enforce take and trade prohibitions.** The listed pine rockland plants are protected by take and trade restrictions of the ESA and the Preservation of Native Flora Act. Since these are inconspicuous plants, take and trade are nonexistent or uncommon.
- S3. Collect biological information important to species recovery.** Additional information on the ecology and life history of pine rockland plants needs to be collected. Determine size and viability of all populations. Known populations of the listed pine rockland plants should be evaluated. Population viability needs to be investigated and determined for each listed plant species.
- S3.1. Continue to investigate and refine the habitat needs of crenulate lead-plant.**
- S3.2. Determine population size and viability of all populations.**
- S3.3. Study the reproductive biology of crenulate lead-plant.**
- S3.4. Conduct genetic studies to document the genetic variation within and between populations.**
- S3.5. Study the fire ecology of *A. crenulata*.**

- S3.6. Study the response of crenulate lead-plant to habitat management treatments.**
- S4. Develop standardized monitoring.** Standardized monitoring based upon the protocols developed by FNAI should be used for pine rockland species in order to determine the effect of management actions on these species and make the data compatible to existing databases.
- S4.1. Collect existing and historical data, and place in a central location.** Contact former researchers for historical data, gather information from herbaria and museums, and contact all present researchers to compile data and place in GIS database in South Florida Ecosystem Office. This location will allow all researchers access to both historic and current data, and provide the FWS with a means to monitor the success of recovery tasks.
- S4.2. Monitor status and success of all populations; change management practices if so indicated.** Because of the varying vegetation conditions and fire histories, different management may be required at different pine rockland sites. Different prescribed burn intervals may be necessary for best results. Intervals should be adjusted over the years to promote pine re-establishment and hardwood reduction.
- S4.3. Convene a meeting of researchers and land managers.** A meeting of current pine rockland researchers and land managers would enable the FWS to locate information sources, and begin the process of compiling those data. The meeting would also afford cooperators an opportunity to discuss monitoring and management procedures and set realistic species level goals.
- S4.4. Monitor reintroduction success and modify procedures as necessary.** Plant reintroductions should be monitored to determine the success of the procedure. The goal of reintroduction should be to establish a viable population. Management of the reintroduction sites should be modified as necessary to improve results. The experimental outplanting conducted by Fairchild Tropical Garden at the Deering Estate should continue to be monitored for information that will help design future reintroductions.
- S5. Continue to provide public information about pine rocklands and their unique flora.** Public support will increase the chances of recovery for pine rockland species. Informational and educational materials have been produced. DERM and Miami-Dade County Parks and Recreation Department's Natural Areas Management have developed flyers, displays, newsletters, and press releases, and have held workshops with the general public. Organizations best able to carry out information and education programs include: Metropolitan Miami-Dade County Parks and Recreation Department, the Florida Native Plant Society, Everglades National Park, and Miami-Dade County DERM. Support of local press coverage should continue. DERM has developed a web page that will also aid in disseminating information about this endangered plant community to the public.

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### Habitat-level Recovery Actions

- H1. Develop a GIS database on all listed pine rockland species and their habitats, and distribute the database to researchers, land managers, and conservationists.**
- H1.1. Assess the available GIS data.**

- H1.2. Create coverage of population locations.**
- H1.3. Acquire recent imageries of the sites.**
- H1.4. Distribute the coverage.**
- H2. Continue to protect and prevent degradation of pine rockland plant habitat.** The decline of the five listed pine rockland plants is due to the almost complete elimination or alteration of pine rocklands in South Florida. Without protection and proper management, the remaining rockland sites will be developed or will deteriorate.
  - H2.1. Protect pine rockland habitat.** Acquisition of remaining private sites may be the only effective way to protect or conserve pine rockland habitat. Miami-Dade County's Environmentally Endangered Lands program and the State of Florida's CARL program have acquired over 450 acres of pine rocklands since 1990. It should be noted that public lands may still be subject to development for recreational, maintenance, or other purposes. Such disturbances, unless carefully planned, may directly destroy pine rockland and may secondarily result in exotic plant infestations as well as destructive human uses.
  - H2.2. Protect or acquire privately owned sites.** Less than fee simple acquisition should be used, where appropriate, as an alternative means of protecting pine rockland habitat. Covenants, as provided for under Miami-Dade County regulations, provide tax incentives for private landowners to protect pine rockland sites. A site owned by Florida Power and Light Company may be maintained through cooperation with that utility. This avenue of protection should also be pursued with the railroad company that owns the site of one of the three largest populations. Miami-Dade County DERM is developing a private lands management and grant program for pine rockland protection and restoration. This program should be implemented as soon as possible.
  - H2.3. Implement additional management to meet habitat needs.**
    - H2.3.1. Eliminate human-caused degradation.** Preventing trash dumping or other destructive human activities in pine rocklands is important. In order to accomplish this task, fencing and access restrictions may be necessary. Mowing of the crenulate lead-plant habitat at A.D. Park should be halted and the habitat allowed to recover.
    - H2.3.2. Control invasive plant species, particularly exotics.** Burma reed, or persistent hardwoods need to be controlled and may require special techniques including herbicide, fire, mechanical, and hand clearing at most sites. Other management needs indicated by ongoing research should also be implemented. The two crenulate lead-plants at Matheson Hammock are being suppressed by a closed hardwood canopy.
- H3. Restore areas to suitable habitat.**
  - H3.1. Eliminate physical degradation of habitat and restore to optimal conditions.** Physical degradation of pine rocklands continues to occur, and hurricane Andrew in 1992 killed most of the adult pines in the Richmond tract and elsewhere in Miami-Dade County. The continued degradation of these areas should be curtailed and restoration of uneven-aged pine stands should be undertaken. Tubelings, or direct seeding experiments may be used to accomplish this task. In order to use direct seeding techniques, collection of local pine seeds must continue.

- H3.2. Develop best management practices for pine rocklands.** This would include development of fire management strategies that would best benefit pine rockland species. Studies specifically on the response of crenulate lead-plant to alternative fire management treatments should be implemented.
- H3.3. Implement necessary management.** Without active fire and exotic plant management, pine rocklands will continue to disappear or degrade. Because of the highly fragmented and restricted nature of remaining pine rocklands, intensive management may be necessary at many of the remaining sites. The existing management plans for sites that include crenulate lead-plant should continue to be implemented and modified as necessary for the benefit of this species.
- H3.4. Continue to expand prescribed burning.** Prescribe fire should be conducted at crenulate lead-plant sites at the appropriate times of the year to lower fuel loads. Growing season burns should then be employed after fuel levels are under control. The response to crenulate lead-plant to prescribed burns should be studied. Special consideration must be incorporated when planning prescribed fire for pine rocklands invaded by Burma reed. Incorporate appropriate actions to minimize additional Burma reed infestations in these areas. Due to the highly urbanized lands surrounding some of the pine rockland sites, burning involves risks of smoke damage and annoyance, or worse, losing control of the fire. The Florida Division of Forestry has expertise in carrying out controlled burns in Miami-Dade County, and should be contacted to assist with burns. Fire management is necessary for all Federal and County lands. Miami-Dade County is composing a Strategic Fire Management Plan. This plan should be implemented once approved.
- H4. Monitor habitat and ecological processes.**
- H4.1. Monitor sites with crenulate lead-plant populations to determine success.** A protocol developed by Fairchild Tropical Garden for monitoring the plant communities at crenulate lead-plant sites should be implemented.
- H4.2. Investigate fire history and incorporate into management strategies.** Look at fire history for pine rocklands in Miami-Dade County, incorporate into GIS database and analyze relative to healthy populations. This exercise will provide adequate information on fire history and intervals in urbanized and non-urbanized settings and enable assessment of the appropriateness of proposed management regimes in Miami-Dade County.
- H4.3. Rehydrate soils where feasible.** A monitoring protocol should be developed and implemented that examines the relationship between hydric soils and the recruitment and survival of seedlings at these sites.
- H5. Continue implementation of the fire education program and modify as necessary any fire management education program that has been developed.** Future modifications to this program may include tri-lingual language (Spanish, English, and Haitian Creole).

