

**Crenulate lead-plant**  
**(*Amorpha crenulata*)**

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

**U.S. Fish and Wildlife Service**  
**Southeast Region**  
**South Florida Ecological Services Office**  
**Vero Beach, Florida**

## **5-YEAR REVIEW**

### **Crenulate lead-plant/*Amorpha crenulata***

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

**A. Methodology used to complete the review:** This review is based on monitoring reports, surveys, and other scientific and management information, augmented by conversations and comments from biologists familiar with the species. The review was conducted by the lead recovery biologist for crenulate lead-plant with the South Florida Ecological Services Office. Literature and documents on file at the South Florida Ecological Services Office were used for this review. All recommendations resulting from this review are a result of thoroughly reviewing all available information on the crenulate lead-plant. Comments and suggestions regarding the review were received from peer reviews from outside the Service (See Appendix). No part of the review was contracted to an outside party.

#### **B. Reviewers**

**Lead Region:** Southeast Region, Kelly Bibb, 404-679-7132

**Lead Field Office:** Marilyn Knight, South Florida Ecological Services Office, 772-562-3909

#### **C. Background**

**1. FR Notice citation announcing initiation of this review:** September 27, 2006. 71 FR 56545.

**2. Species status:** Stable (2006 Recovery Data Call). Representative surveys conducted in 2000 and 2003 have comparable numbers of individuals to the most recent estimate of 410 individuals detected in 2006. A total of 353 individuals were observed in 2000 and 402 in 2003. The numbers indicate a slight increase, but it is difficult to ascertain whether the increase is significant. The estimate obtained for 2006 was based on 2006 surveys for 3 small populations (1-9 individuals) and on 2003 and 2005 surveys for the 2 large populations (125-275 individuals); therefore, the 2006 survey is not representative of the species throughout its range. Only continuing management has prevented the extinction of this species, and reintroduction offers a possibility of creating new populations, although suitable sites are few.

**3. Recovery achieved:** 1 (0-25% recovery objectives achieved) (2006 Recovery Data Call).

#### **4. Listing history**

##### Original Listing

FR notice: 50 FR 29345

Date listed: July 18, 1985

Entity listed: Species

Classification: Endangered

#### **5. Associated rulemakings: N/A**

#### **6. Review History:**

5-year review November 6, 1991 (56 FR 56882), in this review, different species were simultaneously evaluated with no species-specific, in-depth assessment of the five factors, threats, etc. as they pertained to the different species' recovery. The notices summarily listed these species and stated that no changes in the designation of these species were warranted at that time. In particular, no changes were proposed for the status of the crenulate lead-plant.

Recovery Status Summary: September 28, 1994

Final Recovery Plan: 1999

Recovery Data Call: 2000, 2001, 2002, 2003, 2004, 2005, 2006

**7. Species' Recovery Priority Number at start of review (48 FR 43098):** 5c (a monotypic genus with a high degree of threat and low recovery potential that is in conflict with construction or other development projects or other forms of economic activity).

#### **8. Recovery Plan or Outline**

Name of plan: South Florida Multi-Species Recovery Plan (MSRP)

Date issued: May 18, 1999

Dates of previous plans: October 7, 1988 (Recovery plan for five pine rockland plant species)

## **II. REVIEW ANALYSIS**

### **A. Application of the 1996 Distinct Population Segment (DPS) policy**

**1. Is the species under review listed as a DPS?** No. The Endangered Species Act (Act) defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listing DPS to only vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

### **B. Recovery Criteria**

**1. Does the species have a final, approved recovery plan containing objective, measurable criteria?** There are no recovery criteria specified in the recovery plan

for downlisting or delisting. There are criteria for preventing extinction and stabilizing the population.

## C. Updated Information and Current Species Status

### 1. Biology and Habitat –

**a. Abundance, population trends (e.g., increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate), or demographic trends:** According to a 1993 report by Miami-Dade County's Department of Environmental Resources Management (DERM), there were nine naturally occurring populations of crenulate lead-plant in Miami-Dade County, of which, four were found on county-owned lands (DERM 1993). However, only six remained in 2000 (Fisher 2000), presumably as a result of development pressure, lack of management, and/or habitat alteration. Since 2000, two of the remaining six populations were lost to development, leaving only the four that occurred on protected lands. In an effort to preserve genetic integrity and provide plant material for reintroductions, over 600 whole plants were rescued from one of these privately-owned sites slated for development in 2005 (Maschinski et al. 2005a, 2005c, 2006c). Some of these plants were used in an experimental reintroduction to a managed area, while the remaining plants were placed in greenhouse facilities for future reintroductions (Maschinski et al. 2006c).

Two experimental outplantings were conducted on suitable sites, one in 1995 and one in 2002 (Maschinski et al. 2002, 2003). Roncal et al. (2006) reported that fewer than 2,000 plants occurred in the four remaining natural populations and two outplanted populations. In May of 2006, a third outplanted site was established (Maschinski et al. 2006b), bringing the total number of natural and outplanted populations to seven. However, recent population estimates indicate that fewer than 1,000 plants remain on the seven sites (Maschinski 2007 in litt.). Despite the protected status of these lands, the plants remain vulnerable to threats other than those associated with development.

Three of the wild populations, occurring on Sites 1, 21, and 57, were surveyed in 2006 and found to have 182, 13, and 1 plants, respectively (Maschinski et al. 2006d) (Table 1). The other wild population, Site 96, was last surveyed in 2005 and contained 125 plants, the second highest count ever recorded at this site. Maschinski et al. (2006d) reported a 26% increase in the number of individuals observed between 1993 and 2003, indicating that some reproduction was occurring. Between 2003 and 2006, the population on Site 1 experienced a 44% decline from 275 to 182 individuals. According to Maschinski et al. (2007a), Site 1 showed the greatest declines, most likely as the result of the lack of effective maintenance. Populations at Sites 21 and 96

increased slightly in 2006, but results show an overall decline across all populations of 20% from 402 plants in 2003 to 322 plants in 2006. However, the population dynamics for most populations may best be described as fluctuating with no apparent trends through time (Menges 2007 in litt.).

**Table 1.** Numbers of wild *Amorpha crenulata* estimated from census data and the most recent observations (reproduced from Maschinski et al. [2006d] reporting on sites that have been monitored since 1991. It is presumed that Site 185 was not included in the total number of wild populations referenced previously in this document because only one plant was observed).

Site	1991	1992	1993	1995	1996	1997	2000	2001	2002	2003	2005	2006
1			193	177			254	270		275		182
96			93	61	80	62	85	178		114	125	
57	10		8				4		6	4	3	1
21		2		19			10			9		13
185		1									1	1
Total			296	265			353			402		322

In a study conducted in 2000, little to no seedling recruitment was observed at the occupied sites, but it was difficult to determine if shoots were arising from existing root stock or as new plants (Fisher 2000). As is the case with many other pine rockland plants, a symbiotic association with arbuscular mycorrhizal fungi (AMF) was detected in crenulate lead-plant. These plants depend upon colonization by AMF to extract necessary nutrients from the nutrient-poor rockland soils to successfully establish seedlings, and pre-inoculation may be needed for outplantings.

Survival rates were examined for the outplanted populations (Maschinski et al. 2006c). A survival rate of 56% was recorded in 2006 for the population that was introduced in 2002 (Maschinski et al. 2007a). Maschinski et al. (2006a) indicated that the largest plants used for introduction projects had the greatest rate of survival (86%, using rescued whole plants from Site 73), and seedlings had the lowest rate of survival (26%). At times, entire cohorts of crenulate lead-plant seedlings perish (Menges 2007 in litt.). All 100 plants from the 2006 introduction have survived thus far, but 6 did not produce leaves after the dry season and only 3 produced flowers and fruits (Maschinski et al. 2007b).

Seedling survival and recruitment is dependant upon the depth of the litter (duff) layer, with ideal conditions for initial establishment found to be in 1-2 cm of duff (67% and 68% establishment success, respectively) (Maschinski et al. 2006a). Some duff is needed to provide protection from the elements, but too much hinders establishment by preventing roots from contacting the soil. New information suggests that crenulate lead-plant seeds germinate in the wild, but long-term survival is problematic (Maschinski et al. 2006d).

Although Kernan (1999) and Fisher (2000) indicated that the two largest populations contained neither seedlings nor juveniles in 1999 or 2000, Maschinski and others (2006d) discovered seedlings at these populations in October 2004 and initiated a seedling demography study on the wild recruiting seedlings on Site 96. In total over 350 seeds germinated within the natural population at the site, and by 2007 most had died, but there were six still alive as of August 2007 (Maschinski in litt. 2007).

An attempt was also made to delineate the age of individuals of the species using size classes, but the available data were insufficient to accomplish this objective (Kernan 1999, Fisher 2000). Because the branches of crenulate lead-plant die back to the roots following disturbance such as fire, there is probably only a weak correlation between age and plant size (Fisher 2000).

**b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding):** Genetics studies have not been conducted.

**c. Taxonomic classification or changes in nomenclature:** The Integrated Taxonomic Information System (2007) was checked while conducting this review and indicated that the name *Amorpha crenulata* is a synonym and not the current accepted name. After its listing, Isely (1986) suggested that the plant should be called *A. herbacea* var. *crenulata* to differentiate geographic and morphological variation between it and another similar form. Wunderlin and Hansen (2003) also used *A. herbacea* var. *crenulata* in their classification system. Robert Wilbur of Duke University is preparing the assessment of this genus for the publication "Flora of North America". The Service prefers to wait until completion of this most recent publication before considering whether a nomenclatural revision is appropriate for this taxon.

**d. Spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors), or historic range (e.g., corrections to the historical range, change in distribution of the species' within its historic range):** The historic range of crenulate lead-plant was an area 12 miles long and 5 miles wide along the eastern side of the Atlantic coastal ridge in Miami-Dade County from about Little River south to the Deering Estate (DERM 1993). The current range has diminished to a 20 square-mile area from Coral Gables to Kendall (Service 1999), and the remaining four protected populations and three outplanted populations are fragmented and isolated within this range (Maschinski et al. 2005c). Efforts are currently underway to examine the feasibility of developing corridors between occupied and unoccupied fragmented pine rockland habitat in Miami-Dade County (Maschinski et al. 2007c).

**e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):** According to Kernan (1999),

crenulate lead-plants originally occupied the ecotone between wet prairie and pine rockland, but this habitat has been altered and wet prairie no longer exists in the sites containing the two largest natural populations. Fisher (2000) stated that this ecotonal habitat essentially no longer exists in Miami-Dade County and cites this as a potential reason why crenulate lead-plant is so rare in the pine rockland ecosystem.

A high rate of habitat loss occurred in the 1980s along the Miami rock ridge when there were few restrictions placed on urban development (Kernan 1999). Kernan (1999) calculated the remaining pine rockland habitat outside of Everglades National Park to be 4,161 acres scattered in 308 blocks, not including 17 blocks that were each less than 1 acre. This remaining habitat occurs in block sizes that are much smaller than originally existed with a much higher ratio of perimeter:area, thereby affecting how the ecosystem functions and its species diversity. At the time of this study, 46% of the remaining pine rockland habitat outside of Everglades National Park was in private ownership, and, therefore, more at risk for degradation or destruction.

Pine rockland is one of the most severely threatened ecosystems in the United States (Kernan 1999). Less than 2% of the original acreage of pine rockland habitat remains (Maschinski et al. 2002). Most of this habitat occurs in small, isolated stands in an urban landscape that are difficult to protect and manage. Many of these fragments are overgrown and in need of restoration. The sites where crenulate lead-plant occurs on public lands are protected from development, but these sites must be managed to prevent habitat degradation and potential loss of plants. These sites have been purchased by Miami-Dade County for conservation purposes. The County is working to restore and manage these lands. Any privately-owned sites that contain plants that have not been documented remain at risk of being developed and management remains a concern.

Crenulate lead-plant prefers open sun to partial shade and can be threatened by shading from hardwoods and displacement by invasive exotic species in the absence of periodic fires. Disturbance, such as prescribed fire, is a necessary management tool to maintain suitable habitat for the species. Habitat degradation on these sites continues to be a moderate threat because vegetation restoration and management programs are costly and depend upon availability of funding.

**f. Other:** Preliminary experiments show that crenulate lead-plant is easily propagated and short-term seed storage is feasible, but germination rates are higher when freshly-harvested seed is used (Fisher 2000). Ongoing seed germination trials have also indicated that orthodox seed storage is possible (Maschinski et al. 2005a). Roncal et al. (2006) conducted experiments to determine propagation techniques for this species and found that the plants can be propagated both sexually and asexually. They also determined that

seeds were capable of persisting in frozen storage, and germination rates were higher for seeds that had been removed from the pods. Their results indicated that cuttings treated with root hormone and placed in a perlite substrate under periodic misting rooted well, but did not always transplant well. Although labor-intensive because of the care required in removing the fragile roots from between rock fissures, mature plants can also be salvaged. Maschinski et al. (2005a, 2005b, 2006a) stated that plants can survive some root damage and resprout from rootstock after disturbance or dormancy and can be grown in containers successfully for many years.

In the most recent reintroduction study, Maschinski et al. (2007b) experimentally established plants along a gradient of four different habitat types: pineland, ecotone, grassy glade, and restoration glade. Plants that were introduced into the restoration glade produced more leafy branches than did those in pineland or ecotone habitats, but differences in plant height were not found to be statistically different among habitat types. However, plant width differed among the habitat types with plants being wider in the restoration glade and narrower in the grassy glade habitat. An elevation gradient ranging from 2.430 to 2.589 meters above sea level occurred across the four habitat types decreasing from the pineland towards the restoration glade, and differences were determined along this gradient in several soil mineral nutrients, soil composition, and soil texture.

Koptur (2006) evaluated plant-animal interactions in pine rocklands and described pollination and fruiting of crenulate lead-plant. She indicated that a variety of native solitary bees (such as *Dianthidium curvatum floridense*) and non-native honeybees (*Apis mellifera*) visit the plants and provide a mechanism for pollination. Maschinski et al. (2005c) listed the same pollinators and also included the green metallic sweat bee (*Agapostemon splendens*) and unidentified small flies in their list. Crenulate lead-plant relies on pollinator visits for fruit set and produces fruit rather abundantly (Koptur 2006). Wild plants typically produce one seed per fruit but can have up to two seeds per fruit, and most of the fruiting occurs in the fall (Roncal et al. 2006).

Linares (2004) studied the floral and reproductive biology of crenulate lead-plant and stated that plants can flower as early as March and as late as mid-November. The species appears to have a facultative outbreeding system and is mostly self-incompatible. The requirement for out-crossing compounds the threats associated with inbreeding depression and genetic drift that often occur with species that have small populations because out-crossing reduces the availability of suitable mates.

Fairchild Tropical Botanic Garden (FTBG) is conducting research on property owned by the U.S. Coast Guard in the Richmond area of Miami to determine if certain management techniques can provide cost-effective alternatives to burning. The study is designed to examine the effects of thinning, duff



removal, and soil disturbance on vegetation structure in pine rockland habitat. The impacts of these techniques on the abundance of rare plant species were assessed, and although the study did not examine impacts to the crenulate lead-plant, it was determined that thinning treatments did not affect abundance of the endangered tiny polygala (*Polygala smallii*) (Maschinski et al. 2003, 2005c). Additional studies would need to be conducted to examine the impacts to crenulate lead-plant. The abundance and diversity of native species in the understory increased within the first year after treatment in thinned areas with no concurrent increase in abundance of exotic species (Maschinski et al. 2003, 2005c). However, some scientists are concerned that habitat manipulations such as these used in lieu of fire will not produce the same ecological effects, such as nutrient cycling and the community composition and structure of shrubs and herbaceous plants resulting from fire (O'Brien 2006 in litt.). O'Brien (2006) stated the importance of variability in the fire regime, and noted that increased diversity and population levels of herbaceous plants are correlated with more frequent fires in similar types of habitat.

## 2. Five-Factor Analysis -

**a. Present or threatened destruction, modification or curtailment of its habitat or range:** Continued habitat loss and fragmentation threaten the existence of crenulate lead-plant, and less than 2% of the original acreage of pine rockland habitat remains (Maschinski et al. 2002). Although the four remaining known wild populations are on publicly owned sites, any remaining populations on private sites are threatened with destruction / habitat modification due to lack of or improper management. Four natural populations have been lost to urban development within the last decade (Roncal et al. 2006), and fewer than 1,000 plants remain in four natural populations and three outplanted populations (Maschinski in litt. 2007). Modification of habitat on protected lands is also of concern due to lack of or improper management.

Between 2005 and 2060 Florida's population is projected to double from approximately 18 to 36 million people (Zwick and Carr 2006). Assuming a similar pattern of development at current gross urban densities for each county, this translates into the need to convert an additional 7 million acres of undeveloped land into urban land uses. In 2005 the gross urban density of Miami-Dade County was calculated to be 15.45 people per acre in urban use. Although the county is not expected to reach build-out by 2060, a large portion of land in southern Miami-Dade County, where the entire range of crenulate lead-plant is located, is projected to be converted to urban land. Human population projections are expected to increase from 2.4 million in 2005 to 4 million in 2060 in Miami-Dade County, with an expected growth rate of 29,889 people per year. In summary, habitat loss, degradation, and fragmentation continue to be a threat to the crenulate lead-plant.

**b. Overutilization for commercial, recreational, scientific, or educational purposes:** Indiscriminate scientific or other collecting was identified as a potential threat in the original listing package because of this species' limited distribution and population sizes. At this time, we have no evidence to suggest whether or not this is a threat.

**c. Disease or predation:** Disease and predation were not identified as potential threats in the original listing package. However, a witches-broom pathogen has been detected on some crenulate lead-plants in the wild and in conservation collections, but it is not known to what degree it could threaten the species, if at all (Maschinski et al. 2005c). Additionally, the exotic scale insect, lobate lac scale (*Paratachardina lobata lobata*), was observed on some crenulate lead-plants in one of the wild populations in November 2004 and could constitute a potential threat (Maschinski et al. 2005c). Further investigation of the presence of the scale insect on tagged crenulate lead-plants was initiated in 2005, and initial levels of infestation were found to be low (Liu in litt. 2007). Since this time, the infestation level has declined, and none of the insects were found in March 2007. Therefore, data was insufficient to infer effects to the crenulate lead-plant. Because other research on this insect indicates that it prefers shaded habitat, it is hypothesized that a scale infestation may increase to a level that may be harmful to the plants in more shaded areas, such as in an overgrown pine rockland, rather than in open, managed pine rocklands where sunlight is able to penetrate to the forest floor.

**d. Inadequacy of existing regulatory mechanisms:** Generally, managing agencies have limited regulatory tools. The Act provides protection for this species and its habitat through section 7 (interagency cooperation). Crenulate lead-plant is also listed by the Florida Department of Agriculture and Consumer Services as endangered, but this legislation does not provide any direct habitat protection. The Natural Forest Communities (NFC) program established by Miami-Dade County encourages but does not require private landowners to protect forested lands. In some situations, existing regulatory mechanisms do not appear to be adequate, as in the case of pine rockland habitat that was cleared on federal land (O'Brien 2006 in litt.).

**e. Other natural or manmade factors affecting its continued existence:** Land management practices such as prescribed fire are vitally important to stabilizing and working towards recovery of the crenulate lead-plant (Menges 2007 in litt.). Prescribed fire has been utilized at publicly-owned sites, with the participation of the Florida Division of Forestry. However, prescribed burns in pine rockland habitat have slowed since 2000 due to the lack of resources and need to be made a priority (Klein 2006 in litt.). Vegetation restoration and management programs are costly, and the availability of funding is never assured; therefore, habitat modification from inadequate management on protected lands remains an imminent, though moderate,

threat.

Management of pine rocklands in Miami-Dade County is problematic because most of the remaining habitat occurs in small fragments surrounded by residential areas. These residential areas are often a source of exotic plants that invade the pine rocklands. The small size of the pine rockland fragments make it easier for these exotics to invade (Service 1999). Exotic plants have altered the type of fire that occurs in pine rocklands. Historically, pine rocklands had an open, low understory where natural fires remained patchy with low temperature intensity, thus sparing many native plants. Dense infestations of exotic plants like Burma reed (*Neyraudia neyraudiana*) cause higher fire temperatures and longer burning periods, such that vegetation maintenance through fire alone is not possible. Another exotic plant that threatens the imperiled pine rockland forests and suppresses native groundcover is the invasive grass, *Rhynchelytrum repens* (Willd.) C.E. Hubb (Possley and Maschinski 2006). According to these authors, it is likely that this grass does not create the natural structural mosaic of flammable material necessary for proper fire conditions. When exotic plants are abundant in a pine rockland, sites must be prepared for prescribed fire by thinning the overgrown vegetation, which is costly.

Miami-Dade County worked to remove or control exotic plants on publicly owned pinelands in the 1990s. The Nature Conservancy and others have made efforts to slow the rate of exotic plant invasions by encouraging neighbors of natural areas to landscape their properties with non-invasive species. The difficulty of managing protected areas is a potential threat to this species, in addition to the habitat modification caused by lack of appropriate management. Also, the species' limited distribution renders it vulnerable to random natural events, such as hurricanes and drought.

In summary, continued invasion by exotic plant species and fire suppression, as well as the species' limited distribution and random natural events are threats to the crenulate lead-plant.

**D. Synthesis** - The species' recovery plan does not contain objective measurable criteria, but does include the interim goals of increasing populations and preventing extinction. The current range of the crenulate lead-plant had been reduced to pine rockland habitat in a 20-square-mile area of Miami-Dade County from Coral Gables to Kendall, Florida, and the remaining four protected populations and three outplanted populations are fragmented and isolated within this range (Maschinski et al. 2005c). This plant originally occupied the ecotone between wet prairie and pine rockland, but habitat has been altered and prairie no longer exists in the sites containing the two largest natural populations. According to Fisher (2000), this ecotonal habitat essentially no longer exists in Miami-Dade County and this is a potential reason why crenulate lead-plant is so rare. As a result of high rates of habitat loss from urban development, less than 2% of the original acreage of pine rockland habitat remains (Maschinski et al. 2002). However, Klein (2007 in litt.) states that the primary

causes of habitat loss were the lack of invasive plant management and prescribed fire on private lands, combined with the impacts of Hurricane Andrew in 1992.

There has been an overall population decline of 20% from a total of 402 plants in 2003 to 322 plants in 2006 among extant sites (Maschinski et al. 2006c). Crenulate lead-plants depend upon active management to persist. Fire suppression, improper stand management, and invasion by exotic plant species continue to be the most significant threats to the species. Therefore, land management practices, especially prescribed fire, are extremely important for maintaining and working towards recovery of this species. Habitat loss, fragmentation, and changes in land use continue, and conversion of rural lands to urban use in southern Miami-Dade County where this species occurs are projected to continue over the next 50 years. Due to the above continued threats, this species continues to meet the definition of endangered under the Act.

### **III. RESULTS**

#### **A. Recommended Classification:**

  X   **No change is needed**

### **IV. RECOMMENDATIONS FOR FUTURE ACTIONS -**

- The recovery plan should be updated to provide criteria for downlisting and delisting.
- The habitat restoration project conducted by FTBG needs to be monitored for several additional years and should be expanded to address specific impacts to crenulate lead-plant.
- Habitat restoration approaches based on FTBG research and habitat restoration projects carried out by Miami-Dade County and The Institute for Regional Conservation need to be implemented at all pineland sites with crenulate lead-plant.
- Potential habitat should be surveyed if landowners will allow access, and conservation agreements/implementation of management recommendations should be pursued and/or land should be acquired. However, unless there is a high likelihood of success of finding additional populations through surveys, this recommendation should be a lower priority.
- Partnerships should be promoted to share information, conduct collaborative research on pine rockland habitat conservation, and provide land managers and the interested public with information about the ecosystem, threats, recovery actions, and associated rare biota.
- Information on current land management practices for each site where this species occurs should be compiled and correlated with data on recent population trends (Menges 2007 in litt.).
- Management actions should include removal of debris and exotics, thinning, and prescribed fire. If fire is precluded, then removal of debris should be continued and periodic raking should be performed.
- Research on the effects of growing season burns versus non-growing season burns on flowering, seed set, and establishment are needed.

- Variability in the fire regime, including both seasonality and fire return interval, should be considered and applied to management of the species and its habitat.
- Potential reintroduction sites should be identified and reintroduced populations should be established.
- Monitoring should continue on extant populations.
- Additional research should be conducted on the biology, ecology, genetics, and management needs of the species.

The last three recommendations, along with management actions, are perhaps the most important recommendations presented for the recovery of the species.

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**U.S. FISH AND WILDLIFE SERVICE  
5-YEAR REVIEW of Crenulate lead-plant (*Amorpha crenulata*)**

Current Classification Endangered  
Recommendation resulting from the 5-Year Review

X **No change is needed**

Appropriate Listing/Reclassification Priority Number, if applicable \_\_\_\_\_

Review Conducted By Marilyn Knight

**FIELD OFFICE APPROVAL:**

Lead Field Supervisor, Fish and Wildlife Service

Approve [Signature] Date 8/27/07

*The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.*

**REGIONAL OFFICE APPROVAL:**

*The Regional Director or the Assistant Regional Director, if authority has been delegated to the Assistant Regional Director, must sign all 5-year reviews.*

*for* **Lead Regional Director, Fish and Wildlife Service**  
Approve [Signature] Date 9/21/07

*The Lead Region must ensure that other regions within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. If a change in classification is recommended, written concurrence from other regions is required.*

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

\_\_\_\_\_ Concur \_\_\_\_\_ Do Not Concur

Signature \_\_\_\_\_ Date \_\_\_\_\_



**APPENDIX A:** Summary of peer review for the 5-year review of Crenulate lead-plant (*Amorpha crenulata*)

**A. Peer Review Method:** The Service conducted an influential level of peer review. Recommendations for peer reviewers were solicited from the Florida Department of Agriculture and Consumer Services Division of Plant Industry and the Miami-Dade County Department of Environmental Resources Management. Additionally, peer reviewers were selected by the Service. Four official peer reviewers and one unofficial peer reviewer were asked to participate in this review. Individual responses were received from three official peer reviewers.

**B. Peer Review Charge:** See attached guidance.

**C. Summary of Peer Review Comments/Report:** Peer review comments were substantial and provided insights that were beneficial in conducting this review. Comments and concerns covered a variety of topics including the thorough representation of current information regarding the species and the importance of specific recommendations for future actions. Although the literature stated that fewer than 2,000 plants occur in four remaining natural populations and two reintroduced populations, it was suggested that this figure should be updated to approximately 1,000 individuals based upon more recent surveys. It was suggested that population dynamics should be characterized as fluctuating with no real temporal trends. In addition to development pressure, the lack of management and habitat modification were also noted as causes of the loss of populations. Pine rockland habitat decreased due to not only Hurricane Andrew, but also the lack of invasive plant management and fire on private lands. Even plants on public lands, although protected, are vulnerable due to improper management and degradation of habitat. The continued conversion of rural lands to urban use in southern Miami-Dade County where the species occurs will not have as much of an impact on the species as will lack of fire and appropriate management on public lands. It was noted that the greatest declines in the populations have been seen on the site that lacked effective management.

It was brought to our attention that no wild plants had been observed at the 2006 introduction site and that sometimes entire cohorts of crenulate lead-plant seedlings perish. Clarification was needed to indicate that crenulate lead-plant seeds germinate in the wild, but long-term survival is problematic. Ongoing research on tracking the incidence of lobate lac scale on native plants was brought to our attention, and the incidence of the scale insect on crenulate lead-plants appears to have been low to begin with and currently declining. Clarification was needed regarding the rescue of plants from sites slated for development for introduction onto managed areas. Other comments involved the need to emphasize the importance of land management practices for potential recovery and the determination of whether or not additional surveys would be beneficial for the species.

**D. Response to Peer Review:** The Service was in agreement with the comments and concerns received from peer reviewers, and comments were largely incorporated. One comment with which the Service agreed but did not have the information available to incorporate was the suggestion of determining how management practices for each of the populations may be correlated with recent population trends. However, this suggestion was added to the list of recommendations for future actions.

## **Guidance for Peer Reviewers of Five-Year Status Reviews**

U.S. Fish and Wildlife Service, South Florida Ecological Services Office

February 20, 2007

As a peer reviewer, you are asked to adhere to the following guidance to ensure your review complies with U.S. Fish and Wildlife Service (Service) policy.

Peer reviewers should:

1. Review all materials provided by the Service.
2. Identify, review, and provide other relevant data apparently not used by the Service.
3. Not provide recommendations on the Endangered Species Act classification (e.g., endangered, threatened) of the species.
4. Provide written comments on:
  - Validity of any models, data, or analyses used or relied on in the review.
  - Adequacy of the data (e.g., are the data sufficient to support the biological conclusions reached). If data are inadequate, identify additional data or studies that are needed to adequately justify biological conclusions.
  - Oversights, omissions, and inconsistencies.
  - Reasonableness of judgments made from the scientific evidence.
  - Scientific uncertainties by ensuring that they are clearly identified and characterized, and that potential implications of uncertainties for the technical conclusions drawn are clear.
  - Strengths and limitation of the overall product.
5. Keep in mind the requirement that the Service must use the best available scientific data in determining the species' status. This does not mean the Service must have statistically significant data on population trends or data from all known populations.

All peer reviews and comments will be public documents and portions may be incorporated verbatim into the Service's final decision document with appropriate credit given to the author of the review.

Questions regarding this guidance, the peer review process, or other aspects of the Service's recovery planning process should be referred to Cindy Schulz, Endangered Species Supervisor, South Florida Ecological Services Office, at 772-562-3909, extension 305, email: [Cindy\\_Schulz@fws.gov](mailto:Cindy_Schulz@fws.gov).