STATUS SUMMARIES OF 12 ROCKLAND PLANT TAXA IN SOUTHERN FLORIDA

THE INSTITUTE FOR REGIONAL CONSERVATION
22601 S.W. 152 AVE.
MIAMI, FLORIDA 33170

KEITH A. BRADLEY
AND GEORGE D. GANN

Report submitted to U.S. Fish & Wildlife Service,
Vero Beach, Florida

October 27, 1999

Table of Contents

Introduction

This report addresses the conservation status of 12 plant taxa that occur in rockland ecosystems of southern Florida. These twelve taxa are being considered for listing by the United States Fish and Wildlife Service as Threatened or Endangered Species under the Endangered Species Act. These summaries will be used by the U.S. Fish and Wildlife Service to determine if and how each taxon should be listed.

All available data known to the authors has been utilized in preparing these status summaries. This included the authors' own field experience, herbarium specimens, communication with other knowledgeable botanists, published and unpublished literature sources, and data from the Florida Natural Areas Inventory. Each account addresses aspects of each taxon's biology, ecology, and conservation status including taxonomy, current and historic range, habitat, reproductive ecology and biology, number of extant occurrences, size of each occurrence, population trends, habitat data for each occurrence, ownership of each occurrence, threats to each occurrence, opportunities for management and recovery, and previous status summaries. Label data for all herbarium specimens that have been observed by The Institute for Regional Conservation staff have also been included. Herbarium specimens for most taxa have been observed at Fairchild Tropical Garden (FTG), the University of South Florida (USF), University of Florida (FLAS), and the New York Botanical Garden (NYBG). Specimens from other institutions have been listed where available. Standard herbarium abbreviations as provided in Holmgren & Holmgren (1990) have been followed. Population sizes of each occurrence has been estimated following a $\log_{10}$ scale.

For consistency, this report follows the format utilized in the South Florida Multi Species Recovery Plan Multi-Species Recovery Plan (USFWS 1999). Some standardized language from the Management sections of these plans was also borrowed for consistency.

References:

Holmgren, P.K. and N.H. Holmgren. 1990. Index Herbariorum, Eighth Edition. New York Botanical Garden; New York, NY.

USFWS. 1999. South Florida Multi-Species Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, GA.

Status Summary
Argythamnia blodgettii (Torr. ex Chapm.) Chapm.

Common Names: Blodgett's wild-mercury, Blodgett's silverbush

Summary: *A. blodgettii* is a small, suffrutescent perennial in the Euphorbiaceae. It is endemic to southern Florida in Miami-Dade and Monroe counties. On the Miami-Dade County mainland it grows in pine rockland and edges of rockland hammock. In the Florida Keys it grows in pine rockland, rockland hammock, and coastal berm, particularly in open sunny gaps or edges.

Although the historical distribution of *A. blodgettii* once ranged from central Miami-Dade County to Key West in the Florida Keys, most of the appropriate habitats within this range have been developed. Only disjunct locations for this species remain, most in small forest fragments surrounded by densely populated urban areas. Even occurrences on conservation lands are threatened – many of these sites are not properly managed. The pine rockland habitat where this species occurs requires periodic fires to maintain an open subcanopy with low litter levels. Exotic pest plants pose serious threats to this species.

Description: *A. blodgettii* is an erect suffrutescent perennial 1-6 dm tall, the stems and leaves covered with bifurcate hairs; leaves entire, oval to elliptic, sometimes slightly spatulate, 1.5-4 cm long, often colored a distinctive metallic bluish green, distinctly 3-nerved; staminate calyx 7-8 mm wide; sepals are lanceolate; petals broadly elliptic, shorter than sepals; pistillate sepals lanceolate to linear-lanceolate, 5-6 mm long; capsule 4-5 mm wide. (Adapted from Small 1933)

Taxonomy: The species was first described by Torrey in Chapman (1884) as *Aphora blodgettii* reporting it for "South Florida, " naming it after John Loomis Blodgett, physician and plant collector on Key West from 1838-1852. In an 1896 revision of the genus, Pax placed it in the genus *Ditaxis.* In 1897, Chapman placed it in the genus *Argythamnia* (spelling it *Argyrothamnia).* In 1903 Small placed it in the genus *Ditaxis* writing "In sandy soil, Key West." In 1914 Pax placed it in synonymy under *Ditaxis fendleri,* a plant of Colombia, Venezuela, Curacao, and Trinidad. Small (1933) retained it as *Ditaxis blodgettii,* treating it as a southern Florida endemic. Subsequent authors (Webster 1967, Long & Lakela 1971, Wunderlin 1998) have retained it as a southern Florida endemic – *Argythamnia blodgettii.*

Synonyms: *Aphora blodgettii* Torr. ex Chapm.; *Ditaxis blodgettii* (Torr. ex Chapm.) Pax; *Argyrothamnia blodgettii* (Torr. ex Chapm.) Chapm.; *Ditaxis fendleri* Pax, not (Müll. Arg.) Pax and K. Hoof.

Distribution: *A. blodgettii* historically occurred from central and southern Miami-Dade County from Brickell Hammock (latitude ca. 25° 45.9') to southwestern Long Pine Key in Everglades National Park (latitude ca. 25° 24.2'), and throughout the Florida Keys (Monroe County and Miami-Dade County) from Totten Key (latitude 25° 22.95') south to Key West (latitude 24° 32.52'). Historical occurrences which may no longer be extant include Brickell Hammock and Totten Key in Miami-Dade County, and Key Largo, Key Vaca, Key West and Stock Island in Monroe County (Table 1).

A. blodgettii is currently known from central Miami-Dade County from Coral Gables (latitude 25° 43.45') and southern Miami-Dade County to southwestern Long Pine Key in Everglades National Park (latitude 25° 24.2'), and the Florida Keys from Windley Key (latitude 24° 57.08') southwest to Big Pine Key (latitude 24° 38.52'). The range in Miami-Dade County has contracted approximately 12 miles, all at the northern end of its range, the heaviest developed

portion of Miami-Dade County. The range in Monroe County has contracted approximately 43 miles. (Table 1).

Habitat: *A. blodgettii* is primarily a plant of open sunny areas in pine rockland, edges of rockland hammock, edges of coastal berm, and sometimes disturbed areas in close proximity to a natural area. Plants can be found growing from crevices on oolitic or Key Largo limestone or on sand. The pine rockland habitat where it occurs in Miami-Dade County and the Florida Keys requires periodic fires to maintain an open sunny understory with a minimum amount of hardwoods.

A. blodgettii does tolerate some degree of human-induced disturbance. It can often be found along disturbed edges of pine rockland, rockland hammock, and coastal berm, or in completely scarified pine rockland. At Windley Key Fossil Reef State Geological Site it grows in the bottoms of abandoned rock quarries.

Reproduction: Reproduction of *A. blodgettii* is sexual. Flowering and fruiting apparently takes place throughout the year. The reproductive biology and ecology of this species has not been studied.

Relationship to Other Species: This species occurs in several habitats, and therefore is associated with a diversity of other taxa. The pine rocklands where *A. blodgettii* occurs are characterized by a canopy of southern slash pine (*Pinus elliottii* var. *densa*), a shrub canopy of saw palmetto (*Serenoa repens*), wax-myrtle (*Myrica cerifera*), poisonwood (*Metopium toxiferum*), and willow bustic (*Sideroxylon salicifolium*). Common herbaceous associates include crimson bluestem (*Schizachyrium sanguineum*), wire bluestem (*Schizachyrium gracile*), scaleleaf aster (*Aster adnatus*), and bastard copperleaf (*Acalypha chamaedrifolia*).

Rockland hammocks and coastal berms where *A. blodgettii* occurs are dominated by a diverse assemblage of tropical tree and shrub species, with a very sparse herbaceous layer. Common hardwood associates include poisonwood (*Metopium toxiferum*), gumbo limbo (*Bursera simaruba*), willow bustic (*Sideroxylon salicifolium*), crabwood (*Gymnanthes lucida*), and wild coffee (*Psychotria nervosa*).

Rare taxa that it may be associated within pine rocklands include wedge sandmat (*Chamaesyce deltoidea*), *Chamaesyce deltoidea* ssp. *adhaerens*, pineland sandmat (*Chamaesyce deltoidea* ssp. *pinetorum*), Garber's sandmat (*Chamaesyce garberi*), Small's milkpea (*Galactia smallii*), and Mosier's false boneset (*Brickellia mosieri*). Rare taxa that it may be associated with rockland hammock or coastal berm include tearshrub (*Vallesia antillana*) and key tree cactus (*Pilosocereus robinii*).

Status and Trends: There are approximately 18 extant occurrences of *A. blodgettii*. Four of these are in Monroe County, 14 are in Miami-Dade County (Table 1). The exact size of several populations is unknown.

The estimated total population of *A. blodgettii* based on a $\log_{10}$ scale is 1,001 – 10,000 plants. The total is probably closer to 10,000 plants. The population of *A. blodgettii* is declining. Private sites where this plant occurs are either not being managed or are being developed. Populations on public lands are also being impacted. Plants at the Charles Deering Estate and Windley Key Fossil Reef State Geological Site have been impacted by fence and road construction. Plants at Caribbean Park were recently destroyed by development. Other sites are also threatened with development. Exotic pest plants threaten all occurrences, particularly Burmareed (*Neyraudia reynaudiana*) and Brazilian pepper (*Schinus terebinthifolius*). See Table 1 for known or potential threats to each of these occurrences.

Management and Opportunities for Recovery: The pine rockland of Miami-Dade County and the Florida Keys has evolved and adapted to frequent fires (Snyder *et al*. 1990). In two to three

decades of fire suppression these areas mature into hardwood forests with a few pines in the canopy (Snyder *et al.* 1990). A fundamental question about fire ecology in pine rockland is how frequently it should burn and during what season. Snyder *et al.* (1990) inferred the historic fire 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 since fires). The minimum fire regime they found was two to three years and the maximum was 15 years. This wide range in fire frequencies would result in different forest structures and dynamics. This would lead us to believe that a mosaic of burns should be used in the management of pine rockland.

Presently, the recommended burn regime is three to seven years with summer fires generally preferred to winter. Summer fires are preferred since most 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 a step-wise fashion. In some areas it may include winter burns, or the removal of some fuel to prevent a hot fire. Any prescribed fire management should include a monitoring program to determine the effectiveness of the prescription. There should also be a component to the monitoring that captures the health of the community and species that occur in association with *A. blodgettii*.

Invasive exotic species, especially Brazilian pepper and Burmareed, threaten *A. blodgettii* and other rare pine rockland and rockland hammock plants. The control of exotic species in pine rockland is a very important part of habitat maintenance, although it can be very costly once exotics are established in an area. In most cases the control of exotics include the use of manual labor, herbicides, and prescribed fire. In heavily infested areas removal is 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 rockland in Miami-Dade County and the Florida Keys is complicated because most of the remaining habitat occurs in small fragmented areas bordered by urban development. Areas surrounding the managed pine rockland that contain exotic species can act as a seed source of exotics allowing them to continue to invade the pine rockland. To effectively control invasive exotics, a preemptive strategy is needed. This should include a multilingual outreach program stressing the importance of exotic control in areas surrounding managed pine rockland areas.

The Richmond Pine Rocklands, owned mostly by federal and county agencies, is the largest and most important area of pine rockland in Miami-Dade County outside of Everglades National Park. This 10 km^2 area contains 345 ha of pine rockland and has populations of two listed plants, wedge sandmat (*Chamaesyce deltoidea* ssp. *deltoidea*) and Small's milkwort (*Polygala smallii*). The Miami-Dade County Department of Environmental Resources Management (DERM) has completed a management plan for the Richmond Pine Rocklands under a grant of the U.S. Fish and Wildlife Service. The restoration and management of the Richmond Pine Rocklands is being led by the Miami-Dade County DERM. They have been replanting pines lost as a result of Hurricane Andrew, cutting and applying herbicide treatments to exotic plants, and using prescribed fire where possible. In areas where management has been completed the restoration has been successful.

Reintroductions may also be possible with this species. Attempts could be made in the Florida Keys and throughout most of the Miami-Rock Ridge in Miami-Dade County. Augmentation of small populations may also be feasible.

Previous Status Surveys: No formal status surveys have been conducted for this species. Avery (no date) reports a number of occurrences on Big Pine Key with vague place-names. These are listed in Table 1. Additional field studies both in the Florida Keys and in mainland Miami-Dade

County are needed. Additional occurrences are likely and some previously reported occurrences may be extant (e.g. Totten Key). Better data on population sizes is also needed.

References:

Avery, G. No date. *Argythamnia blodgettii* p. 1388. in "Unpublished field notes." 2789pp.

Chapman, A.W. 1884. Flora of the Southern United States. American Book Company; New York, N.Y.

Chapman, A.W. 1897. Flora of the Southern United States. American Book Company; New York, N.Y.

Long, R. and O. Lakela. 1971. A Flora of Tropical Florida. University of Miami Press; Coral Gables, FL.

Pax, F. 1896. Ditaxis. In A. Engler. "Die Natürlichen Pflanzenfamilien." Verlag; Leipzig.

Pax, F. 1914. Ditaxis. in A. Engler. "Das Pflanzenreich." Verlag; Leipzig.

Small, J.K. 1903. Flora of the Southeastern United States. Published by the author; New York, N.Y.

Small, J.K. 1933. Manual of the Southeastern Flora. Published by the author; New York, N.Y.

Snyder, J.R., A. Herndon, and W.B. Robertson, Jr. 1990. South Florida rocklands. Pages 230-277 *in* R.L. Myers and J.J. Ewel, eds. Ecosystems of Florida. University of Central Florida Press; Orlando, FL.

Webster, G.L. 1967. Argythamnia. In "Genera of Euphorbiaceae." Journal of the Arnold Arboretum 48: 364-366.

Wunderlin, R.P. 1998. Guide to the Vascular Plants of Florida. University Press of Florida; Gainesville, FL.

Status Summary
Brickellia mosieri (Small) Shinners

Common Names: Mosier's false boneset, Brickell bush

Summary: *B. mosieri* is an erect perennial herb in the Asteraceae. It is a rare plant endemic to pine rocklands of Miami-Dade County. Although *B. mosieri* once ranged from central to southern Miami-Dade County, most of the area where it once occurred has been developed. Only disjunct occurrences of this species remain, all in small forest fragments no greater than 350 hectares in size. Even occurrences on conservation lands are threatened since many of these areas are not properly managed. Periodic fires are required to maintain a low litter level and an open understory. Exotic pest plants pose serious threats to this species.

Description: *B. mosieri* is a slender erect perennial 3-11 dm tall; leaves linear, 1-3 cm long, entire are rarely slightly serrate, usually spreading or reflexed; involucre 8-9 mm tall, pubescent, inner phyllaries ribbed; corolla 6-7 mm long, white; pappus pale brown or whitish. (Adapted from Cronquist 1980)

Taxonomy: *B. mosieri* was first described by Small in 1933 as *Kuhnia mosieri*. In 1970, Long reduced it to a varietal rank of *K. eupatorioides*, a plant more widespread in the eastern United States. Instead of using Small's epithet, he unfortunately created a completely new name for the variety, calling the species *K. eupatorioides* var. *floridana*. Shinners (1971) retained it at the specific rank, but included all members of the genus *Kuhnia* in *Brickellia*, calling the species *B. mosieri*. In a 1989 study of the *B. eupatorioides* complex Turner recognized it as a variety of the more widespread *B. eupatorioides*, and gave it the new name *B. eupatorioides* var. *floridana*, using Long's varietal epithet. Wunderlin (1998), thinking the plant to be specifically distinct from *B. eupatorioides*, has retained the use of *B. mosieri*.

Synonyms: *Kuhnia mosieri* Small, *K. eupatorioides* L. var. *floridana* R.W. Long, *B. eupatorioides* (L.) Shinners var. *floridana* (R.W. Long) B.L. Turner, *Kuhnia paniculata* Cass. misapplied.

Distribution: *B. mosieri* is endemic to Miami-Dade County on the Miami Rock Ridge. It was historically distributed from central and southern Miami-Dade County from South Miami (latitude ca. 25° 42.5) to Florida City (latitude ca. 25° 26.0). This is a range of approximately 22.5 miles along the Miami Rock Ridge. Herbarium specimens have not been studied from the New York Botanical Garden, so the full extent of its historic range is unknown.

B. mosieri is currently distributed from central and southern Miami-Dade County from SW 120 St. (latitude ca. 25° 39.4) to Florida City (latitude ca. 25° 26.0). It's historic range has contracted at least three miles.

Habitat: *B. mosieri* is found exclusively in pine rocklands. It tolerates only minor amounts of disturbance. The pine rockland habitat where it occurs in Miami-Dade County requires periodic fires to maintain and open sunny understory with a minimum amount of hardwoods. It tends to occur in areas with an open shrub canopy and exposed limestone with minimal organic litter (pine needles, leaves, and other organic materials). Some populations are found at relatively high elevations (ca. 3-4 meters), one occurrence is known from a low elevation pine rockland very close to a marl prairie (2-3 meters). The pine rockland which contains this occurrence may have flooded periodically during the summer wet season.

Periodic fires are extremely important in maintaining this ecosystem. The natural fire regime was probably 3-7 years, with most fires occurring at the beginning of the wet season in spring and early summer. These periodic fires keep the shrub canopy low and reduce litter accumulation.

Reproduction: Reproduction of *B. mosieri* is sexual. Pollinators and dispersers are unknown. Flowering takes place primarily in the fall (August – October), but individuals may be found in flower most of the year.

Relationship to Other Species: The pine rocklands where *B. mosieri* occurs are characterized by a canopy of southern slash pine (*Pinus elliottii* var. *densa*), a shrub canopy of saw palmetto (*Serenoa repens*), wax myrtle (*Myrica cerifera*), poisonwood (*Metopium toxiferum*), and willow bustic (*Sideroxylon salicifolium*). Common herbaceous associates include crimson bluestem (*Schizachyrium sanguineum*), wire bluestem (*Schizachyrium gracile*), scaleleaf aster (*Aster adnatus*), and bastard copperleaf (*Acalypha chamaedrifolia*).

B. mosieri may be found in close association with several other rare plant taxa, including wedge sandmat (*Chamaesyce deltoidea* ssp. *deltoidea*), *Chamaesyce deltoidea* ssp. *adhaerens*, pineland sandmat (*Chamaesyce deltoidea* ssp. *pinetorum*), Small's milkpea (*Galactia smallii*), Small's milkwort (*Polygala smallii*), and Blodgett's wild-mercury (*Argythamnia blodgettii*).

Status and Trends: The full extent of the status of *B. mosieri* is somewhat uncertain. There are currently 14 confirmed occurrences. An additional 18 occurrences have been reported by Herndon (no date) (Table 1). Six of the stations where Herndon reported it have been developed. Several additional sites have been disturbed, or, because of lack of management, extensive amounts of exotic pest plants and/or dense hardwoods now dominate the sites. *B. mosieri* may no longer occur at some of these stations. In any case, it is likely that approximately 25 stations exist. See Table 1 for approximate sizes and ownership of each of these populations.

Brickellia mosieri rarely occurs in great abundance. Most, if not all, populations are very sparse, containing a low density of plants. Of the occurrences listed in Table 1, only two are believed to contain more than 1,000 individuals.

The estimated total population of *B. mosieri* based on a $\log_{10}$ scale is 1,001-10,000 plants. The exact number is probably between to 5,000 and 7,000 plants. The population of *B. mosieri* is probably declining. Private sites where this plant occurs are either not being managed or are being developed. Populations on public lands are also being impacted. See Table 1 for known or potential threats to each occurrence.

Management and Opportunities for Recovery: The pine rocklands of Miami-Dade County have evolved and adapted to frequent fires (Snyder *et al.* 1990). In two to three decades of fire suppression these areas mature into hardwood forests with a few pines in the canopy (Snyder *et al.* 1990). A fundamental question about fire ecology in pine rocklands is how frequently they should burn and during what season. Snyder *et al.* (1990) inferred the historic fire 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 where enough fuel is available to carry a fire (minimum time since fires). The minimum fire regime they found was two to three years and the maximum was 15 years. This wide range in fire frequencies would result in different forest structures and dynamics. This would lead us to believe that a mosaic of burns should be used in the management of pine rocklands.

Presently, the recommended burn regime is three to seven years with summer fires generally preferred to winter. Summer fires are preferred since most 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 a step-wise fashion. In some

areas it may include winter burns, or removal of some fuel to prevent a hot fire. Any prescribed fire management should include a monitoring program to determine the effectiveness of the prescription. There should also be a component to the monitoring that captures the health of the community and species that occur in association with *B. mosieri*.

Invasive exotic species, especially Brazilian pepper and Burmareed, threaten *B. mosieri* and other rare pine rockland plants. The control of exotic species in the pine rocklands is a very important part of habitat maintenance, although it can be very costly once exotics are established in an area. In most cases the control of exotics include the use of manual labor, herbicides, and prescribed fire. In heavily infested areas removal is 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 the managed pine rockland that contain exotic species can act as a seed source of exotics allowing them to continue to invade the pine rockland. To effectively control invasive exotics, a preemptive strategy is needed. This should include a multilingual outreach program stressing the importance of exotic control in areas surrounding managed pine rockland areas.

The Richmond Pine Rocklands, owned mostly by federal and county agencies, is the largest and most important area of pine rockland in Miami-Dade County outside of Everglades National Park. This 10 km^2 area contains 345 ha of pine rockland forest and has populations of two listed, plants wedge sandmat (*Chamaesyce deltoidea* ssp. *deltoidea*) and Small's milkwort (*Polygala smallii*). The Miami-Dade County Department of Environmental Resources Management (DERM) has completed a management plan for the Richmond Pine Rocklands under a grant of the U.S. Fish and Wildlife Service. The restoration and management of the Richmond Pine Rocklands is being led by the Miami-Dade County DERM. They have been replanting pines lost as a result of Hurricane Andrew, cutting and applying herbicide treatments to exotic plants, and using prescribed fire where possible. In areas where management has been completed the restoration has been successful.

Private properties are very important to the existence of this species. Over half of the occurrences of this species exist on private properties. These properties need to be acquired, or they need to be managed.

Reintroductions or augmentations may also be possible with this species. Many suitable sites could probably be identified as suitable reintroduction stations.

Previous Status Surveys: None. Many of the stations reported by Herndon need confirmation. *B. mosieri* may no longer be extant at many of these stations. Herbarium specimens should also be checked at the New York Botanical Garden to develop a better understanding if its historic range and abundance.

References:

Cronquist, A. 1980. Vascular Flora of the Southeastern United States. Volume I. Asteraceae. University of North Carolina Press; Chapel Hill, NC.

Herndon, A. No date. Distribution of Kuhnia eupatorioides in Miami Rock Ridge Pinelands. Unpublished list in The Institute for Regional Conservation files.

Long, R.W. 1970. Additions and nomenclatural changes in the flora of southern Florida – I. Rhodora 72:17-46.

Shinners, L. 1971. Kuhnia L. transferred to Brickellia Ell. (Compositae). Sida 4(3): 274.

Small, J.K. 1933. Manual of the Southeastern Flora. Published by the author; New York, N.Y.

Snyder, J.R., A. Herndon, and W.B. Robertson, Jr. 1990. South Florida rocklands. Pages 230-277 *in* R.L. Myers and J.J. Ewel, eds. Ecosystems of Florida. University of Central Florida Press; Orlando, FL.

Turner, B.L. 1989. An overview of the Brickellia (Kuhnia) eupatorioides (Asteraceae, Eupatoriae) complex. Phytologia 67(2): 121-131.

Wunderlin, R.P. 1998. Guide to the Vascular Plants of Florida. University Press of Florida; Gainesville, FL.

Status Summary
Chamaesyce deltoidea (Engelm. ex Chapm.) Small ssp. *pinetorum* (Small) A. Herndon

Common Names: deltoid spurge, pineland sandmat

Summary: *C. deltoidea* ssp. *pinetorum* is a small ascending to erect perennial herb in the Euphorbiaceae. It is a rare plant endemic to pine rocklands of southern Miami-Dade County on the Miami Rock Ridge. Some of the population is protected within Everglades National Park but there are tracts in private ownership northeast of Everglades National Park which contain occurrences of this taxon. It is threatened by development, fire suppression, hydroperiod manipulation, and exotic pest plant invasions.

Description: *C. deltoidea* ssp. *pinetorum* is an ascending to erect perennial herb forming small tufts. Stems villous, often reddish; leaf blades reniform or deltoid to orbicular or ovate, villous; involucres 1 mm long, pubescent; glands green; gland appendages very narrow, even-edged; capsules 2 mm broad, pubescent; seed 1 mm long, transversely wrinkled, yellowish. (Adapted from Small 1933)

Taxonomy: *C. deltoidea* ssp. *pinetorum* was first described by Small (1905) as *C. pinetorum* for plants collected by him in "Pinelands between Cutler and Camp Longview" in 1903. Small recognized that it was closely related to *Chamaesyce deltoidea* which is known from further north on the Miami Rock Ridge. Burch (1966), in a study of Caribbean *Chamaesyce*, retained the use of *C. pinetorum.* Some workers do not consider *Chamaesyce* to be a distinct genus in the very diverse Euphorbiaceae. In 1989, Oudejans published this taxon under the genus *Euphorbia.* Unfortunately, the name *Euphorbia pinetorum* was already in use for another taxon, so he produced the new name *Euphorbia smallii*. Other authors (Herndon 1993, Wunderlin 1998) have retained the use of the genus *Chamaesyce.* In a 1993 study Herndon included this taxon within the *C. deltoidea* complex, composed of three other taxa, two occurring further north on the Miami Rock Ridge, and one occurring on Big Pine Key in the Florida Keys (Monroe County). The three taxa on the Miami Rock Ridge have distinct ranges which abut each other. Herndon placed all four taxa at the same taxonomic level, treating each as a distinct subspecies, treating this taxon as *C. deltoidea* ssp. *pinetorum*. *C. deltoidea* ssp. *adhaerens* occurs immediately to the north of it, and *C. deltoidea* ssp. *deltoidea* occurs to the north of var. *adhaerens.* Wunderlin (1998) follows Herndon's treatment in using *C. deltoidea* ssp. *pinetorum*.

Synonyms: *Chamaesyce pinetorum* Small, *Euphorbia smallii* Oudejans.

Distribution: *C. deltoidea* ssp. *pinetorum* was historically known from only the southern portions of the Miami-Rock Ridge in southern Miami-Dade County. The northernmost occurrences were found at SW 296 St. (latitude ca. 25° 29.52') and possibly as far north as SW 248 St. (latitude ca. 25° 32.14').[1] It extended south through Long Pine Key in Everglades National Park.

C. deltoidea ssp. *pinetorum* is currently known from throughout its historical range. One occurrence does exist as far north as SW 296 St. Most of the pine rockland from this station

[1] A specimen was collected by Burch (#232, NYBG) in 1963 at the intersection of SW 187 Ave. and 248 St. The label describes the station as "Princeton." This intersection is over five miles west of the area known as Princeton, and three miles north of the northernmost confirmed station for this taxon. The label data seems suspicious.

south to Everglades National Park has been developed, and this area contains few remaining occurrences. This area outside of Everglades National Park represents nearly half of the range of this taxon.

Habitat: This species occurs in pine rockland in pockets of clayey marl or on oolitic limestone. The soils on which it occurs outside of Everglades National Park are classified as Opalocka rock-outcrop soils (soils within the National Park have not been classified) (USDA 1996). The pine rocklands where this taxon occurs are at the southern end of the Miami Rock Ridge and are at lower elevations than most pine rockland areas to the north. This is especially true for the pine rocklands on Long Pine Key, which flood occasionally. Fire is an important element in maintaining the pine rockland habitat. Periodic fires eliminate the shrub subcanopy and remove litter from the ground.

Reproduction: Reproduction is sexual. No studies have been made of this taxon's reproductive biology or ecology. The reproductive ecology of *Chamaesyce* species has been poorly studied but is known to be highly variable (Ehrenfeld 1976 and 1979, Webster 1967). Some species are completely reliant on insects for pollination and seed production while others are self pollinating. Pollinators may include bees, flies, ants, and wasps (Ehrenfeld 1979). Seed capsules of many members of the Euphorbiaceae are explosively dehiscent, ejecting seeds a short distance from the parent plant. The seeds of some species are dispersed by ants (Pemberton 1988).

Relationship to Other Species: The pine rockland where *C. deltoidea* ssp. *pinetorum* occurs is characterized by a canopy of southern slash pine (*Pinus elliottii* var. *densa*), a shrub canopy of saw palmetto (*Serenoa repens*), wax myrtle (*Myrica cerifera*), poisonwood (*Metopium toxiferum*), and willow bustic (*Sideroxylon salicifolium*). Common herbaceous associates include crimson bluestem (*Schizachyrium sanguineum*), wire bluestem (*Schizachyrium gracile*), scaleleaf aster (*Aster adnatus*), and bastard copperleaf (*Acalypha chamaedrifolia*).

This taxon is often associated with other rare plant taxa including Mosier's false boneset (*Brickellia mosieri*) and Blodgett's wild-mercury (*Argythamnia blodgettii*).

Status and Trends: There are approximately 14 known occurrences of *C. deltoidea* ssp. *pinetorum*. It is most common on Long Pine Key in Everglades National Park, which includes most of the population. The 13 occurrences outside of the National Park are much smaller. The largest station outside of the National Park is only 140 hectares; all other stations are less than 8 hectares. Based on a $\log_{10}$ scale there is an estimated total population size of 1,001-10,000 plants. See Table 1 for approximate sizes of each of these occurrences.

The population of *C. deltoidea* ssp. *pinetorum* is probably declining. Private sites where this plant occurs are either not being managed or are being developed. Exotic pest plants will continue to decrease the quality of the pine rockland habitat where this taxon occurs. Both Brazilian pepper (*Schinus terebinthifolius*) and Burmareed (*Neyraudia reynaudiana*) are the most problematic exotic pest plants in the pine rockland of Miami-Dade County.

Hydrologic manipulations to Taylor Slough and the Shark River Slough could effect the occurrence of this taxon in Everglades National Park. Excessive flooding in the pine rockland of Long Pine Key may be damaging to this population. The effects of any hydrological manipulations should be monitored.

Management and Opportunities for Recovery: The pine rocklands of Miami-Dade County have evolved and adapted to frequent fires (Snyder *et al.* 1990). In two to three decades of fire suppression these areas mature into hardwood forests with a few pines in the canopy (Snyder *et al.* 1990). A fundamental question about fire ecology in pine rocklands is how frequently they should burn and during what season. Snyder *et al.* (1990) inferred the historic fire 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 where enough fuel is available to carry a fire (minimum time since fires). The minimum fire regime they found was two to three years and the maximum was 15 years. This wide range in fire frequencies would result in different forest structures and dynamics. This would lead us to believe that a mosaic of burns should be used in the management of pine rocklands.

Presently, the recommended burn regime is three to seven years with summer fires generally preferred to winter. Summer fires are preferred since most 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 a step-wise fashion. In some areas it may include winter burns, or removal of some fuel to prevent a hot fire. Any prescribed fire management should include a monitoring program to determine the effectiveness of the prescription. There should also be a component to the monitoring that captures the health of the community and species that occur in association with *C. deltoidea* ssp. *pinetorum*.

Invasive exotic species, especially Brazilian pepper and Burmareed, threaten *C. deltoidea* ssp. *pinetorum* and other rare pine rockland plants. The control of exotic species in the pine rocklands is a very important part of habitat maintenance, although it can be very costly once exotics are established in an area. In most cases the control of exotics include the use of manual labor, herbicides, and prescribed fire. In heavily infested areas removal is 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 outside of Everglades National Park in Miami-Dade County is complicated because most of the remaining habitat occurs in small fragmented areas bordered by urban development. Areas surrounding the managed pine rockland that contain exotic species can act as a seed source of exotics allowing them to continue to invade the pine rockland. To effectively control invasive exotics, a preemptive strategy is needed. This should include a multilingual outreach program stressing the importance of exotic control in areas surrounding managed pine rockland areas.

Previous Status Surveys: None. Further surveys for this taxon need to be conducted.

References:

Burch, D. 1966. Two new species of *Chamaesyce* (Euphorbiaceae), new combinations, and a key to the Caribbean members of the genus. Ann. Missouri Bot. Gard. 53: 90-99.

Ehrenfeld, J. 1976. Reproductive biology of three species of *Euphorbia* subgenus *Chamaesyce* (Euphorbiaceae). American Journal of Botany 63(4):406-413.

Ehrenfeld, J. 1979. Pollination of three species of *Euphorbia* subgenus *Chamaesyce* (Euphorbiaceae), with special reference to bees. American Midland Naturalist 101(1) 87-98.

Herndon, A. 1993. A Revision of the *Chamaesyce deltoidea* (Euphorbiaceae) complex of southern Florida. Rhodora 95(881): 38-51.

Oedejans, R.H.M. 1989. New Names and New Combinations in the Genus *Euphorbia* L. (Euphorbiaceae). Phytologia 67:48.

Pemberton, R.W. 1988. Myrmechorchory in the introduced range weed, Leafy spurge (*Euphorbia esula*). American Midland Naturalist 119(2):431-435.

Small, J.K. 1905. Additions to the flora of subtropical Florida. Bulletin of the New York Botanical Garden. 3(11): 419-440.

Small, J.K. 1933. Manual of the Southeastern Flora. Published by the author; New York, N.Y.

Snyder, J.R., A. Herndon, and W.B. Robertson, Jr. 1990. South Florida rocklands. Pages 230-277 *in* R.L. Myers and J.J. Ewel, eds. Ecosystems of Florida. University of Central Florida Press; Orlando, FL.

USDA. 1996. Soil Survey of Dade County Area, Florida.

Webster, R.L. 1967. Genera of Euphorbiaceae. Journal of the Arnold Arboretum. 48.

Wunderlin, R.P. 1998. Guide to the Vascular Plants of Florida. University Press of Florida; Gainesville, FL.

Status Summary

Chamaesyce deltoidea (Engelm. ex Chapm.)Small ssp. *serpyllum* (Small) D.G. Burch

Common Names: wedge sandmat

Summary: *C. deltoidea* ssp. *serpyllum* is a small prostrate perennial herb in the Euphorbiaceae. It is a rare plant endemic to pine rocklands of Big Pine Key in the Lower Florida Keys (Monroe County). While much of the population is protected within the National Key Deer Refuge, there are many tracts in private ownership which contain occurrences of this taxon. It is threatened by development, fire suppression, exotic pest plants, and sea level rise.

Description: *C. deltoidea* ssp. *serpyllum* is a small prostrate perennial herb. Stems puberulent-canescent, filiform, numerous and radiating out from the taproot; leaves deltoid or ovate deltoid to triangular-ovate, 3-5 mm long, obtuse, tomentose above and below; stipules laciniate, brown to white; involucres 1 mm long, appendages minute; capsule 1.5 mm broad, pubescent; seed less than 1 mm long, yellowish or grayish. (Adapted from Small 1933)

Taxonomy: *C. deltoidea* ssp. *serpyllum* was first described by Small (1913) as *C. serpyllum* for plants collected by him on Big Pine Key in 1912. It was later found that this taxon was closely related to the *Chamaesyce deltoidea* complex which is represented in the pine rocklands of Miami-Dade County by three additional taxa (Herndon 1993). Burch (1966) in a study of Caribbean *Chamaesyce* included *C. serpyllum* as a subspecies of *C. deltoidea, C. deltoidea* ssp. *serpyllum.* Some workers do not consider *Chamaesyce* to be a distinct genus in the very diverse Euphorbiaceae. In 1989 Oudejans published this taxon under the genus *Euphorbia,* producing the new combination *Euphorbia deltoidea* var. *serpyllum.* Other authors (Herndon 1993, Wunderlin 1998) have retained the use of the genus *Chamaesyce* and have accepted Burch's combination, *C. deltoidea* ssp. *serpyllum*.

Synonyms: *Chamaesyce serpyllum* Small, *Euphorbia deltoidea* Engelm. ex Chapm. var. *serpyllum* (Small) Oudejans.

Distribution: *C. deltoidea* ssp. *serpyllum* was historically known only from Big Pine Key in the lower Florida Keys, Monroe County. Ross and Ruiz (1996) found it in study transects only in the northern and eastern portions of the island. Colonies of plants do seem to be somewhat scattered on the island (Herndon 1993).

Habitat: This taxon occurs in pine rocklands. Plants grow directly from crevices in the oolitic limestone substrate. This soil type has been classified as Keyvaca very gravelly loam (USDA 1995). Pine rocklands in the lower Florida Keys are dominated by a canopy of *Pinus elliottii* var. *densa*. The subcanopy is composed of several palms including Key thatch palm (*Thrinax morrisii*), Florida thatch palm (*Thrinax radiata*), and silver palm (*Coccothrinax argentata*), and several hardwoods including locustberry (*Byrsonima lucida*), longstalked stopper (*Psidium longipes*),and poisonwood (*Metopium toxiferum*). Ross and Ruiz (1996) found that it occurs primarily in areas with exposed limestone substrate, where hardwoods are relatively unimportant, and with low total understory cover. Fire is an important element in maintaining the pine rockland habitat. Periodic fires eliminate the shrub subcanopy and remove litter from the ground.

Reproduction: Reproduction is sexual. No studies have been made of this taxon's reproductive biology or ecology. The reproductive ecology of *Chamaesyce* species has been poorly studied but is known to be highly variable (Ehrenfeld 1976 and 1979, Webster 1967). Some species are completely reliant on insects for pollination and seed production while others are self pollinating. Pollinators may include bees, flies, ants, and wasps (Ehrenfeld 1979). Seed capsules of many members of the Euphorbiaceae are explosively dehiscent, ejecting seeds a short distance from the parent plant. The seeds of some species are dispersed by ants (Pemberton 1988).

Relationship to Other Species: The pine rocklands of Big Pine Key are dominated by a single canopy tree, southern slash pine (*Pinus elliottii* var. *densa*). Understory shrubs are very common in most areas and include several palms such as Florida thatch palm (*Thrinax radiata*), Key thatch palm (*Thrinax morrisii*),and silver palm (*Coccothrinax argentata*), and several hardwoods such as locustberry (*Byrsonima lucida*), longstalked stopper (*Psidium longipes*), and smooth devilsclaws (*Pisonia rotundata*). There is also a rich herbaceous layer composed of several grasses (*Schizachyrium* spp., *Andropogon* spp.), and herbs including silver dwarf morningglory (*Evolvulus sericeus*), eyebright ayenia (*Ayenia euphrasiifolia*), scaleleaf aster (*Aster adnatus*),and sand flax (*Linum arenicola*).

This taxon can grow in association with other rare taxa, including sand flax (*Linum arenicola*), and Big Pine partridge pea (*Chamaecrista lineata* var. *keyensis*).

Status and Trends: *C. deltoidea* ssp. *serpyllum* is known only from Big Pine Key. It is widespread on the island, but seems to be most common in the northern and eastern portions of the island (Ross & Ruiz 1996). The population on Big Pine Key is sizable. Ross and Ruiz (1996) detected it in 32 (22%) of 145 pine rockland sample plots on the island. Densities were found to exceed 2 plants/m^2 in two transects. Herndon (1993) believed that colonies of plants were scattered on the island and that the total number of plants did not appear to be large. The total population size of *C. deltoidea* ssp. *serpyllum* on a $\log_{10}$ scale is probably 1,001-10,000 plants.

The population of *C. deltoidea* ssp. *serpyllum* is probably declining. Private sites where this plant occurs on Big Pine Key are either not being managed or are being developed. Sea level rise may be reducing pine rockland acreage on Big Pine Key, effecting the population size of this plant.

While much of the habitat for this taxon is contained within conservation lands owned by the U.S. Fish and Wildlife Service and The Nature Conservancy, a great deal of pine rocklands still exists in private ownership. Development is currently limited in Monroe County, but losses to this taxons' habitat still occur due to development.

Exotic pest plants may also impact populations of this taxon. Brazilian pepper (*Schinus terebinthifolius*) is currently the biggest threat on Big Pine Key.

Management and Opportunities for Recovery: The pine rocklands of the lower Florida Keys have evolved and adapted to frequent fires (Snyder *et al*. 1990). In absence of fire these areas mature into hardwood forests with a few pines in the canopy (Snyder *et al*. 1990). Alexander and Dickson (1972) suggested that this process may take up to 50 years in the Florida Keys. A fundamental question about fire ecology in pine rocklands is how frequently they should burn and during what season. Snyder *et al.* (1990) inferred the historic fire regimes on the Florida mainland 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 where enough fuel is available to carry a fire (minimum time since fires). The minimum fire regime they found was two to three years and the maximum was 15 years. This wide range in fire frequencies would result in different forest structures and dynamics. This would lead us to believe that a mosaic of burns should be used in the management of pine rocklands.

Presently, the recommended burn regime in Miami-Dade County pine rocklands is three to seven years with summer fires generally preferred to winter. It is likely that this is too short a fire frequency in the Florida Keys where soil and water conditions limit plant growth. Summer fires are preferred since most 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 a step-wise fashion. In some areas it may include winter burns, or removal of some fuel to prevent a hot fire. Any prescribed fire management should include a monitoring program to determine the effectiveness of the prescription. There should also be a component to the monitoring that captures the health of the community and species that occur in association with *C. deltoidea* ssp. *serpyllum*.

Invasive exotic species, especially Brazilian pepper, threaten *C. deltoidea* ssp. *serpyllum* and other rare pine rockland plants. The control of exotic species in the pine rocklands is a very important part of habitat maintenance, although it can be very costly once exotics are established in an area. In most cases the control of exotics include the use of manual labor, herbicides, and prescribed fire. In heavily infested areas removal is 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.

Previous Status Surveys: Ross and Ruiz (1996) studied the abundance and habitat preferences on Big Pine Key and surrounding keys. Further work on the distribution on Big Pine Key should be conducted.

References:

Alexander, T.R. and J.D. Dickson.1972. Vegetational changes in the National Key Deer Refuge II. Quart. Journ. FL. Acad. Sciences. 35:85-96.

Burch, D. 1966. Two new species of *Chamaesyce* (Euphorbiaceae), new combinations, and a key to Caribbean members of the genus. Ann. Missouri Bot. Gard. 53:90-99.

Ehrenfeld, J. 1976. Reproductive biology of three species of *Euphorbia* subgenus *Chamaesyce* (Euphorbiaceae). American Journal of Botany 63(4):406-413.

Ehrenfeld, J. 1979. Pollination of three species of *Euphorbia* subgenus *Chamaesyce* (Euphorbiaceae), with special reference to bees. American Midland Naturalist 101(1) 87-98.

Herndon, A. 1993. A Revision of the *Chamaesyce deltoidea* (Euphorbiaceae) complex of southern Florida. Rhodora 95(881): 38-51.

Oedejans, R.H.M. 1989. New Names and New Combinations in the Genus *Euphorbia* L. (Euphorbiaceae). Phytologia 67:45.

Pemberton, R.W. 1988. Myrmechorchory in the introduced range weed, Leafy spurge (*Euphorbia esula*). American Midland Naturalist 119(2):431-435.

Ross, M. and P. Ruiz. 1996 A Study of the Distribution of Several South Florida Endemic Plants in the Florida Keys.

Small, J.K. 1913. Flora of the Florida Keys. Published by the author; New York, NY.

Small, J.K. 1933. Manual of the Southeastern Flora. Published by the author; New York, N.Y.

Snyder, J.R., A. Herndon, and W.B. Robertson, Jr. 1990. South Florida rocklands. Pages 230-277 *in* R.L. Myers and J.J. Ewel, eds. Ecosystems of Florida. University of Central Florida Press; Orlando, FL.

USDA. 1995. Soil Survey of Monroe County, Keys Area, Florida.

Webster, R.L. 1967. Genera of Euphorbiaceae. Journal of the Arnold Arboretum. 48.

Wunderlin, R.P. 1998. Guide to the Vascular Plants of Florida. University Press of Florida; Gainesville, FL.

Status Summary
Chamaecrista lineata (Sw.) Greene var. *keyensis* (Pennell) H.S. Irwin & Barneby

Common Names: Big Pine partridge pea, narrowpod sensitive pea

Summary: *C. lineata* var. *keyensis* is a small prostrate to ascending shrub in the Fabaceae. It is a rare plant endemic to pine rocklands of Monroe County in the lower Florida Keys. While it once occurred on several islands, it is now known only from Big Pine Key. Much of the population is protected within the National Key Deer Refuge.

Description: *C. lineata* var. *keyensis* is a prostrate to ascending subshrub. Young branches pilosulous; stipules 3-9.5 x 0.7-2 mm.; leaves 1.7-3.5(-4) cm; gland 0.3-0.6 mm diameter, sessile or nearly so; leaflets (5-) 6-9 pairs, oblong-lanceolate, obtuse mucronulate, 7-12 x 2-4.5 (-5) mm; sepals 9-20 mm long; petals 11-15 mm long; ovules 10-13; pod 33-45 x 4.5 – 5 mm, pilosulous. (Adapted from Irwin & Barneby 1982)

Taxonomy: John Loomis Blodgett was the first to collect this taxon sometime between 1838 and 1852 on "Pine Key" (Big Pine Key). Pollard (1894) was the first to recognize that this was different than other Florida species of *Chamaecrista*, calling it *C. grammica*, a West Indian plant now called *C. lineata* var. *brachyloba* (Irwin & Barneby 1982). Small (1903, 1913) followed this usage. In 1917 Pennell recognized it as a distinct endemic species, naming it *Chamaecrista keyensis* (see Irwin & Barneby 1982). This name was also retained by Small (1933). In 1919, Macbride placed the taxon in the genus Cassia, creating the name *Cassia keyensis* (See Isely 1975). Isely (1975) and Long & Lakela (1971) followed this treatment. In an exhaustive study of *Cassia* and *Chamaecrista* in 1982, Irwin and Barneby noticed the similarity between plants in Florida and other parts of the West Indies. Retaining the plant in the genus *Chamaecrista,* they named the plant *C. lineata* var. *keyensis*, retaining it as endemic with close relatives in the Bahamas and Cuba. Isely (1990) and Wunderlin (1998) have followed this treatment.

Synonyms: *Cassia keyensis* (Pennell) J.F. Macbr., *Chamaecrista keyensis* Pennell, *Chamaecrista grammica* Spreng. misapplied, *Cassia grammica* Spreng, misapplied.

Distribution: *C. lineata* var. *keyensis* was historically known from Big Pine Key, No Name Key, Ramrod Key, and Cudjoe Key, all in the lower Florida Keys, Monroe County. It has apparently been extirpated from all but Big Pine Key. Plants have not been reported for other islands for some time (Cudjoe Key in 1977 (Weiner 1979), Ramrod Key in 1911, and No Name Key in 1895). Plants may persist on these islands, most likely Cudjoe Key, but more thorough searches are needed. Ross and Ruiz (1996) in a study of endemic plants in the Florida Keys only found plants on Big Pine Key.

Habitat: This taxon occurs in pine rocklands. Pine rocklands in the lower Florida Keys are dominated by a canopy of southern slash pine *Pinus elliottii* var. *densa*. The subcanopy is composed of several palms such as Key thatch palm (*Thrinax morrisii*), Florida thatch palm (*Thrinax radiata*), and silver palm (*Coccothrinax argentata*), and several hardwoods such as locustberry (*Byrsonima lucida*) and longstalked stopper (*Psidium longipes*). Ross and Ruiz (1996) found that it occurs primarily in areas where hardwoods are relatively unimportant, and where understory and overstory palms are important. Fire is an important element in maintaining

the pine rockland habitat. Periodic fires eliminate the shrub subcanopy and remove litter from the ground.

Reproduction: Reproduction is sexual. No studies have been made of this taxon's reproductive biology or ecology.

Relationship to Other Species: The pine rocklands of Big Pine Key are dominated by a single canopy tree, southern slash pine (*Pinus elliottii* var. *densa*). Understory shrubs are very common in most areas and include several palms such as Florida thatch palm (*Thrinax radiata*), Key thatch palm (*Thrinax morrisii*),and silver palm (*Coccothrinax argentata*), and several hardwoods such as locustberry (*Byrsonima lucida*), longstalked stopper (*Psidium longipes*), and smooth devilsclaws (*Pisonia rotundata*). There is also a rich herbaceous layer composed of several grasses (*Schizachyrium* spp., *Andropogon* spp.), and herbs including silver dwarf morningglory (*Evolvulus sericeus*), eyebright ayenia (*Ayenia euphrasiifolia*), scaleleaf aster (*Aster adnatus*),and sand flax (*Linum arenicola*).

This taxon can grow in association with other rare taxa, including sand flax (*Linum arenicola*), and Big Pine partridge pea (*Chamaecrista lineata* var. *keyensis*).

Status and Trends: There is currently only one known occurrence of *C. lineata* var. *keyensis*. It is widespread on Big Pine Key. The population on Big Pine Key is sizable. Ross and Ruiz (1996) detected it in 130 (89%) of 145 pine rockland sample plots on the island. Densities were found to exceed 1 plant/m^2 in some places, with the highest densities occurring near the northern end of the island. Based on a $\log_{10}$ scale there is an estimated total population of 1,001-10,000 plants, The total population is probably close to 10,000 individuals.

The population of *C. lineata* var. *keyensis* is probably declining. It may already be extirpated on three of the four islands where it once occurred. Private sites where this plant occurs on Big Pine are either not being managed or are being developed. Sea level rise may be reducing pine rockland acreage on Big Pine Key, effecting the population size of this plant.

While much of the habitat for this taxon is contained within conservation lands owned by the U.S. Fish and Wildlife Service and The Nature Conservancy, a great deal of pine rocklands still exists in private ownership. Development is currently limited in Monroe County, but losses to pine rockland habitat still occurs due to development.

Exotic pest plants may also impact populations of this taxon. Brazilian pepper (*Schinus terebinthifolius*) is currently the biggest threat on Big Pine Key.

Management and Opportunities for Recovery: The pine rocklands of the lower Florida Keys have evolved and adapted to frequent fires (Snyder *et al.* 1990). In absence of fire these areas mature into hardwood forests with a few pines in the canopy (Snyder *et al.* 1990). Alexander and Dickson (1972) suggested that this process may take up to 50 years in the Florida Keys. A fundamental question about fire ecology in pine rocklands is how frequently they should burn and during what season. Snyder *et al.* (1990) inferred the historic fire regimes on the Florida mainland 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 where enough fuel is available to carry a fire (minimum time since fires). The minimum fire regime they found was two to three years and the maximum was 15 years. This wide range in fire frequencies would result in different forest structures and dynamics. This would lead us to believe that a mosaic of burns should be used in the management of pine rocklands.

Presently, the recommended burn regime in Miami-Dade County pine rocklands is three to seven years with summer fires generally preferred to winter. It is likely that this is too short a fire frequency in the Florida Keys where soil and water conditions limit plant growth. Summer fires are preferred since most 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 a step-wise fashion. In some areas it may include winter burns, or removal of some fuel to prevent a hot fire. Any prescribed fire management should include a monitoring program to determine the effectiveness of the prescription. There should also be a component to the monitoring that captures the health of the community and species that occur in association with *C. lineata* var.*keyensis*.

Invasive exotic species, especially Brazilian pepper, threaten *C. lineata* var. *keyensis* and other rare pine rockland plants. The control of exotic species in the pine rocklands is a very important part of habitat maintenance, although it can be very costly once exotics are established in an area. In most cases the control of exotics include the use of manual labor, herbicides, and prescribed fire. In heavily infested areas removal is 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.

While Ross and Ruiz (1996) found that long term fire frequency was relatively unimportant to densities of populations, we feel that fire should still remain an issue of great importance in the recovery of this taxon. It is likely that long term fire suppression will effect populations in at least two ways: Competition with understory hardwoods in the long term should reduce plant densities, and, when fire is reintroduced into a fire suppressed area, either intentionally or unintentionally, excessive fire temperatures may kill plants. Ross and Ruiz (1996) did find that plant densities were quite variable in recently burned pine stands. While no explanation for this was offered, this may be one possibility.

Acquisition of private occurrences on Big Pine Key should be a high priority for this taxon. Fire management and control of exotic pest plants should be conducted at extant sites.

It may also be possible to reintroduce this taxon onto Cudjoe, Ramrod, and No Name Keys. Any possible reintroduction sites should be burned prior to reintroduction efforts.

Previous Status Surveys: Ross and Ruiz (1996) studied the abundance and habitat preferences on Big Pine Key and surrounding keys. Plants were detected in sample plots only on Big Pine Key.

References:

Alexander, T.R. and J.D. Dickson.1972. Vegetational changes in the National Key Deer Refuge II. Quart. Journ. FL. Acad. Sciences. 35:85-96.

Irwin, H.S. and R.C. Barneby. 1982. The American Cassiinae. Memoirs of the New York Botanical Garden. 35(1-2): 1-918.

Isely, D. 1975. Leguminosae of the United States: II. Subfamily Caesalpinioideae. Memoirs of the New York Botanical Garden. 25(2):1-228.

Isely, D. 1990. Vascular Flora of the Southeastern United States. Leguminosae (Fabaceae). Vol. 3, Part 2. University of North Carolina Press; Chapel Hill, NC.

Long, R.W. and O. Lakela. 1971. A Flora of Tropical Florida. University of Miami Press; Coral Gables, FL.

Ross, M. and P. Ruiz. 1996 A Study of the Distribution of Several South Florida Endemic Plants in the Florida Keys.

Small, J.K. 1903. Flora of the Southeastern States. Published by the author; New York, NY.

Small, J.K. 1913. Flora of the Florida Keys. Published by the author; New York, NY.

Small, J.K. 1933. Manual of the Southeastern Flora. Published by the author; New York, NY.

Snyder, J.R., A. Herndon, and W.B. Robertson, Jr. 1990. South Florida rocklands. Pages 230-277 *in* R.L. Myers and J.J. Ewel, eds. Ecosystems of Florida. University of Central Florida Press; Orlando, FL.

Weiner, A. 1979. The Hardwood Hammocks of the Florida Keys: An Ecological Study. National Audubon Society and the Florida Keys Land Trust. 25 pp. + apps.

Wunderlin, R.P. 1998. Guide to the Vascular Plants of Florida. University Press of Florida; Gainesville, FL.

Status Summary
Chromolaena frustrata (B.L. Rob.) R.M. King and H. Rob.

Common Names: Cape Sable thoroughwort

Summary: *C. frustrata* is an erect herb in the Asteraceae. It is endemic to southern Florida in Monroe, Miami-Dade, and Collier counties. It grows in coastal rock barren, rockland hammock, and coastal berm. Many of the places where this species once occurred have been developed. There are currently only four known occurrences in the Florida Keys. Its status on the Florida mainland, mostly in coastal berm along the edge of Florida Bay, is unknown. It is threatened by exotic pest plants and development.

Description: *C. frustrata* is an erect fragrant herb 2-10 dm tall with 1-many stems, hirtellous-puberulent or short spreading hirsute throughout; leaves opposite, 3-nerved, 1.5-4 x 0.7–2 cm on a slender petiole 4-10 mm long, lance-ovoid to broadly ovate, toothed or subentire; heads in small clusters ending the numerous branches, forming a diffuse inflorescence; involucre 5.5–7.5 (-8) mm high; bracts strongly imbricate in several series; flowers ca. 20-25 or more, blue or lavender; achenes (3-)3.5-4 mm long. (Adapted from Cronquist 1980)

History and Taxonomy: Chapman (1886) was the first to report this species in Florida, calling it *Eupatorium heteroclinium*, reporting it for "Keys of South Florida." This species was named for a Jamaican plant by Grisebach (1864). Small (1903), also used this species epithet, but placed the plant in the genus *Osmia*, reporting it for the Florida Keys and Jamaica. This species was first described as a Florida endemic in 1911 as *Eupatorium frustratum* by Robinson. Small (1913) adopted this species epithet, but again included it in the genus *Osmia*, noting it for "Hammocks in the Upper and Lower Florida Keys." Small in 1933 continued to use *Osmia frustrata*. Ledin (1951) also used the name *Osmia frustrata*. In 1970 King and Robinson placed this species in the genus *Chromolaena*. Long and Lakela (1971) and Cronquist (1980), reverted back to the older name *Eupatorium frustratum*. Wunderlin (1998) follows King and Robinson, using *Chromolaena frustrata*.

Synonyms: *Eupatorium frustratum* B.L. Rob., *Osmia frustrata* (B.L. Rob.) Small, *Eupatorium heteroclinium* Chapm., not Grisebach, *Osmia heteroclinium* (Griseb.) Small.

Distribution: *C. frustrata* historically occurred in Monroe County, both on the mainland and the Florida Keys, in Miami-Dade County along Florida Bay, and just inside Collier County along the Turner River. Within its range on the Florida mainland it is reported for the Turner River (Moldenke 1944), the 10,000 Islands area, Cape Sable, along the Buttonwood Canal (west of Coot Bay, north of the Bear Lake Road), just south of West Lake, and in Madeira Hammock (along the edge of Madeira Bay). These mainland occurrences are all along the extreme southern edge of the Florida mainland.

In the Florida Keys it has been reported from Key Largo to Boca Grande Key (12 miles west of Key West), on nine islands (Boca Grande Key, Key Largo, Big Pine Key, Upper Matecumbe Key, Long Key, Knight's Key, Plantation Key, Lignumvitae Key, and Lower Matecumbe Key).

C. frustrata is currently known in the Florida Keys from Long Key (two occurrences), Lignumvitae Key, and Upper Matecumbe Key. Populations almost certainly exist on Big Pine Key but have not been observed recently. It has been searched for on Knight's Key but that island has been almost completely developed, and it probably no longer exists there. It was not

seen in a 1996 survey of Boca Grande Key. It has not been seen recently on Lower Matecumbe Key, Key Largo, or Plantation Key, but thorough searches have not been conducted.

The current distribution of this species on the mainland is unknown. Many of the areas where it probably occurs are difficult to access. Attempts should be made to conduct surveys of these areas.

Habitat: This herb has been observed most commonly in open sun to partial shade at the edges of rockland hammock and in coastal rock barren. It was historically known from coastal berm along the northern edges of Florida Bay. It is often found under other plant species, buffering it from full exposure to the sun. It has not been observed in disturbed areas. Coastal rock barrens are open communities with no tree canopy and a sparse subcanopy of understory hardwoods. Coastal rock barrens are composed of exposed Key Largo Limestone with a diverse assemblage of herbaceous plant taxa, many of which are halophytes. The origin of these communities is not understood. It seems possible that periodic storm events are responsible for maintaining the community.

C. frustrata sometimes occurs along the sparsely vegetated edges of rockland hammocks abutting coastal swamp forest or buttonwood forests. Plants occur on the exposed bare rock or in a light layer of leaf litter, in filtered sunlight.

Reproduction: Reproduction is sexual. The reproductive biology and ecology of this species has not been studied.

Relationship to Other Species: Coastal rock barrens have no tree canopy and a sparse, usually clumped shrub layer. Common plant species in this shrub layer include Florida Keys blackbead (*Pithecellobium keyense*), Spanish stopper (*Eugenia foetida*), gumbo limbo (*Bursera simaruba*), bayleaf capertree (*Capparis flexuosa*), buttonwood (*Conocarpus erectus*), poisonwood (*Metopium toxiferum*), and willow bustic (*Sideroxylon celastrinum*). Succulents and herbaceous species are also common.

The edges of rockland hammock where this species can occur are often very sparsely vegetated. Common species along this ecotonal area include joewood (*Jacquinia keyensis*), willow bustic, samphire, and saltwort (*Batis maritima*).

This species may occur in association with several rare plant taxa, including *Opuntia triacanthos*, Yucatan flymallow (*Cienfuegosia yucatanensis*), upland cotton (*Gossypium hirsutum*), Poeppig's rosemallow (*Hibiscus poeppigii*), Florida Keys indigo (*Indigofera mucronata* var. *keyensis*), and limestone flatsedge.

Status and Trends: There are four known occurrences in the Florida Keys. The estimated total population of *C. frustrata* based on a $\log_{10}$ is 1,001-10,000 plants. It is difficult to make a more accurate determination because of a lack of information on mainland occurrences. The population of *C. frustrata* is probably declining. It may already be extirpated on five of the nine islands in the Florida Keys where it once occurred. The extent of the population on the Florida mainland is unknown. It had been reported in abundance in areas in the Cape Sable Region, 10,000 islands, and West Lake area. These areas have been little explored recently, and some have changed dramatically since these reports. Much of Cape Sable had been cleared for farming, and the exotic shrub latherleaf (*Colubrina asiatica*) is invading large areas of hammocks along the edges of Florida Bay. Uplands in the vicinity of the Turner River have not been surveyed, so its status there is unknown.

Exotic pest plants are a definite threat to all occurrences of *C. frustrata*. Brazilian pepper (*Schinus terebinthifolius*) occurs in all habitats where this species occurs and is currently a big problem in coastal rock barrens, and rockland hammocks ecotones. Latherleaf is invading large areas of hammocks within Everglades National Park along the edge of Florida Bay. This species

can radically change the structure of these hammocks and may be eliminating occurrences of this species.

Sea level rise may also be a long-term problem for this species. All known populations occur in low lying areas near the coast.

Management and Opportunities for recovery: The most important conservation actions for *C. frustrata* include acquisition of private occurrences on Long Key and Upper Matecumbe Key and control of exotic pest plants. The most problematic exotic pest plants that occur in association with *C. frustrata* include Brazilian pepper and latherleaf. Latherleaf may be severely impacting occurrences on the Florida mainland. Occurrences should be monitored to determine impacts of exotic pest plants, habitat succession, and sea level rise.

Previous Status Surveys: None. Further status surveys are needed for this species. Little is known about its present status on the mainland. New occurrences may also be discovered in the Florida Keys.

References:

Chapman, A.W. 1886. Flora of the Southern United States. American Book Company. New York, NY.

Cronquist, A. 1980. Vascular Flora of the Southeastern United States. Volume I. Asteraceae. University of North Carolina Press; Chapel Hill, NC.

Grisebach, A.H.R. 1864. Flora of the British West Indian Islands. Lovell Reeve & Co. London.

King, R.M., and H. Robinson. 1970. Studies in the Eupatorieae (Compositae). XXIX. The Genus Chromolaena. Phytologia 20: 196-209.

Ledin, B. 1951. The Compositae of south Florida. University of Miami Press; Coral Gables, FL.

Long, R.W., and O. Lakela. 1971. A Flora of Tropical Florida. University of Miami Press; Coral Gables, FL.

Moldenke, H.N. 1944. A contribution to the knowledge of the wild and cultivated flora of Florida-I. Amer. Mid. Nat. 32(3):529-590.

Small, J.K. 1903. Flora of the Southeastern States. Published by the author; New York, NY.

Small, J.K. 1913. Flora of the Florida Keys. Published by the author; New York, NY.

Small, J.K. 1933. Manual of the Southeastern Flora. Published by the author; New York, NY.

Wunderlin, R.P. 1998. Guide to the Vascular Plants of Florida. University Press of Florida; Gainesville, FL.

Status Summary

Dalea carthagenensis (Jacq.) J.F. Macbr. var. *floridana* (Rydb.) Barneby

Common Names: Florida prairieclover

Summary: *D. carthagenensis* var. *floridana* is a shrub in the Fabaceae. It is endemic to peninsular Florida and was at one time found in Palm Beach, Miami-Dade, Monroe, and Collier counties in pine rocklands, edges of rockland hammocks, and coastal uplands. It is currently extirpated in Palm Beach County. There are only five extant occurrences. It is threatened by exotic pest plants, fire suppression, and human induced disturbances.

Description: *D. carthagenensis* var. *floridana* is an erect suffrutescent shrub 0.5-2 m tall; leaflets 15-23, ovate to elliptic, 5-14 mm long, glandular punctate beneath; spikes subcapitate to shortly oblong, 0.5-1.5 (-2) cm long, pubescent; peduncles opposite the leaves, terminal or appearing axillary, 1-3.5 cm long; bracts shorter than calyx; calyx 5-7 mm long, subequal and exceeding the tube, plumose; corolla subpapilionaceous, initially greenish white, turning maroon or dull purple, 4-5 mm long; stamens 9-10. (Adapted from Isely 1990)

History and Taxonomy: Chapman (1886) was the first to report this taxon in Florida, calling it the tropical *Dalea domingensis,* reporting it for Key Biscayne based on a specimen collected by Curtiss. Small (1903 and 1913) accepted this epithet but included the taxon in the genus *Parosela,* making the plant *P. domingensis*. Rydberg (1920) renamed the plant, calling it *Parosela floridana,* treating it as a southern Florida endemic because of differences in the inflorescence, calyx, and leaf rachis. In 1933 Small retained this name. In 1946 Clausen reviewed the taxonomy of Florida plants and considered them to be the same as plants of the West Indies. He also found that the name *D. domingensis* was a homonym of *D. emphysodes,* and published the name *D. emphysodes* ssp. *domingensis*. Clausen (1946b) later discovered that his use of the name *D. emphysodes* was in error, and renamed the plants *D. carthagenensis* ssp. *domingensis*. Long and Lakela (1971) accepted this usage. Barneby in 1977, in a monograph of the genus, also found that Florida plants were distinct from West Indian plants, citing differences in leaf characters. He named the Florida plants *D. carthagenensis* var. *floridana*. Wunderlin (1998) has followed this treatment.

Synonyms: *Parosela floridana* Rydb., *D. emphysodes* (Jacq.) R.T. Clausen ssp. *domingensis* (DC.) R.T. Clausen, misapplied, *Parosela domingensis* (DC.) Millsp., misapplied, *D. carthagenensis* (Jacq.) J.F. Macbr. ssp. *domingensis* (DC.) R.T. Clausen, misapplied

Distribution: *D. carthagenensis* var. *floridana* was historically known from Miami-Dade, Collier, Monroe, and Palm Beach counties. Collections were made in Palm Beach County at an unknown location near Palm Beach by Curtiss in 1895, and south of Palm Beach by Small in 1918. In Monroe County it has been known historically from the Pinecrest region in the Big Cypress National Preserve. It was discovered in Collier County portion of the Big Cypress National Preserve in 1999 (Bradley 1999). In Miami-Dade County it has been reported for many locations including Key Biscayne, Castellow Hammock, the Charles Deering Estate, R. Hardy Matheson Preserve, the edge of Everglades National Park, the Coral Gables area, pinelands south of the Miami River, and Cox Hammock (now the Monkey Jungle).

D. carthagenensis var. *floridana* is currently known only from five occurrences. It has not been reported from Palm Beach County since 1918. The two colonies reported in Collier and Monroe Counties are extant, both occurring in the Big Cypress National Preserve. In Miami-Dade County only three occurrences remain, two at the Charles Deering Estate, and one at the R.

Hardy Matheson Preserve. Several sites where it was formerly reported still exist, and plants may be found there in the future, including Key Biscayne (in Crandon Park), Castellow Hammock, the Cox Hammock, or the edge of Everglades National Park.

Habitat: This shrub is found in several habitats, including edges of rockland hammock and pine rockland, coastal upland, and marl prairie. Fire is probably very important to the livelihood of this taxon. Plants probably do not tolerate shading by hardwoods in the absence of periodic fires.

Two of the extirpated occurrences were reported from rockland hammocks (Castellow and Cox). Plants probably occurred at the edges of these hammocks. It is likely that plant disappeared either from a lack of fire at the edges of the hammocks, or from clearing at the edges.

While plants were known to occur in coastal uplands on Key Biscayne at Crandon Park, we do not have good information on the habitat it occurred in. It probably occurred along the edges of one of several small maritime hammocks there, and possibly in coastal strand. At least one of the Palm Beach collections was also made in some type of coastal upland.

Reproduction: Reproduction is sexual. The reproductive biology and ecology of this taxon has not been studied.

Relationship to Other Species: Each of the five known occurrences of this taxon occur in slightly different habitat types; disturbed pine rockland, a pine rockland/rockland hammock ecotone, a pine rockland/rockland hammock ecotone along road edges, edge of roadside in marl prairie, and ecotone between rockland hammock and marl prairie and flatwoods. Common species that occur in association with this taxon include southern slash pine (*Pinus elliottii* var. *densa*), live oak (*Quercus virginiana*), gumbo-limbo (*Bursera simaruba*), poisonwood (*Metopium toxiferum*), willow bustic (*Sideroxylon celastrinum*), white stopper (*Eugenia axillaris*), *Schizachyrium* spp., and *Paspalum* spp.

Status and Trends: There are five known occurrences of this taxon, three in Miami-Dade County, one in Collier County, and one in Monroe County. All five of these occurrences are within conservation lands, two of them in the Big Cypress National Preserve, and three in parks managed by Miami-Dade County. See Table 1 for approximate sizes of each of these occurrences.

The estimated total population of *D. carthagenensis* var. *floridana* based on a $\log_{10}$ scale is 101-1,000 plants. The total population size is probably closer to 200 or 300 individuals. The population of *D. carthagenensis* is probably declining. It has already been extirpated on many of the stations where it once occurred.

Exotic pest plants, off-road vehicles, and modifications to fire regime are all threats to this taxon. Damage to plants by off-road vehicles is a serious threat to occurrences in the Big Cypress National Preserve. Plants may be easily damaged by these large vehicles, as plants occur along the edges of an off-road vehicle trail. Operators of these vehicles frequently veer off of established trails, and if this happens here, plants could be harmed or destroyed.

One station in Miami-Dade County (R. Hardy Matheson Preserve) is threatened by illegal mountain biking. Plants occur in a pine rockland fragment which in the past was heavily used by mountain bikers. The Miami-Dade County Parks and Recreation Department has erected fencing to protect the site, but it is still broken into on occasion.

Management and Opportunities for Recovery: A natural fire regime should be established at all stations. Control of exotic pest plants should be a priority at all stations. Brazilian pepper (*Schinus terebinthifolius*) and Burmareed (*Neyraudia reynaudiana*) are serious threats to this taxon. Off-road vehicle usage in the Big Cypress National Preserve should be eliminated in the

vicinity of the two occurrences there. Mountain biking at R. Hardy Matheson Preserve should be eliminated.

Reintroduction could also be attempted in several locations. Plants could be reintroduced into Crandon Park on Key Biscayne. Following management, it may also be possible to reintroduce plants into Castellow Hammock or Cox Hammock.

Previous Status Surveys: None. A status survey is badly needed for this taxon.

References:

Barneby, R.C. 1977. Dalea Imagines. Memoirs of the New York Botanical Garden. 27: 1-891.

Bradley, K.A. 1999. Personal communication. Institute for Regional Conservation. 22601 SW 152 Ave. Miami, FL.

Chapman, A.W. 1886. Flora of the Southern United States. American Book Company; New York, NY.

Clausen, R.T. 1946a. A review of the status of several American species of Dalea. Bull. Torr. Bot. Club. 73(1): 80-85.

Clausen, R.T. 1946b. Dalea emphysodes, an invalid name. Bull. Torr. Bot. Club. 73(6): 572.

Isely, D. 1990. Vascular Flora of the Southeastern United States. Leguminosae (Fabaceae). Vol. 3, Part 2. University of North Carolina Press; Chapel Hill, NC.

Long, R.W., and O. Lakela. 1971. A Flora of Tropical Florida. University of Miami Press; Coral Gables, FL.

Rydberg, P.A. 1920. North American Flora. (Rosales) Fabaceae. Psoraleae. Vol. 14(2):114.

Small, J.K. 1903. Flora of the Southeastern States. Published by the author; New York, NY.

Small, J.K. 1913. Flora of the Miami. Published by the author; New York, NY.

Small, J.K. 1933. Manual of the Southeastern Flora. Published by the author; New York, NY.

Wunderlin, R.P. 1998. Guide to the Vascular Plants of Florida. University Press of Florida; Gainesville, FL.

Status Summary
Digitaria pauciflora Hitchcock

Common Names: twospike crabgrass, particular grass, few flowered fingergrass

Summary: *D. pauciflora* is a rhizomatous member of the Poaceae. It is easily recognized in the field by its dense covering of erect hairs, giving the plant a very fuzzy and glaucous look. It is endemic to southern Florida on the Miami Rock Ridge in Miami-Dade County. It grows in low elevation pine rockland and marl prairie. It is currently known from only one occurrence in the Long Pine Key area of Everglades National Park. It is potentially threatened by hydrological manipulations of Taylor Slough.

Description: *D. pauciflora* is a rhizomatous perennial; sheath auricles ca. 1.5 mm long; sheaths hairy (becoming glabrous with age); ligule 1.5-2 mm long; leaf blades flexuous or twisted, spreading, 7-18 cm long, 1–2.2 mm wide, hairy on both surfaces (becoming glabrous with age); main axis of the inflorescence 10-80 mm long, primary branches 2-8, appressed or spreading from the main axis, ca. 0.3 mm wide; pedicels 2-3 mm long, 0.7-0.9 mm wide; spikelets 30-60 on a primary branch, lanceolate, 2.7-3 mm long, 0.7-0.9 mm wide; first glume often present; second glume the same length as spikelet, usually 7-nerved, glabrous, acuminate to acute; lemma of lower floret 7-nerved, acuminate to acute, glabrous; upper floret the same length as the lower floret; lemma of the upper floret becoming purple, acuminate to acute (Adapted from Webster and Hatch 1990)

Taxonomy: The species was first described by Hitchcock in 1928 (see Webster and Hatch 1990) from specimens collected by Eaton from "Jenkins to Everglade" in 1903 on a collecting trip with J.K Small and J.J. Carter. Hitchcock in Small (1933) later placed it in the genus *Syntherisma.* Subsequent authors (Webster & Hatch 1990, Hitchcock 1951, Wunderlin 1998) have retained it in the genus *Digitaria.*

Synonyms: *Syntherisma pauciflorum* (Hitchcock) Hitchcock ex Small

Distribution: The historic distribution of *D. pauciflora* once included central and southern Miami-Dade County along the Miami Rock Ridge, from the South Miami Area (latitude ca. 25° 42.5') to Long Pine Key (latitude ca. 25° 20.5'), a range of approximately 42 miles. It is currently known only from southern Miami-Dade County in the Long Pine Key area of Everglades National Park, occupying an area of approximately 31 square miles (Avery 1983), stretching from near the park entrance (just east of Long Pine Key), southwest to the Mahogany Hammock turnoff at the western end of Long Pine Key. The range of this species has contracted by approximately 29 miles.

After a few collections at the beginning of the century it seemed to disappear. It was apparently not seen after a 1936 collection until 1973 when it was found again by Charles E. Hilsenbeck in Everglades National Park, near Osteen Hammock on Long Pine Key (Avery 1983). Since that time it has been found and collected in many stations on Long Pine Key. In 1995 one plant was discovered in a marl prairie in the Richmond Pine Rocklands in central Miami-Dade County, but that single plant seems to have disappeared (Bradley 1999).

Habitat: Plants occur most commonly along the ecotone between pine rockland and marl prairie, but do overlap somewhat into both of these ecosystems. The soil where it occurred at the Richmond Pine Rocklands has been classified as Biscayne marl, drained (USDA 1996). These habitats, particularly marl prairie, do flood for one to several months every year in the wet season.

The hydroperiod requirements for this species should be studied. It may be limited in its distribution by hydroperiod, which could affect the long term viability of the Long Pine Key occurrence.

Periodic fires are extremely important in maintaining the habitat for this species. Both marl prairie and pine rockland require fire to remove understory hardwoods and eliminate litter accumulations. Pine rockland in Miami-Dade County probably had a natural fire period of every 3-7 years. Marl prairies may have burned slightly more frequently.

Reproduction: Reproduction is sexual. The reproductive biology and ecology of this species has not been studied.

Relationship to Other Species: *D. pauciflora* grows primarily at the ecotones between marl prairie and pine rockland. If a canopy is present it is composed of southern slash pine (*Pinus elliottii* var. *densa*). Understory shrubs may be present and include cabbage palm (*Sabal palmetto*), saw palmetto (*Serenoa repens*), wax myrtle (*Myrica cerifera*), and dahoon holly (*Ilex cassine*). Herbaceous species that may be present include gulfdune paspalum (*Paspalum monostachyum*), *Schizachyrium rhizomatum*, Florida ironweed (*Vernonia blodgettii*), and *Elytraria caroliniensis* var. *angustifolia*.

Status and Trends: There is only one extant occurrence of this species. It is confined to Long Pine Key in Everglades National Park. There are approximately 1,001-10,000 individuals.

This plant has recently disappeared from the one locality it was known from outside of Everglades National Park, where only one individual was known. The population in the Park seems to be stable. With continued fire management and no major hydrological changes on Long Pine Key the population should remain stable. The possibility of major hydrologic changes is high, so the population of this species could be impacted in the future.

Management and Opportunities for Recovery: The only known occurrence of *D. pauciflora* is threatened by changes in hydrology, exotic pest plants, and changes in fire regime. Exotic pest plants could physically displace this species and alter the habitats it occurs in. The most problematic pest plants in pine rocklands are Brazilian pepper (*Schinus terebinthifolius*) and Burmareed (*Neyraudia reynaudiana*). Brazilian pepper is a threat to marl prairies.

Potential impacts of major hydrological changes are unknown. Manipulations to hydroperiod are probably the biggest threat to this species. The effects of hydroperiod manipulations, primarily to Taylor Slough but also Shark River Slough, if they occur, should be monitored. Plants may not be able to withstand an increased hydroperiod and may not be able to disperse quickly enough into areas of higher elevation. It seems likely that plants do not tolerate a decreased hydroperiod. This may have been a contributing factor in the disappearance of one the plant recently known from outside of Everglades National Park.

Reintroduction of other occurrences may be possible at one location just outside of Everglades National Park, the Frog Pond. North of the Frog Pond, a few marl prairie fragments do remain, but they have been so severely drained that they never have standing water. Unless the hydrology of these areas is restored, it may be impossible for plants to persist or reproduce there.

Previous Status Surveys: None. The exact population size on Long Pine Key is unknown. The remaining marl prairies outside of Everglades National Park, particularly at the Richmond Pine Rocklands, should be surveyed.

References:

Avery, G.N. 1983. *Digitaria pauciflora* – A very particular grass. Fairchild Tropical Garden Bulletin. July issue. pp. 30-31.

Bradley, K.A. 1999. Personal communication. The Institute for Regional Conservation. 22601 SW 152 Ave. Miami, FL.

Hitchcock, A.S. 1951. Manual of the Grasses of the United States, 2nd ed. Revised by A. Chase. U.S. Dept. Agric., Misc. Publ. No. 200; Washington, D.C.

Small, J.K. 1933. Manual of the Southeastern Flora. Published by the author; New York, NY.

USDA. 1996. Soil Survey of Dade County Area, Florida.

Webster, R.D., and S.L. Hatch. 1990. Taxonomy of *Digitaria* section *Aequiglumae* (Poaceae: Paniceae). Sida 14(2): 145-167.

Wunderlin, R.P. 1998. Guide to the Vascular Plants of Florida. University Press of Florida; Gainesville, FL.

Status Summary

Indigofera mucronata Spreng. ex DC. var. *keyensis* (Small) Isely

Common Names: Florida Keys indigo

Summary: *I. mucronata* var. *keyensis* is a small, ascending perennial herb in the Fabaceae. It is endemic to southern Florida in the Florida Keys (Monroe County). It grows in coastal rock barren and rockland hammock edges or canopy gaps. It is currently known only from six occurrences on six islands. It is threatened by development, exotic pest plants, and lack of management.

Description: *I. mucronata* var. *keyensis* is a scrambling to erect annual or probably perennial herb to 1 m tall; stems strigulose; leafstalk 1.5-2.5 (-4) cm long; leaflets ca. 5, paired, elliptic, 0.7-1.8 cm long, strigulose on both surfaces; stipules setaceous, 5-8 mm long; racemes exerted, lax, with few to numerous flowers, shortly pedunculate; pedicels 1-2 mm long; calyx 2-2.5 mm long, lobes lanceolate, longer than the tube; corolla pink to salmon, 6-7 mm long; legume dehiscent, oblong, straight or falcate, turgid, 3-4.5 cm x 2.5 mm, slightly strigulose. (Adapted from Isely 1990)

Some authors have indicated that this species is decumbent. Decumbent plants identified as *I. mucronata* var. *keyensis* are probably misidentified individuals of *I. miniata*. Examples of this error have been seen on herbarium collections (Bradley 1999).

Taxonomy: The species was first described by Small (1913) as *I. keyensis* from specimens collected on Lower Matecumbe Key in 1907. Isely (1982), recognized that the plant was similar to the tropical *I. mucronata* of the West Indies, and treated it as a variety of that species – *I. mucronata* var. *keyensis*. In a revision of Southeast Asia *Indigofera*, de Kort and Thijsse (1984) included *I. mucronata* as a synonym of *I. trita* ssp. *scabra*. Kartesz and Gandhi (1990) felt that this taxon did warrant status as a unique variety, but point out that *I. mucronata* DC. was a later homonym of *I. mucronata* Lamark, making Isely's combination illegitimate. They published a new combination *I. trita* L. var. *keyensis* (Small) Kartesz & Gandhi. Isely (personal communication in Kartesz and Gandhi 1990) apparently did not agree with this solution, believing that the de Kort and Thijsse study of New World materials to be incomplete. Wunderlin (1998) has continued to use Isely's combination, *I. mucronata* var. *keyensis*. It is apparent that the nomenclature of this taxon needs further study.

Synonyms: *Indigofera keyensis* Small, *Indigofera trita* L. var. *keyensis* (Small) Kartesz & Gandhi.

Distribution: *I. mucronata* var. *keyensis* was historically distributed in the Florida Keys from Key Largo south to Knight's Key, in the upper and middle Keys. It has been collected or reported on 11 islands including Crawl Key, Key Largo, Knight's Key, Lignumvitae Key, Long Key, Long Point Key, Lower Matecumbe Key, Plantation Key, Upper Matecumbe Key, Vaca Key, and Windley Key. Historical occurrences which may no longer be extant include Knight's Key, Lignum Vitae Key, Lower Matecumbe Key, Upper Matecumbe Key, and Vaca Key. Thus, this taxon has been eliminated from nearly half of the islands from which it was once known.

I. mucronata var. *keyensis* is currently known from Crawl Key, Key Largo, Long Key, Long Point Key, Plantation Key, and Windley Key.

Habitat: This taxon grows in coastal rock barren on the edges of rockland hammock on Key Largo limestone and on coastal berm. It has also been recorded for "Buttonwood Woodland" in

the habitat classification scheme proposed by Ross et al. (1992). Soils it has been recorded on include Matecumbe muck, Cudjoe marl, and Pennekamp gravelly muck (USDA 1995).

Three of the occurrences of this taxon occur on coastal rock barren: Long Key, Crawl Key, and Windley Key. Coastal rock barren is an open community with no tree canopy and a sparse subcanopy of understory hardwoods. Most of the area is composed of exposed Key Largo Limestone with a diverse assemblage of herbaceous plant taxa, many of which are halophytes. The origin of this community is not understood. It seems possible that periodic storm events are responsible for maintaining coastal rock barrens. The Crawl Key and Long Key sites are excellent examples of this community. The Windley Key coastal rock barren is very small, possibly because of hardwood invasion from the adjacent rockland hammock. Many of the extirpated populations of this taxon may have once occurred in coastal rock barrens that have been developed (e.g. Lignumvitae Key, Key Vaca, Lower Matecumbe Key, Knight's Key).

This taxon is also associated with the rockland hammock community, where it occurs mostly along sunny edges and roadsides. Some of these edges take on characteristics of coastal rock barrens. Occurrences associated with rockland hammocks include Key Largo and Plantation Key. On Key Largo there were formerly plants along an old road transecting rockland hammock but those plants seem to have disappeared. On Plantation Key plants occur on the edges of a rockland hammock along a transition zone that takes on many of the characteristics of a coastal rock barren. The existing plants on Key Largo are growing on an open, disturbed coastal berm within a few meters of the ocean.

Some authors indicate that this is a commonly weedy species (Isely 1990, Austin 1980). All colonies currently known occur in natural areas or only slightly disturbed soils in natural areas (e.g. along edge of an old roadbed in a rockland hammock or at the edge of a wrack line adjacent to rockland hammock). Weedy individuals are probably plants of *I. miniata*.

Reproduction: Reproduction is by seed. The reproductive biology and ecology of this species has not been studied.

Relationship to Other Species: Coastal rock barren has no tree canopy and a sparse, usually clumped shrub layer. Common plant species in this shrub layer include Florida Keys blackbead (*Pithecellobium keyense*), Spanish stopper (*Eugenia foetida*), gumbo-limbo (*Bursera simaruba*), bayleaf capertree (*Capparis flexuosa*), buttonwood (*Conocarpus erectus*), poisonwood (*Metopium toxiferum*), and saffron-plum (*Sideroxylon celastrinum*). Succulents are common, both in the subcanopy and ground layer, and include false sisal (*Agave decipiens*), dildoe cactus (*Acanthocereus tetragonus*), erect pricklypear (*Opuntia stricta*), redstem purslane (*Portulaca rubricaulis*), and samphire (*Blutaparon vermiculare*). Herbaceous species that are frequent in coastal rock barren include Porter's sandmat (*Chamaesyce porteriana*), Garber's sandmat (*Chamaesyce garberi*), whitemouth dayflower (*Commelina erecta*), Gulf Coast swallowwort (*Cynanchum angustifolium*), limestone flatsedge (*Cyperus fuligineus*), bearded flatsedge (*Cyperus squarrosus*), bindweed dwarf morningglory (*Evolvulus convolvuloides*), Carolina leafflower (*Phyllanthus caroliniensis*), and showy milkwort (*Polygala grandiflora*).

The rockland hammock on Plantation Key where this taxon occurs has not well been studied. The transition zone where this occurrence is located contains Spanish stopper, crabwood (*Gymnanthes lucida*), limestone flatsedge, upland cotton (*Gossypium hirsutum*), and coral-panicum (*Paspalidium chapmanii*).

The disturbed coastal berm on Key Largo where this taxon occurs has not been well studied. Some taxa which do occur there include sea blite (*Suaeda linearis*), coastal beach sandmat (*Chamaesyce mesembrianthemifolia*), crested saltbush (*Atriplex pentandra*), and shoreline seapurslane (*Sesuvium portulacastrum*). No listed taxa are known to occur in association with the occurrence on Key Largo.

Status and Trends: Only six occurrences of *I. mucronata* var. *keyensis* are currently known. Three of these occurrences contain very small populations, Key Largo, Windley Key, and Long Point Key. For approximate size of each occurrences see Table 1.

The estimated total population of *I. mucronata* var. *keyensis* based on a $\log_{10}$ scale is 101-1,000 plants, although this may be a slight underestimate. The population of *I. mucronata* var. *keyensis* is probably declining. Private sites where this plant occurs are either not being managed and are at risk of development. Populations on public lands are also being impacted. The coastal rock barrens where populations occur at Long Key State Recreation Area, Windley Key Fossil Reef State Geological Site are being invaded by native and exotic hardwoods. The exotic hardwoods on these sites should be controlled.

Management and Opportunities for Recovery: All privately owned sites should be acquired, including those on Crawl Key, Long Point Key, and Plantation Key. Both the Crawl Key and Long Point Key sites are adjacent to Curry Hammock State Park. The Plantation Key site is in very good condition.

Control of exotic pest plants is important on all sites. The most problematic exotic pest plant that grows in association with *I. mucronata* var. *keyensis* is Brazilian pepper (*Schinus terebinthifolius*), which can form dense stands in coastal rock barren and rockland hammock edges. Latherleaf (*Colubrina asiatica*) could also severely impact occurrences of this taxon.

Studies on the ecology and management of the poorly understood coastal rock barren habitat should be conducted.

Reintroduction of extirpated occurrences may also be possible. Suitable habitats may exist on Lignumvitae Key, Vaca Key, Upper Matecumbe Key, and Lower Matecumbe Key. Lignumvitae Key is publicly owned. A portion of Lower Matecumbe Key is also publicly owned. Land acquisitions would be necessary for Upper Matecumbe and Vaca Keys.

Previous Status Surveys: No comprehensive status survey has been conducted. Ross and Ruiz (1996) summarized their understanding of the distribution of this taxon, reporting it for Long Point Key, Long Key, and Windley Key. Their report includes a habitat characterization for each of these occurrences. This taxon may occur on addition sites in the Middle and Upper Keys and should be searched for in additional locations.

References:

Austin, D. 1980. Endangered and threatened plant species survey in southern Florida and the National Key Deer and Great White Heron National Wildlife Refuges, Monroe County, Florida. Report submitted to the U.S. Fish and Wildlife Service, Atlanta, Georgia.

Bradley, Keith. 1999. Personal communication. Institute for Regional Conservation. 22601 SW 152 Ave. Miami, Florida.

de Kort, I., and G. Thijsse. 1984. A revision of the genus Indigofera (Leguminosae-Papilionideae) in Southeast Asia. Blumea 30: 89-151.

Isely, D. 1982. New combinations and one new variety among the genera Indigofera, Robinia, and Tephrosia (Leguminosae). Brittonia 34(3): 339-341.
Isely, D. 1990. Vascular Flora of the Southeastern United States. Leguminosae (Fabaceae). Vol. 3, Part 2. University of North Carolina Press; Chapel Hill, NC.

Kartesz, J.T., and K. Gandhi. 1990. Nomenclatural notes for the North American flora. II. Phytologia 68(6): 421-427.

Ross, M., J. O'Brien, and L. Flynn. 1992. Ecological site classification of Florida Keys terrestrial habitats. Biotropica 24(4): 488-502.

Ross, M. and P. Ruiz. 1996. A study of the distribution of several south Florida endemic plants in the Florida Keys. Report to the U.S. Fish and Wildlife Service.

Small, J.K. 1913. Flora of the Florida Keys. Published by the Author. New York, NY.

USDA. 1995. Soil Survey of Monroe County, Keys Area, Florida.

Wunderlin, R.P. 1998. Guide to the Vascular Plants of Florida. University Press of Florida. Gainesville, FL.

Status Summary
Linum arenicola (Small) H.J.P. Winkler

Common Names: sand flax

Summary: *L. arenicola* is a wiry, yellow flowered herb in the Linaceae. It is endemic to southern Florida in Miami-Dade and Monroe counties. It is found in pine rockland, disturbed pine rockland, marl prairie, and roadsides on rocky soils. It is currently known from only seven occurrences, with only two of those occurrences on conservation lands and only two occurrences actually within natural areas. It is threatened by development, exotic pest plants, and modifications to fire regime.

Description: *L. arenicola* is a glabrous perennial herb; stems 1-several from the base, wiry, 35-53 cm tall; leaves mostly alternate, linear, 7-10 mm long, 0.6-1 mm wide, entire or with scattered marginal glands; stipules glandular, reddish; inflorescence a cyme of a few slender, spreading or ascending branches; pedicels 2 mm long or less; sepals lanceolate to ovate with a prominent midrib, 2.4-3.2 mm long; petals yellow, obovate, 4.5-5.5 mm long; fruit 2.1-2.5 mm long, 2-2.3 mm diameter, pyriform, dehiscing into ten segments; seeds ovate, 1.2-1.4 mm long, 0.7-0.8 mm wide. (Adapted from Rogers 1963)

Taxonomy: This species was first described by Small in 1907 as *Cathartolinum arenicola* for plants he collected in Miami-Dade County in 1904. This treatment was consistently followed by Small (1913a, 1913b, 1933). In 1931, Winkler included *Cathartolinum* within the genus *Linum*, renaming the plants *Linum arenicola.* Others have followed this treatment, including Rogers (1963), Long and Lakela (1971), Robertson (1971), and Wunderlin (1998).

Synonyms: *Cathartolinum arenicola* Small

Distribution: *L. arenicola* was historically distributed in Monroe County in the lower Florida Keys and central and southern Miami-Dade County. In Miami-Dade County this plant has been found in many widespread stations, from the Coconut Grove area to southern Miami-Dade, close to what is now the main entrance to Everglades National Park and the Turkey Point Area. In Monroe County this species has been recorded from Big Pine Key, Ramrod Key, Sugarloaf Key, Park Key, Boca Chica Key, and Middle Torch Key.

L. arenicola is currently known in Miami-Dade County from four occurrences, extending from just south of Coconut Grove to Homestead Bayfront Park in southern Miami-Dade. In Monroe County it is extant on Big Pine and Sugarloaf keys. Populations on Ramrod, Middle Torch, and Boca Chica keys have not been surveyed recently, but could be extant.

Habitat: *L. arenicola* is found in pine rockland, marl prairie, and disturbed areas. It grows on oolitic limestone formations. The pine rockland and marl prairie where this species occurs requires periodic wildfires in order to maintain an open, shrub free subcanopy and reduce litter levels. This taxon is currently rare in relatively undisturbed natural areas, with the exception of plants on Big Pine Key and the Burger King World Headquarters. Several occurrences are in scarified pine rockland fragments that are dominated by native pine rockland species, but have little or no canopy or subcanopy. One population in Miami-Dade County occurs entirely on a levee composed of crushed oolitic limestone in the middle of a sawgrass marsh.

It is possible that this taxon was at one time more common in pine rocklands in Miami-Dade County, but a lack of periodic fires in most pine rockland fragments over the last century have pushed this species into more sunny, artificial environments.

Reproduction: Reproduction is sexual. The reproductive ecology and biology of this taxon has not been studied.

Relationship to Other Species: The pine rocklands of Big Pine Key are dominated by a single canopy tree, southern slash pine (*Pinus elliottii* var. *densa*). Understory shrubs are very common in most areas and include several palms such as Florida thatch palm (*Thrinax radiata*), Key thatch palm (*Thrinax morrisii*), and silver palm (*Coccothrinax argentata*), and several hardwoods such as locustberry (*Byrsonima lucida*), longstalked stopper (*Psidium longipes*), and smooth devilsclaws (*Pisonia rotundata*). There is also a rich herbaceous layer composed of several grasses (*Schizachyrium* spp., *Andropogon* spp.), and herbs including silver dwarf morningglory (*Evolvulus sericeus*), eyebright ayenia (*Ayenia euphrasiifolia*), scaleleaf aster (*Aster adnatus*),and sand flax (*Linum arenicola*).

The pine rocklands of the Miami Rock are characterized by a canopy of southern slash pine (*Pinus elliottii* var. *densa*), a shrub canopy of saw palmetto (*Serenoa repens*), wax myrtle (*Myrica cerifera*), poisonwood (*Metopium toxiferum*), and willow bustic (*Sideroxylon salicifolium*). Common herbaceous associates include crimson bluestem (*Schizachyrium sanguineum*), wire bluestem (*Schizachyrium gracile*), scaleleaf aster (*Aster adnatus*), and bastard copperleaf (*Acalypha chamaedrifolia*).

This taxon can grow in association with several other rare taxa, including Carter's flax (*Linum carteri* var. *carteri*), Blodgett's wild-mercury (*Argythamnia blodgettii*), wedge sandmat (*Chamaesyce deltoidea* ssp. *serpyllum*), Big Pine partridge pea (*Chamaecrista lineata* var. *keyensis*), and Mexican alvaradoa (*Alvaradoa amorphoides*).

Status and Trends: There are seven known occurrences of this taxon, four in Miami-Dade County and two in Monroe County. The estimated total population of *L. arenicola* is 10,001 to 100,000 plants. The total population is probably closer to 10,000 plants, with 1,000 to 3,000 occurring in completely artificial environments. Many of these plants are not in natural areas, occurring on roadsides or other artificial conditions. Only two occurrences actually occur in natural areas, on Big Pine Key and at the Burger King World Headquarters. The population of *L. arenicola* may be declining. See Table 1 for approximate population sizes of each occurrence.

Development, exotic pest plants, hydrologic modifications, modification to fire regime, mechanical disturbance, and herbicide usage are all threats to this taxon. Some small populations in Miami-Dade County will likely disappear because of disturbances. Two occurrences were been lost in the last four years. The large population at the Homestead Air Reserve base is severely threatened by development and may be lost unless preventative measures are taken.

L. arenicola is probably more stable on Big Pine Key. Much of the pine rockland habitat on this island is protected, either in the National Key Deer Refuge, or in The Nature Conservancy's Big Pine Key Tracts. The occurrence on Sugarloaf Key is threatened, and could be extirpated by road construction or maintenance activities.

Management and Opportunities for Recovery: The most important conservation actions for *L. arenicola* include management of plants on Big Pine Key, management of plants at Burger King World Headquarters, the reestablishment of populations in natural areas on the Miami Rock Ridge, and the restoration of suitable pine rockland habitat on the Miami Rock Ridge. The occurrence at the Burger King World Headquarters is the only one known in Miami-Dade County from a relatively undisturbed natural area. It is threatened by exotic pest plants and fire suppression and needs management.

The remaining occurrences in Miami-Dade County are in disturbed areas adjacent to pine rockland habitat, scarified pine rockland, and disturbed sites such as roadsides and canal levees. Where plants occur adjacent to pine rockland habitat, the species should be reintroduced. This

should be done at Camp Owaissa Bauer, where plants are known to have historically occurred within the pine rockland. Where *L. arenicola* occurs on scarified pine rockland the habitat should be restored. The occurrence at Homestead Air Reserve Base is an example of this.[1] The scarified pine rockland there contains a large population of *L. arenicola* as well as other native pine rockland plants. A restoration plan for this site should include elimination of mowing, outplanting of slash pine, control of exotic plants, and introduction of controlled fires. Occurrences in disturbed areas should also be maintained as a source of genetic materials. The occurrences should be protected from dumping, herbicide use, or construction activities. Important examples of this include Big Pine Key, Sugarloaf Key, and Camp Owaissa Bauer/Country Ridge Estates.

Periodic fires may be extremely important to this taxon, and the lack of fires in most forest fragments in Miami-Dade County during the last century may be a reason why this species primarily occurs in disturbed areas. All pine rocklands adjacent to occurrences of this species should be burned periodically.

The pine rockland of Miami-Dade County and the Florida Keys has evolved and adapted to frequent fires (Snyder *et al.* 1990). In two to three decades of fire suppression these areas mature into hardwood forests with a few pines in the canopy (Snyder *et al.* 1990). A fundamental question about fire ecology in pine rockland is how frequently it should burn and during what season. Snyder *et al.* (1990) inferred the historic fire 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 since fires). The minimum fire regime they found was two to three years and the maximum was 15 years. This wide range in fire frequencies would result in different forest structures and dynamics. This would lead us to believe that a mosaic of burns should be used in the management of pine rockland.

Presently, the recommended burn regime is three to seven years with summer fires generally preferred to winter. Summer fires are preferred since most 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 a step-wise fashion. In some areas it may include winter burns, or the removal of some fuel to prevent a hot fire. Any prescribed fire management should include a monitoring program to determine the effectiveness of the prescription. There should also be a component to the monitoring that captures the health of the community and species that occur in association with *L. arenicola.*

Invasive exotic species, especially Brazilian pepper and Burmareed, threaten *L. arenicola* and other rare pine rockland and rockland hammock plants. The control of exotic species in pine rockland is a very important part of habitat maintenance, although it can be very costly once exotics are established in an area. In most cases the control of exotics include the use of manual labor, herbicides, and prescribed fire. In heavily infested areas removal is 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 rockland in Miami-Dade County and the Florida Keys is complicated because most of the remaining habitat occurs in small fragmented areas bordered by urban development. Areas surrounding the managed pine rockland that contain exotic species can act as a seed source of exotics allowing them to continue to invade the pine rockland. To effectively control invasive exotics, a preemptive strategy is needed. This should include a multilingual outreach program stressing the importance of exotic control in areas surrounding managed pine rockland areas.

[1] The occurrence at Cocoplum Circle could also be restored but the property is probably far too expensive to be acquired, and fire management may not be practical.

Previous Status Surveys: Kernan and Bradley (1995) conducted a survey of this taxon in Miami-Dade County. They reported six stations at that time. Two of those stations have been extirpated since that time, and one additional station has been discovered. Ross and Ruiz (1996) developed a habitat characterization for this taxon on Big Pine Key. No comprehensive survey of all available habitats has been conducted, and with the preference of this taxon for disturbed habitats, a full survey may not be practical. Additional occurrences may eventually be discovered.

References:

Kernan, C., and K. Bradley. 1995. Conservation survey of *Linum arenicola* in Dade County, Florida. Report to the U.S. Fish and Wildlife Service.

Long, R.W., and O. Lakela. 1971. A Flora of Tropical Florida. University of Miami Press. Coral Gables, FL.

Robertson, K.R. 1971. The Linaceae in the southeastern United States. Journal of the Arnold Arboretum. 52:649-665.

Rogers, C.M. 1963. Yellow flowered species of Linum in Eastern North America. Brittonia 15:97-122.

Ross, M., and P. Ruiz. 1996. A study of the distribution of several south Florida endemic plants in the Florida Keys.

Small, J.K. 1907. Linaceae. North American Flora. Volume 25(1):67-87.

Small, J.K. 1913a. Flora of the Miami. Published by the Author. New York, NY.

Small, J.K. 1913b. Flora of the Florida Keys. Published by the Author. New York, NY.

Small, J.K. 1933. Manual of the Southeastern Flora. Published by the author. New York, N.Y.

Snyder, J.R., A. Herndon, and W.B. Robertson, Jr. 1990. South Florida rocklands. Pages 230-277 *in* R.L. Myers and J.J. Ewel, eds. Ecosystems of Florida. University of Central Florida Press; Orlando, FL.

Winkler, H. 1931. Ditaxis. In A. Engler. “Die Natürlichen Pflanzenfamilien.” Verlag. Leipzig.

Wunderlin, R.P. 1998. Guide to the Vascular Plants of Florida. University Press of Florida. Gainesville, FL.

Status Summary
Linum carteri Small var. *carteri*

Common Names: Carter's flax

Summary: *L. carteri* var. *carteri* is an erect, yellow-flowered herb in the Linaceae. This taxon is endemic to Miami-Dade County where it grows in pine rockland, particularly disturbed pine rockland. There are only nine known occurrences of this taxon, and only three of those occur on conservation lands. Two occurrences are in disturbed natural areas. Three occurrences are adjacent to natural areas. Three occurrences are in scarified pine rockland. One occurrence is in a disturbed area. This taxon is threatened by development, exotic pest plants, mountain biking, modification to fire regime, mechanical disturbance, and herbicide usage

Description: *L. carteri* var. *carteri* is an annual or short-lived perennial herb. Stems erect 23-36 cm tall, commonly branched near the base, puberulent; leaves slender, 18-26 mm long, 0.8-1.2 mm wide, entire, alternate, closely overlapping at the base of the plant, more distant above; stipules with paired dark glands; inflorescence an ascending or spreading cyme; pedicels 4.5-9 mm log in fruit; sepals lanceolate, short-awned, glandular toothed, 3-nerved; petals orange yellow, broadly obovate, 9-17 mm long, quickly deciduous; fruit straw-colored, ovoid, 4.1-4.6 mm long, 3.4-3.7 mm diameter, dehiscing into five two-seeded segments; seeds narrowly ovoid-elliptic, 2.3-2.8 mm long, 1-1.3 mm wide. (Adapted from Rogers 1963 and 1968)

In habit and flower the plant closely resembles pitted stripeseed (*Piriqueta caroliniana*) in the Turneraceae.

Taxonomy: Small (1905) named *Linum carteri* for plants collected by him in Miami-Dade County in "pinelands between Cocoanut Grove and Cutler" in 1905. Just two years later in 1907 Small put it in a segregate genus, calling it *Cathartolinum carteri.* He followed this treatment again in 1913 and 1933. In a 1963 revision of the genus in eastern North America, Rogers noted the close relationship of Florida plants to those in the Western United States and renamed the plants as a variety of *L. rigidum*. Small's concept of this taxon included both pubescent and glabrous plants, with or without stipular glands. In a 1968 study of southern Florida plants, Rogers split the taxon into two varieties, calling them *L. carteri* var. *carteri*, and segregating glabrous plants as *L. carteri* var. *smallii*. He based this division on new genetic data from Mosquin and Hayley (1967) and his own morphological data. *L. carteri* var. *carteri* was treated as endemic to Miami-Dade County, while *L. carteri* var. *smallii* was slightly more widespread in southern Florida. This treatment has been followed by Long and Lakela (1971), Robertson (1971), and Wunderlin (1998).

Synonyms: *Cathartolinum carteri* Small, *Linum rigidum* Pursh var. *carteri* (Small) Rogers

Distribution: *L. carteri* var. *carteri* is endemic to Miami-Dade County. It has been found at many widespread stations, from the Coconut Grove area (latitude ca. 25° 43.8') to southern Miami-Dade County, terminating in the vicinity of SW 280 St (latitude ca. 25° 30.4'). This is a range of approximately 24 miles.

L. carteri var. *carteri* is currently known from nine occurrences. Only three of these are on conservation lands. These stations are found nearly throughout the historic range of the species, with a distance of 17.5 miles between the farthest stations.

Habitat: *L. carteri* var. *carteri* is found in pine rocklands, particularly those that have undergone some sort of soil disturbance. It is peculiar that no populations are currently known from a completely undisturbed pine rockland. All of the known occurrences are within scarified pine rocklands, in disturbed areas adjacent to or within pine rocklands, or in completely disturbed areas. Herbarium label data indicated that this taxon once occurred in pine rocklands with sand or marl deposits. One collection was made from Brickell Hammock, but it is likely that the collection was made outside of the hammock or along a roadside.

L. carteri var. *carteri* may not be able to tolerate shading or litter accumulation, and therefore has been excluded from much of its original habitat. Most of the pine rockland in Miami-Dade County was fire suppressed for decades, and may have been forced out of these fragments. Fire has now been reintroduced to many of these fragments but plants have not yet re-colonized them.

The scarified pine rocklands where this taxon now occurs often supports a diverse assemblage of native pine rockland herbaceous and graminoid plant species. Periodic mowing in these areas may partially replace fires, maintaining an open, shrub free understory.

Reproduction: Reproduction is sexual. The reproductive ecology and biology of this taxon has not been studied.

Relationship to Other Species: The pine rocklands of Miami-Dade County are characterized by a canopy of southern slash pine (*Pinus elliottii* var. *densa*), a shrub canopy of saw palmetto (*Serenoa repens*), wax myrtle (*Myrica cerifera*), poisonwood (*Metopium toxiferum*), and willow bustic (*Sideroxylon salicifolium*). Common herbaceous associates include crimson bluestem (*Schizachyrium sanguineum*), wire bluestem (*Schizachyrium gracile*), scaleleaf aster (*Aster adnatus*), and bastard copperleaf (*Acalypha chamaedrifolia*). Disturbed areas or scarified pine rocklands where *L. carteri* var. *carteri* occurs contain a subset of the pine rockland flora, as well as a component of weedy native and exotic taxa, including beggarticks (*Bidens alba* var. *radiata*), centipedegrass (*Eremochloa ophiuroides*), ticktrefoil (*Desmodium* ssp.), and St. Augustinegrass (*Stenotaphrum secundatum*).

This taxon may grow in association with several other rare species including sand flax (*Linum arenicola*), Florida prairieclover (*Dalea carthagenensis* var. *floridana*), and Blodgett's wild-mercury (*Argythamnia blodgettii*).

Status and Trends: There are nine known occurrences of this taxon. Only three of those occur on conservation lands. The estimated total population of *L. carteri* var. *carteri* is 100-1,000 plants. The population of *L. carteri* may be declining. Only three of these occurrences are on conservation lands. One of these is threatened by impacts from mountain bikers. See Table 1 for estimated population sizes for each occurrence.

Development, exotic pest plants, mountain biking, modification to fire regime, mechanical disturbance, and herbicide usage are all threats to this taxon. Since five of the eight occurrences of this taxon do not occur on conservation lands this taxon is in severe danger. The three conservation areas where this taxon occurs contain only a few dozen plants combined. One of these occurrence was recently damaged by management crews, showing that even occurrences on conservation lands are not completely secure.

Management and Opportunities for Recovery: The most important conservation actions for *L. carteri* var. *carteri* include acquisition of privately owned stations, management of plants at U.S.D.A. Chapman Field Station, control of exotic pest plants, use of prescribed fire, and elimination of mountain biking at R. Hardy Matheson Preserve. Attempts should be made to introduce this taxon into intact pine rocklands that have an open, fire maintained understory.

Periodic fires may be extremely important to this taxon, and the lack of fires in most forest fragments in Miami-Dade County during the last century may be a reason why this taxon primarily occurs in disturbed areas. All pine rocklands adjacent to occurrences of this taxon should be burned periodically.

The pine rockland of Miami-Dade County has evolved and adapted to frequent fires (Snyder *et al*. 1990). In two to three decades of fire suppression these areas mature into hardwood forests with a few pines in the canopy (Snyder *et al.* 1990). A fundamental question about fire ecology in pine rockland is how frequently it should burn and during what season. Snyder *et al.* (1990) inferred the historic fire 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 since fires). The minimum fire regime they found was two to three years and the maximum was 15 years. This wide range in fire frequencies would result in different forest structures and dynamics. This would lead us to believe that a mosaic of burns should be used in the management of pine rockland.

Presently, the recommended burn regime is three to seven years with summer fires generally preferred to winter. Summer fires are preferred since most 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 a step-wise fashion. In some areas it may include winter burns, or the removal of some fuel to prevent a hot fire. Any prescribed fire management should include a monitoring program to determine the effectiveness of the prescription. There should also be a component to the monitoring that captures the health of the community and species that occur in association with *L. carteri* var. *carteri*.

Invasive exotic species, especially Brazilian pepper and Burmareed, threaten *L. carteri* var. *carteri* and other rare pine rockland and rockland hammock plants. The control of exotic species in pine rockland is a very important part of habitat maintenance, although it can be very costly once exotics are established in an area. In most cases the control of exotics include the use of manual labor, herbicides, and prescribed fire. In heavily infested areas removal is 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 rockland in Miami-Dade County and the Florida Keys is complicated because most of the remaining habitat occurs in small fragmented areas bordered by urban development. Areas surrounding the managed pine rockland that contain exotic species can act as a seed source of exotics allowing them to continue to invade the pine rockland. To effectively control invasive exotics, a preemptive strategy is needed. This should include a multilingual outreach program stressing the importance of exotic control in areas surrounding managed pine rockland areas.

Previous Status Surveys: Austin (1980) mapped 17 stations for this taxon. It is not clear how many of those stations were believed extant at that time. A number of those stations are now definitely destroyed. We also believe that several of those occurrences were misidentified plants of either *L. arenicola* or *L. carteri* var. *smallii*. We have not included these occurrences in Table 1. A comprehensive field survey for this species has not been conducted.

References:

Austin, D. 1980. Endangered and threatened plant species survey in southern Florida and the National Key Deer ad Great White Heron National Wildlife Refuges, Monroe County, Florida. Report submitted to the U.S. Fish and Wildlife Service, Atlanta, Georgia.

Long, R.W., and O. Lakela. 1971. A Flora of Tropical Florida. University of Miami Press. Coral Gables, FL.

Mosquin, T., and D.E. Hayley. 1967. Evolutionary relationships of the southern Florida populations of *Linum rigidum* (Linaceae). Can. Jour. Bot. 45: 1277-1283.

Robertson, 1971. The Linaceae in the southeastern United States. Journal of the Arnold Arboretum. 52:649-665.

Rogers, C.M. 1963. Yellow flowered species of Linum in Eastern North America. Brittonia 15:97-122.

Rogers, C.M. 1968. A reassessment of Linum rigidum and L. carteri (Linaceae) in Florida. Brittonia 4: 209-210.

Small, J.K. 1905. Additions to the flora of subtropical Florida. Bulletin of the New York Botanical Garden. 3(11): 419-440.

Small, J.K. 1913. Flora of the Miami. Published by the author. New York, NY.

Small, J.K. 1933. Manual of the Southeastern Flora. Published by the author. New York, NY.

Snyder, J.R., A. Herndon, and W.B. Robertson, Jr. 1990. South Florida rocklands. Pages 230-277 *in* R.L. Myers and J.J. Ewel, eds. Ecosystems of Florida. University of Central Florida Press; Orlando, FL.

Wunderlin, R.P. 1998. Guide to the Vascular Plants of Florida. University Press of Florida. Gainesville, FL.

Status Summary
Opuntia corallicola (Small) Werdermann

Common Names: Florida semaphore cactus

Summary: *O. corallicola* is an erect, trunk forming cactus (Cactaceae) with distinctive "semaphore like" branches. This species is endemic to the Florida Keys in Monroe County. Historically, this species was reported from three occurrences, Key Largo, Big Pine Key, and Little Torch Key. It is currently known from a single, very small occurrence on Little Torch Key, on a preserve owned by the Nature Conservancy. Sexual reproduction is apparently very rare, if it even occurs in the wild. Plants have only been observed to reproduce in the wild asexually. This species is severely threatened by the exotic moth *Cactoblastus cactorum*. The species is also threatened by collectors and natural disturbances such as storm events.

Description: *O. corallicola* is a shrub or tree 1-3 m (-5) m high. Trunk 0.5-2.5 m long, 7.5 cm diameter, nearly cylindrical, occasionally bearing a longitudinal blackish scar. Larger terminal joints light green, standing mostly at right angles to older joints, all somewhat flattened but relatively thick, elliptic to elongate or asymmetrical, length 2-4 times beneath, 15-27.5 (-30) cm long, 5-8.5 cm broad, 6-9 mm thick. Areoles elliptic, 1.5 mm long, typically 0.75-1.5 cm apart. Spines numerous, in all areoles (or some joints spineless), salmon to straw-colored, turning brown with age, 2 or 3 (-4) per areole, spreading or some deflexed, straight, the longer 2.5-5 (-11) cm long, basally 0.25 – 0.5 mm in diameter, acicular, nearly circular in cross section, twisted, somewhat barbed. Glochids tan or brown, abundant, 1-1.5 mm long. Leaves are small, deciduous, and scale-like. Flowers 1.2-2.5 cm in diameter, 3-7.5 mm long. Sepals green to orange-red, ovate-deltoid, mostly 3-6 mm long and broad, acute or obtuse. Petals orange-yellow, turning red with age, broadly ovate-acute or truncate and mucronate, entire. Filaments yellow, 6 mm long. Anthers yellow, 0.5 mm long. Style 6-7.5 mm long, 0.5 mm in diameter. Stigmas 5, 1.5 mm long, thick. Ovary in anthesis spiny. Fruit yellow, fleshy at maturity, spiny, often flattened, 2.5-8 cm long, 2-4 cm in diameter. Seeds few, irregular, the edges cristate, the sides hairy, 6-8 mm in diameter. (From Alcorn 1990)

Taxonomy: *O. corallicola* was first described by Small in 1930 as *Consolea corallicola.* The type specimen was collected on Big Pine Key in 1919 by Small (1921). *Consolea* is a segregate genus from the large and complex genus *Opuntia.* Some authors continue to use this segregate genus (e.g. Britton 1930, Areces-Mallea 1996). Areces-Mallea (1996) argues that *Consolea* can be easily distinguished by plant habit, seed anatomy, distinctive pollen, and floral structure. Most authors however do not accept this segregation and continue the use of *Opuntia* (Britton and Rose 1937, Adams 1972, Snow 1981, Correll and Correll 1982, Liogier 1994, Austin *et al.* 1998, Wunderlin 1998) as detailed in Austin *et al.* (1998).

O. corallicola was long thought to be synonymous with a plant of Jamaica and possibly the Cayman Islands, *O. spinosissima*. This treatment was first used by Long and Lakela (1971) and was followed by many others (Benson 1982, Alcorn 1990, Wunderlin 1998). Some behind-the-scenes controversy followed this usage. Austin *et al.* (1998) note that some botanists including Richard Howard of Harvard University and George Avery, a Miami field botanist, believed that Florida plants were actually *O. rubescens*, a plant from Hispaniola, Puerto Rico, and the Lesser Antilles.

Two studies have been responsible for "sorting out" the taxonomy of this species. Gordon and Kubisiak (1998) conducted a random amplified polymorphic DNA (RAPD) analysis of all remaining Florida plants and plants from the Caribbean. Their analysis of 42 RAPD

markers revealed that all of the Florida plants are closely related. Differences at only one to five markers were found. In contrast, Jamaican plants differed from Florida plants at 22 markers, indicating that Jamaican plants may be distinct at the species-level. In 1998 Austin *et al.* report further morphological studies of all Caribbean members of the *Consolea* group. They found that Florida plants were closely related to three taxa, *O. millspaughii* of Cuba, the Bahamas, and the Cayman Island, *O. rubescens*, and *O. spinosissima*. Florida plants were found to be distinct based on characters of areoles, pad shape, joint length, spines, petals, pericarp, and chromosome number. Florida plants are believed to be more closely related to *O. millspaughii* than to *O. spinosissima* (Austin *et al.* 1998).

As stated above, Small (1930) described this species in the genus *Consolea*, which is not generally accepted as distinct. In 1931, Werdermann (in Bakeberg) did publish a combination of the species in the genus *Opuntia*, making the Florida plants *O. corallicola* (Small) Werdermann.

Synonyms: *Consolea corallicola* Small, *Opuntia spinosissima* auct. non Miller.

Distribution: *O. corallicola* is endemic to the Florida Keys (Monroe County). Small (1930) reported it for Key Largo and Big Pine Key. The exact location of his plants on Key Largo is unknown. Small did not publish any specific location data. The population on Big Pine Key occurred in the southeastern portion of the island (Small 1921). Avery (no date) reports finding plants along Long Beach, just west southwest of the southeastern point of Big Pine Key, in the same area where Small discovered it in 1919. It was discovered on Little Torch Key sometime before 1965 by Clarence Webb and Oley Olsen (Avery no date). It has been reported that these plants were introduced based on data in Avery's notes (Alcorn 1990), but study of Avery's notes showed no indication that he believed they were introduced there.

No occurrences have been reported from Key Largo since Small's original report in 1930. In the 1960s plants were eradicated from Big Pine Key due to a combination of road building and collecting by cactus enthusiasts (Avery no date). Plants are currently known only from the southern end of Little Torch Key in the Torchwood Hammock Preserve, owned by The Nature Conservancy.

It should be noted that Snow (1981) reported *O. corallicola* (as *O. spinosissima*) as introduced in Florida, with no supporting data.

Habitat: *O. corallicola* at Torchwood Hammock Preserve occurs in a low buttonwood transition area between rockland hammock and coastal swamp. The canopy of this area is composed mostly of buttonwood (*Conocarpus erectus*), with halophytes covering the oolitic limestone substrate. The soils here are classified as Matecumbe Muck (USDA 1995).

The plants seen by Avery in the 1960's on Big Pine Key were probably growing on a coastal berm. He indicated that plants were growing in sand (in Austin 1980), and in thick humus (no date). Coastal berm still exists in this area.

Small (1930) recorded the habitat on Key Largo simply as hammocks. Small had a very broad concept of this community which included rockland hammock, coastal berm, coastal rock barren, and probably buttonwood woodland. It is unknown exactly what community it occurred in.

Studies conducted by Fairchild Tropical Garden (Kernan 1999) indicate that plants require more sun than is available in hammocks and do poorly there. Kernan reports that in an experimental planting of young plants in four habitat types, rockland hammock, buttonwood mangrove, coastal berm, and a sunny opening in a rockland hammock, plants did poorly both in the rockland hammock and buttonwood mangrove area. He suggests that plants required several habitats to reach maturity, with young plants requiring hurricane generated canopy gaps in rockland hammocks or buttonwoods, and then hurricanes dispersing pads into more mature hammocks.

Reproduction: Negrón-Ortiz (1998) studied the reproductive biology of *O. corallicola*, investigating breeding systems, pollination, and seed production. Studies were conducted both on wild plants on Little Torch Key, and cultivated plants. Negrón-Ortiz found that plants flowered throughout the year but with a peak from December to April. Only one flower visitor was observed, a species of ant *Crematogaster* aff. *ashmeadi* (Hymenoptera, Formicidae). These ants were observed feeding on pollen and passively loaded the stigmatic lobes with pollen from the same plant. This ant was probably not the pollinator of this species. Since plants were caged other pollinators probably could not reach the plants. Suggested pollinators included bees, hawkmoths, hummingbirds, and bats.

Fruit abortion was found to be high and viable seed set to be very low. In pairwise crosses no plants set seed. It was suggested that the species may be unable to reproduce sexually because of meiotic problems resulting from polyploidy. It was suggested that this species has pre-zygotic self incompatibility.

Seeds collected in the field were viable. This probably occurs due to agamospermy, so seeds are genetically the same as the parent plant. Unfortunately, no seedlings were observed in the field. All recruitment was by asexual means. Pads commonly fall to the ground and root. Negrón-Ortiz suggests that all extant plants on Little Torch Key are derived from the same lineage.

Relationship to Other Species: The single occurrence of *O. spinosissima* grows under a canopy of buttonwood. The shrub layer is composed of Florida mayten (*Maytenus phyllanthoides*), wild dilly (*Manilkara jaimiqui* ssp. *emarginata*), and manchineel (*Hippomane mancinella*). Other associates include seashore dropseed (*Sporobolus virginicus*) and erect pricklypear (*Opuntia stricta*) (Alcorn 1990).

Status and Trends: There is only one known historical occurrence of *O. corallicola*. This occurrence is located within the Torchwood Hammock Preserve on Little Torch Key. Reintroduction efforts are underway at two sites by Fairchild Tropical Garden, one on Key Largo and one on Big Pine Key. An introduction is also underway on Saddlebunch Key by Peter Styling of The University of South Florida. Conrad Byrd attempted to introduce plants into a coastal rock barren on Long Key in the late 1960's (Avery no date). This introduction apparently failed.

The Little Torch occurrence is currently represented by only ten mature individuals. One of these mature plants is probably dying. Dozens of small clones exist underneath these mature plants (C. Bergh personal communication 1999).

The exotic moth *Cactoblastus cactorum* has become a great threat to this occurrence. This moth is native to Argentina, Uruguay, and Paraguay, and has been introduced into Australia, Hawaii, Montserrat, Antigua, and Grand Cayman to control *Opuntia* species (Pemberton 1995). It has spread from introduction points to other areas, including Puerto Rico, Haiti, the Dominican Republic, and the Bahamas (Pemberton 1995). It was discovered in the United States for the first time in 1989 by Carol Lippincott in the Florida Keys (Habeck and Bennett 1990). Pemberton (1995) argues that it was probably introduced somewhere into southeastern Florida with nursery imports, and then spread. This moth has recently infested two plants an Little Torch Key causing one plant to lose some pads.

Management and Opportunities for Recovery: Several agencies are actively involved in the management and recovery of this species. The Nature Conservancy, which owns the preserve containing the single occurrence of this species, has been extremely active for some time. Most of the plants at the Torchwood Hammock Preserve were caged to prevent infestation by *Cactoblastus cactorum*. These cages were removed right before Hurricane Georges passed over the lower Florida Keys in 1998. The cages have not been replaced, but The Nature Conservancy

has recruited volunteers to monitor plants weekly in order to detect early infestations from the moth.

This moth is probably the greatest threat to this species. Continued monitoring of the Little Torch Key occurrence will be necessary for some time. The Nature Conservancy may place cages on the plants again (C. Bergh 1999). Control of this moth will prove to be very difficult, if not impossible. Large infestations exist on Big Pine Key on cultivated cactus species. These cultivated species will provide a constant food source for the moth and will keep the population size of the moth high. Control of moths on cultivated cacti, including destruction of the plants, should be attempted where possible.

Two reintroductions are underway. These are being conducted by Fairchild Tropical Garden on Big Pine Key and Key Largo. An introduction is also underway on Saddlebunch Key by Peter Styling of The University of South Florida.

Exotic pest plants are a threat to all upland habitats in the Florida Keys. The exotic plants which pose the greatest threat to *O. corallicola* habitat are Brazilian pepper *(Schinus terebinthifolius*) and latherleaf (*Colubrina asiatica*). Populations of these taxa in the vicinity of *O. corallicola* should be controlled immediately.

Previous Status Surveys: No formal survey of *O. corallicola* has been conducted. Regardless, the uplands of the Florida Keys have been well explored by botanists. Two excellent reports on rockland hammock of the Florida Keys are Weiner (1979) and Kruer (1992). It is unlikely, but possible, that new occurrences will be discovered.

References:

Adams, R. 1972. Flowering Plants of Jamaica. Univ. of the West Indies, Mona.

Alcorn, P.W. 1990. Element stewardship abstract for *Opuntia spinosissima.* Florida semaphore cactus. The Nature Conservancy, Arlington, VA.

Areces-Mallea, A.E. 1996. New taxa of Consolea Lemaire (Cactaceae: Opuntioideaea) from Cuba. Brittonia 48(2): 224-236.

Austin, D.F., D.M. Binninger, and D.J. Pinkava. 1998. Uniqueness of the endangered Florida semaphore cactus (*Opuntia corallicola*). Sida 18(2) 527-534.

Avery, G.N. No Date. Unpublished field notes.

Bakeberg, C. 1931. Neue Kakteen, Jagden, Arten, Kultur. Gartenbau-Verlag Trowitzsch and Shon. Frankfurt (Oder)-Berlin.

Benson, L. 1982. The Cacti of the United States and Canada. Stanford University Press, Stanford, CA.

Bergh, C. 1999. Personal Communication. The Nature Conservancy. 201 Front Street, Suite 222. Key West, FL.

Britton, N.L. 1930. The native Cactaceae of Puerto Rico and the Virgin Islands. Cact. & Succ. J. 1(12):226-231.

Britton, N.L., and J.N. Rose. 1937. The Cactaceae. Descriptions and Illustrations of Plants of the Cactus Family. Dover Publ. Inc., New York, NY.

Correll, D.S., and H.B. Correll. 1982. Flora of the Bahama Archipelago. Cramer, Vaduz.

Gordon, D.R., and T.L. Kubisiak. 1998. RAPD analysis of the last population of a likely Florida Keys endemic cactus. Florida Sci. 61:203-210.

Habeck, D.H., and F.D. Bennett. 1990. *Cactoblastus cactorum* Berg (Lepidoptera: Pyralidae), a phyticine new to Floida. Fla. Dep. Agric. Consum. Serv., Div. Plant Ind. Entom. Circ. 333.

Kernan, C. 1999. Identifying the semaphore cactus' original habitat. Solving an ecological mystery. Fairchild Tropical Garden - Garden News. July issue.

Kruer, C.R. 1992. An assessment of Florida's remaining coastal upland natural communities: Florida Keys. Unpublished report prepared for Florida Natural Areas Inventory; Tallahassee, FL.

Liogier, H.A. 1994. Descriptive Flora of Puerto Rico and Adjacent Islands. Volumen III. University of Puerto Rico, Rio Piedras, PR.

Long, R., and O. Lakela. 1971. A Flora of Tropical Florida. University of Miami Press, Coral Gables, FL.

Negrón-Ortiz, V. 1998. Reproductive biology of a rare cactus, *Opuntia spinosissima* (Cactaceae), in the Florida Keys: why is seed set very low? Sexual Pl. Reprod. 11:208-212.

Pemberton, R.W. 1995. *Cactoblastus cactorum* (Lepidoptera: Pyralidae) in the United States: An immigrant biological control agent or an introduction to the nursery industry? Amer. Entom. 41: 230-232.

Small, J.K. 1921. Old Trails and New Discoveries. Journal of the New York Botanical Garden vol. XXII, no. 255, pp 49-64.

Small, J.K. 1930. *Consolea corallicola*, Florida semaphore cactus. Addisonia 15:25-26, pl. 493.

Snow, B.L. 1981. A history of the Cactaceae of the southeastern United States. Cact. & Succ. Journal 53: 177-182.

Weiner, A. 1979. The Hardwood Hammocks of the Florida Keys: An Ecological Study. National Audubon Society and the Florida Keys Land Trust. 25 pp. + apps.

Wunderlin, R.P. 1998. Guide to the Vascular Plants of Florida. University Press of Florida. Gainesville, FL.

Table 1: *Argythamnia blodgettii*

Extant Occurrences

Site	Owner	County	Population Size	Threats	Habitat
Boot Key	Private	Monroe	11-100	Development	Coastal berm along edge of dirt road
Camp Owaissa Bauer	Miami-Dade County	Miami-Dade	101-1,000	Fire suppression, exotic pest plants	Pine rockland and road edges
Castellow Hammock	Miami-Dade County	Miami-Dade	11-100	Fire suppression, exotic pest plants	Pine rockland
Charles Deering Estate	Miami-Dade County	Miami-Dade	11-100	Fire suppression, exotic pest plants, fenceline maintenance	Edge of pine rockland
Country Ridge Estates	Private	Miami-Dade	11-100	Exotic pest plants	Pine rockland and road edges
Epmore Drive Pineland Fragment	Private	Miami-Dade	2-10	Development, exotic pest plants	Pine rockland
Everglades National Park, Deer Hammock Area	National Park Service	Miami-Dade	101-1000	Exotic pest plants	Pine rockland
Gifford Arboretum Pineland	Private	Miami-Dade	2-10	Development, exotic pest plants	Scarified pine rockland
Larry & Penny Thompson Park & adjacent properties	Miami-Dade County	Miami-Dade	1,001-10,000	Development, fire suppression, exotic pest plants	Pine rockland and road edges
Lignumvitae Key State Botanical Site	Dept. Environmental Protection	Monroe	11-100	Maintenance activities, exotic pest plants	Rockland hammock edge
National Key Deer Refuge	U.S. Fish & Wildlife Service	Monroe	101-1,000	Fire suppression, exotic pest plants	Pine rockland, rockland hammock edge, and road edges
Ned Glenn Nature Preserve	Miami-Dade County	Miami-Dade	11-100	Fire suppression, exotic pest plants	Pine rockland
NFC #317	Private	Miami-Dade	2-10	Development, fire suppression, exotic pest plants	Pine rockland
Old Dixie Pineland (=Keg South Pineland)	Private	Miami-Dade	11-100	Development, fire suppression, exotic pest plants	Pine rockland and road edges
Owaissa Bauer Addition	Miami-Dade County	Miami-Dade	11-100	Fire suppression, exotic pest plants	Pine rockland
Pine Ridge Sanctuary	Private Preserve	Miami-Dade	2-10	Exotic pest plants	Pine rockland
S.W. 184 St. & 83 Ave.	Private	Miami-Dade	11-100	Development, fire suppression, exotic pest plants	Scarified pine rockland
Windley Key Fossil Reef State Geological Site	Florida	Monroe	11-100	Maintenance activities, exotic pest plants	Rockland hammock edge and disturbed areas

Extirpated Occurrences

Site	Owner	County	Last Observation	Cause	Habitat
Brickell Hammock	Unknown	Miami-Dade	1937	Developed	Rockland hammock or pine rockland
Caribbean Park	Miami-Dade County	Miami-Dade	1998	Developed	Pine rockland
Coconut Grove	Unknown	Miami-Dade	1901	Developed	Pine rockland
Coral Gables Area	Unknown	Miami-Dade	1967	Developed	Pine rockland
Fuchs Hammock	Miami-Dade County	Miami-Dade	1991	Developed, fire suppression	Pine rockland or rockland hammock
Key West	Unknown	Monroe	1965	Developed	Rockland hammock
Key West Cemetary	Private?	Monroe	1965	Unknown	Rockland hammock
Miller & 72 Ave.	Unknown	Miami-Dade	1975	Developed	Pine rockland
North Key Largo	Unknown	Monroe	1977	Unknown	Rockland hammock
Orchid Jungle	Miami-Dade County	Miami-Dade	1930	Unknown (development, fire suppression and exotic pest plants likely)	Rockland hammock
Palms Woodlawn Cemetery	Private	Miami-Dade	1992	Developed	Pine rockland
S. of Miami River	Unknown	Miami-Dade	1913	Developed	Unknown
Stock Island	Private?	Monroe	1981	Developed	Rockland hammock
Totten Key (Biscayne National Park)	National Park Service	Miami-Dade	1904	Unknown	Rockland hammock
Vaca Key	Unknown	Monroe	1909	Developed	Rockland hammock

Indefinite Occurrences

Site	County	Last Observation	Habitat
Between Coconut Grove and Cutler	Miami-Dade	1904	Pine rockland
Between Cutler and Longview Camp	Miami-Dade	1903	Pine rockland

Table 2: *Brickellia mosieri*

Extant Occurrences

Site	Owner	County	Population Size	Threats	Habitat
Camp Choee	Private	Miami-Dade	11-100	Fire suppression, exotic pest plants, development	Pine rockland
Camp Owaissa Bauer	Miami-Dade County	Miami-Dade	11-100	Fire suppression, exotic pest plants	Pine rockland
Larry & Penny Thompson Park & Adjacent Properties	Miami-Dade County, in part	Miami-Dade	1,001-10,000	Fire suppression, exotic pest plants, development	Pine rockland
Navy Wells	Miami-Dade County	Miami-Dade	101-1,000	Fire suppression, exotic pest plants	Pine rockland
NFC #295	Private	Miami-Dade	11-100	Development, fire suppression, exotic pest plants	Pine rockland
Panther Pineland	Private	Miami-Dade	11-100	Development, fire suppression, exotic pest plants	Pine rockland
Pine Shore Park	Miami-Dade County	Miami-Dade	2-10	Fire suppression, exotic pest plants	Pine rockland
Rockdale	Miami-Dade County	Miami-Dade	11-100	Fire suppression, exotic pest plants	Pine rockland
Ron Ehman Park	Miami-Dade County	Miami-Dade	11-100	Fire suppression, exotic pest plants	Pine rockland
Seminole Wayside Park	Miami-Dade County	Miami-Dade	11-100	Fire suppression, exotic pest plants	Pine rockland
Tamiami Pinelands	Miami-Dade County	Miami-Dade	10-100	Fire suppression, exotic pest plants	Pine rockland
Turnpike Extension and 93rd Terrace	Private	Miami-Dade	1	Development, fire suppression, exotic pest plants	Pine rockland
West Biscayne Pineland	Miami-Dade County	Miami-Dade	10-100	Fire suppression, exotic pest plants	Pine rockland

Extirpated Occurrences

Site	Owner	County	Last Observation	Cause	Habitat
Palms Woodlawn Cemetery	Private	Miami-Dade	1992	Developed	Pine rockland
Sunset Dr. & 71 Ct.	Private	Miami-Dade	1968	Developed	Pine rockland

Status Undetermined (not seen by authors)

Site	Owner	County	Last Observation	Habitat
SW 112 Ave. & 173 St.	Private	Miami-Dade	Unknown	Pine rockland
SW 172 St. & 177 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 184 St. & 112 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 184 St. & 147 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 204 St. & 127 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 204 St. & 153 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 208 St. & 137 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 208 St. & 145 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 244 St. & 164 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 260 St. & 182 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 280 St. & 194 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 288 St. & 167 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 288 St. & 190 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 290 St. & 162 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 294 St. & 172 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 296 St. & 207 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 300 St. & 203 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 302 St. & 180 Ave.	Private	Miami-Dade	1980	Pine rockland
SW 308 St. & 187 Ave.	Private	Miami-Dade	1963	Pine rockland
SW 322 St. & 199 Ave.	Private	Miami-Dade	Unknown	Pine rockland
SW 334 St. & 192 Ave.	Private	Miami-Dade	Unknown	Pine rockland

Table 3: *Chamaecrista lineata* var. *keyensis*

Extant Occurrences

Site	Owner	County	Population Size	Threats	Habitat
National Key Deer Refuge	U.S. Fish & Wildlife Service, in part	Monroe	1,000-10,000	Development, fire suppression, sea level rise, exotic pest plants	Pine rockland

Extirpated

Site	Owner	County	Last Observation	Cause	Habitat
Cudjoe Key	Private	Monroe	1977	Unknown	Pine rockland
No Name Key	Unknown	Monroe	1895	Unknown	Pine rockland
Ramrod Key	Unknown	Monroe	1911	Unknown	Pine rockland

Table 4: *Chamaesyce deltoidea* ssp. *pinetorum*

Extant Occurrences

Site	Owner	County	Population Size	Threats	Habitat
Everglades National Park	National Park Service	Miami-Dade	10,000-100,000	Hydrologic changes, exotic pest plants, fire suppression	Pine rockland
Florida City Pineland	Miami-Dade County	Miami-Dade	100-1,000	Exotic pest plants, fire suppression	Pine rockland
Navy Wells	Miami-Dade County	Miami-Dade	1,000-10,000	Exotic pest plants, fire suppression	Pine rockland
Navy Wells #2	Private	Miami-Dade	1,000-10,000	Exotic pest plants, development, fire suppression	Pine rockland
Palm Drive Pineland	Miami-Dade County	Miami-Dade	10-100	Exotic pest plants, fire suppression	Pine rockland
Pine Ridge Sanctuary	Private Preserve	Miami-Dade	10-100	Exotic pest plants, fire suppression	Pine rockland
Rock Pit #39	Miami-Dade County	Miami-Dade	100-1,000	Exotic pest plants, fire suppression	Pine rockland
Seminole Wayside Park	Miami-Dade County	Miami-Dade	100-1,000	Exotic pest plants, fire suppression	Pine rockland

Status Undetermined (not seen by authors)

Site	Owner	County	Last Observation	Habitat
Kings Hwy. 0.5 miles west of 162 Ave.	Private	Miami-Dade	1979	Pine rockland
SW 296 St. & 207 Ave.	Private	Miami-Dade	1985	Pine rockland
SW 300 St. & 197 Ave.	Private	Miami-Dade	1980	Pine rockland
SW 302 St. & 197 Ave.	Private	Miami-Dade	1982	Pine rockland
SW 334 St. & 194 Ave.	Private	Miami-Dade	1985	Pine rockland
SW 340 St. & 183 Ave.	Private	Miami-Dade	1980	Pine rockland
SW 340 St. & 216 Ave.	Private	Miami-Dade	1980	Pine rockland

Indefinite Occurrences

Site	County	Last Observation	Habitat
Between Cutler and Longview Camp	Miami-Dade	1903	Pine rockland
Between Cutler and Longview Camp	Miami-Dade	1904	Pine rockland
Between Homestead and Camp Jackson	Miami-Dade	1904	Pine rockland
Between Long Prairie and Camp Longview	Miami-Dade	1906	Pine rockland
Camp Jackson to Camp Longview	Miami-Dade	1911	Pine rockland
Homestead to Big Hammock Prairie	Miami-Dade	1911	Pine rockland
Pinelands about Nixon-Lewis Hammock	Miami-Dade	1915	Pine rockland
Pinelands about Ross Hamock	Miami-Dade	1915	Pine rockland
Pinelands about Sykes Hammock	Miami-Dade	1915	Pine rockland
Pinelands near Camp Longview	Miami-Dade	1904	Pine rockland
Pinelands near Long Prairie	Miami-Dade	1904	Pine rockland
Pinelands near Nelson Hammock	Miami-Dade	1915	Pine rockland

Possibly Erroneous

Site	County	Last Observation
Sw 248 St. & 187 Ave.	Miami-Dade	1963

Table 5: *Chromolaena frustrata*

Extant Occurrences

Site	Owner	County	Population Size	Threats	Habitat
Everglades National Park	National Park Serice	Miami-Dade, Monroe	Unknown	Exotic pest plants	Coastal berm
Lignumvitae Key State Botanical Site	Dept. of Environmental Protection	Monroe	10-100	Exotic pest plants, trail maintenance	Rockland hammock
Long Key Layton Coastal Rock Barren	Private	Monroe	100-1,000	Exotic pest plants, development	Coastal rock barren
Long Key State Recreation Area	Dept. of Environmental Protection	Monroe	100-1,000	Exotic pest plants	Coastal rock barren
Upper Matecumbe Key	Private	Monroe	10-100	Exotic pest plants, development	Rockland hammock

Extirpated Occurrences

Site	Owner	County	Last Observation	Cause	Habitat
Big Pine Key	Unknown	Monroe	1955	Unknown	Probably rockland hammock
Boca Grande Key	U.S. Fish & Wildlife Service	Monroe	1940	Unknown	Probably rockland hammock
Islamorada	Unknown	Monroe	1968	Probably development	Probably rockland hammock
Key Largo	Unknown	Monroe	1930	Unknown	Probably rockland hammock
Knight's Key	Unknown	Monroe	1979	Development	Probably rockland hammock or coastal rock barren
Lower Matecumbe Key	Unknown	Monroe	1930	Probably development	Probably rockland hammock
Turner River Hammock	Unknown	Monroe	1930's or 1940's	Unknown	Coastal berm or shell mound

Table 6: *Dalea carthagenensis* var. *floridana*

Extant Occurrences

Site	Owner	County	Population Size	Threats	Habitat
Big Cypress National Preserve, Florida Trail	National Park Service	Collier	11-100	Off-road vehicles, fire suppression, exotic pest plants	Edges of dirt road adjacent to rockland hammock and marl prairie
Big Cypress National Preserve, Pinecrest	National Park Service	Monroe	11-100	Off-road vehicles, fire suppression, exotic pest plants	Roadside adjacent to pine rockland and marl prairie
Charles Deering Estate , north of Addison Hammock	Miami-Dade County	Miami-Dade	11-100	Fire suppression, exotic pest plants	Ecotone between pine rockland and rockland hammock and pine rockland
Charles Deering Estate, south of Addison Hammock	Miami-Dade County	Miami-Dade	2-10	Fire suppression, exotic pest plants	Pine rockland
R. Hardy Matheson Preserve	Miami-Dade County	Miami-Dade	11-100	Fire suppression, mountain biking, exotic pest plants	Disturbed pine rockland

Extirpated Occurrences

Site	Owner	County	Last Observation	Cause	Habitat
Castellow Hammock Environmental Education Center	Miam-Dade County	Miami-Dade	1975	Fire suppression, exotic pest plants	Edge of rockland Hammock
Coral Gables area	Private	Miami-Dade	1967	Development	Pine rockland
Cox Hammock	Private	Miami-Dade	1930	Development, fire suppression, exotic pest plants	Rockland hammock or edge of rockland hammock
Crandon Park	Miami-Dade County	Miami-Dade	1966	Unknown	Coastal uplands
Everglades National Park	National Park Service	Miami-Dade	1964	Unknown	Unknown
Palm Beach Area	Private	Palm Beach	1918	Development	Coastal uplands

Indefinite Occurrences

Site	County	Last Observation	Habitat
Between Cutler and Longview Camp	Miami-Dade	1903	Pine rockland
Miami	Miami-Dade	1877	Pine rockland
Pinelands between Miami and Coconut Grove	Miami-Dade	1912	Pine rockland
Pinelands south of Miami River	Miami-Dade	1912	Unknown

Table 7: *Digitaria pauciflora*

Extant Occurrences

Site	Owner	County	Population Size	Threats	Habitat
Everglades National Park	National Park Service	Miami-Dade	1,000-10,000	Fire suppression, exotic pest plants, hydrologic changes	Uncommon in marl prairies and pine rockland

Extirpated Occurrences

Site	Owner	County	Last Observation	Cause	Habitat
Luis Martinex Army Reserve Station	U.S. Army Reserve	Miami-Dade	1997	Decreased hydroperiod	Marl prairie

Indefinite Occurrences

Site	County	Last Observation	Habitat
Between Cutler and Longview Camp	Miami-Dade	1903	Pine rockland
Jenkins Homestead	Miami-Dade	Unknown	Unknown
South Miami	Miami-Dade	1939	Pine rockland

Table 8: *Indigofera mucronata* var. *keyensis*

Extant Occurrences

Site	Owner	County	Population Size	Threats	Habitat
Crawl Key: Valhalla Rock Barren	Private	Monroe	100-1,000	Development, exotic pest plants	Coastal rock barren
John Pennekamp Coral Reef State Park	Dept. of Environmental Protection	Monroe	2-10	Storm surges, exotic pest plants	Disturbed coastal berm
Long Key State Recreation Area	Dept. of Environmental Protection	Monroe	100-1,000	Exotic pest plants	Coastal rock barren
Long Point Key	Private	Monroe	2-10	Development, exotic pest plants	Buttonwood woodland
Plantation Key	Private	Monroe	11-100	Development, exotic pest plants	Edge of rockland hammock
Windley Key Fossil Reef State Geological Site	Dept. of Environmental Protection	Monroe	2-10	Storm surges, exotic pest plants, shading by hardwoods, sea-level rise	Coastal rock barren

Extirpated Occurrences

Site	Owner	County	Last Observation	Cause	Habitat
Craig Key	Private	Monroe	1965	Unknown, possibly reported in error	Unknown
Knight's Key	Private	Monroe	1909	Development	Rockland hammock or coastal rock barren
Lignumvitae Key	Florida	Monroe	ca. 1840's	Unknown, possibly construction of a landing strip in 1947 or 1948	Rockland hammock or coastal rock barren
Lower Matecumbe Key	Private	Monroe	1988	Development	Rockland hammock or coastal rock barren
Upper Matecumbe Key	Private	Monroe	1982	Development	Rockland hammock
Vaca Key	Private	Monroe	1964	Development	Rockland hammock or coastal rock barren

Table 9: *Linum arenicola*

Extant Occurrences

Site	Owner	County	Population Size	Threats	Habitat
Big Pine Key	U.S. Fish & Wildlife Service, in part	Monroe	1,001-10,000	Development, fire suppression	In pine rockland and roadsides
Burger King World Headquarters	Private	Miami-Dade	11-100	Development, fire suppression, exotic pest plants	At edge of Miami Rock Ridge in pine rockland
Cocoplum Development	Private	Miami-Dade	11-100	Development	At edge of Miami Rock Ridge in scarified pine rockland
Country Ridge Estates/Camp Owaissa Bauer	Private/Miami-Dade County	Miami-Dade	11-100	Development	Edge of road adjacent to pine rockland
Homestead Air Reserve Base	U.S. Air Force	Miami-Dade	101-1,000	Development	Scarified pine rockland
Homestead Bayfront Park	Miami-Dade County	Miami-Dade	101-1,000	Road clearing or other maintenance	On edges of canal levee
Sugarloaf Key	Dept. of Transportation	Monroe	11-100	Road clearing or other maintenance	On road right-of-way

Extirpated Occurrences

Site	Owner	County	Last Observation	Cause	Habitat
Allapatah Linum Site	Private	Miami-Dade	1996	Land clearing	Marl prairie
Boca Chica	Federal	Monroe	1912	Unknown	Unknown
Camp Jackson Area	Unknown	Miami-Dade	1907	Unknown	Pine rockland
Camp Owaissa Bauer	Miami-Dade County	Miami-Dade	1983	Fire suppression	Pine rockland
Cemetary Pineland	Private	Miami-Dade	1996	Property scarified, may regenerate	Scarified pine rockland
East of Naranja	Unknown	Miami-Dade	1907	Unknown	Pine rockland
Homestead ot Camp Jackson	Unknown	Miami-Dade	1907	Unknown	Pine rockland
Homestead to Big Hammock Prairie	Unknown	Miami-Dade	1911	Unknown	Pine rockland
Middle Torch Key	Unknown	Monroe	1979	Unknown	Roadside
Park Key	Unknown	Monroe	1961	Unknown	Roadside
Ramrod Key	Unknown	Monroe	1979	Unknown	Roadside

Table 10: *Linum carteri* var. *carteri*

Extant Occurrences

Site	Owner	County	Population Size	Threats	Habitat
Cocoplum Development	Private	Miami-Dade	11-100	Development	In scarified pine rockland
Gifford Arboretum Pineland	Private	Miami-Dade	11-100	Development	In scarified pine rockland
Homestead Air Reserve Base	U.S. Air Force	Miami-Dade	11-100	Development, exotic pest plants	Canal bank
Old Dixie Pineland (=Keg South Pineland)	Private	Miami-Dade	11-100	Development, exotic pest plants	Along edges of FEC railway tracks, adjacent to pine rockland
Owaissa Bauer Addition	Miami-Dade County	Miami-Dade	2-10	Fire suppression, exotic pest plants	In scarified pine rockland
Ponce and Riviera Pineland	Private	Miami-Dade	11-100	Development	In scarified pine rockland
R. Hardy Matheson Preserve North Of Snapper Creek	Miami-Dade County	Miami-Dade	11-100	Mountain biking, fire suppression, exotic pest plants	In disturbed pine rockland
Rockdale	Miami-Dade County	Miami-Dade	11-100	Poor management	In scarified pine rockland
USDA Subtropical Horticulture Research Station	U.S. Dept. of Agriculture	Miami-Dade	11-100	Development, exotic pest plants	Edge of pine rockland

Extirpated Occurrences

Site	Owner	County	Last Observation	Cause	Habitat
Brickell Hammock	Unknown	Miami-Dade	1911	Development	Unknown
Charles Deering Estate	Miami-Dade County	Miami-Dade	1992	Unknown	Scarified pine rockland
Red Rd. and 114 Terr.	Private	Miami-Dade	1969	Development	Pine rockland

Indefinite Occurrences

Site	County	Last Observation	Habitat
Between Coconut Grove and Cutler	Miami-Dade	1903	Pine rockland
Goulds	Miami-Dade	1930	Pine rockland
Pinelands west of Miami	Miami-Dade	1911	Pine rockland

Table 11: *Opuntia corallicola*

Extant Occurrences

Site	Owner	County	Population Size	Threats	Habitat
Torchwood Hammock Preserve	The Nature Conservancy	Monroe	13	Exotic moth (*Cactoblastis cactorum),* collecting, storms	Plants grow in a low buttonwood forest

Extirpated Occurrences

Site	Owner	County	Last Observation	Cause	Notes
Big Pine Key	Unknown	Monroe	1964	Development and road building	A reintroduction attempt is underway in several habitats
Key Largo	Unknown	Monroe	Unknown	Unknown	A reintroduction attempt is underway in several habitats