
Garber's Spurge

Chamaesyce garberi (Engelman ex Chapman) Small

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

Figure 1. County distribution of Garber's spurge.



Garber's spurge is a short-lived, perennial herb belonging to the Euphorbiaceae or spurge family. This species is known from pine rocklands, coastal flats, coastal grasslands, and beach ridges in Miami-Dade and Monroe counties, Florida. It requires open sunny areas and needs periodic fires to maintain habitat suitability, although this has not yet been verified by studies. It is found throughout its historic range and is abundant in some areas, but the populations are relatively disjunct. Habitat loss and exotic plant invasion threaten its recovery.

This account represents a revision of the existing recovery plan for the Garber's spurge (FWS 1988).

Description

Garber's spurge is a prostrate to erect herb with pubescent stems. The leaves are ovate in shape and 4 to 9 mm long, with entire or obscurely serrate leaf margins. The cyathia are about 1.5 mm long and borne singly at the leaf axils. The appendages are minute or completely absent. The fruit is a pubescent capsule 1.5 mm wide. The seeds either are smooth or have transverse ridges, but are not wrinkled; this is not, however, a distinctive character for this species.

Taxonomy

Garber's spurge was first described by Engelman as *Euphorbia garberi* Engelman in 1883 (Engelman *in* Chapman 1883). In 1903, Small transferred it to the genus *Chamaesyce* (Small 1903), a natural genus distinguished from *Euphorbia* by having the main stem abortive just above the cotyledons, making the aerial portion of *Chamaesyce* homologous to the inflorescence of *Euphorbia* subgenus *Esula* (Webster 1967). Herndon (1989, 1993) includes *Chamaesyce porteri* Small var. *keyensis* Small within *C. garberi*, citing that the erect growth form of *C. porteri* var. *keyensis* was within the range of variation for *C. garberi*. Herndon also notes that

three somewhat distinct forms of Garber's spurge occur, although these have never been described and may be simple morphological variations (A. Herndon, personal communication 1998).

Synonyms: *Euphorbia garberi* Engelman ex Chapman; *Chamaesyce porteriana* Small var. *keyensis* (Small) Burch; *C. acidoides* Small; *C. brachypoda* Small; *C. mosieri* Small.

Distribution

Garber's spurge is endemic to South Florida (Figure 1). It is abundant on Cape Sable and is probably found throughout the Keys in small numbers. Historically, it occurred from Perrine, Miami-Dade County, west to Cape Sable, Monroe County, and to the Sand Keys west of Key West, Monroe County (Small 1933, Long and Lakela 1971).

Habitat

Garber's spurge occurs at low elevations either on thin sandy soils composed largely of Pamlico sands or directly on limestone. It is found in a variety of open to moderately shaded habitat types. In pine rocklands, it grows out of crevices in oolitic limestone. On Cape Sable, Everglades NP, it has been reported from hammock edges, open grassy prairies, and backdune swales. In the Florida Keys, it grows on semi-exposed limestone shores, open calcareous salt flats, pine rocklands, calcareous sands of beach ridges, and along disturbed roadsides.

Reproduction

Reproductive ecology in *Chamaesyce* 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). The seed capsules of many *Euphorbiaceae* are explosively dehiscent, ejecting seeds a short distance from the parent plant. Some seeds are dispersed by ants (Pemberton 1988).

Relationship to Other Species

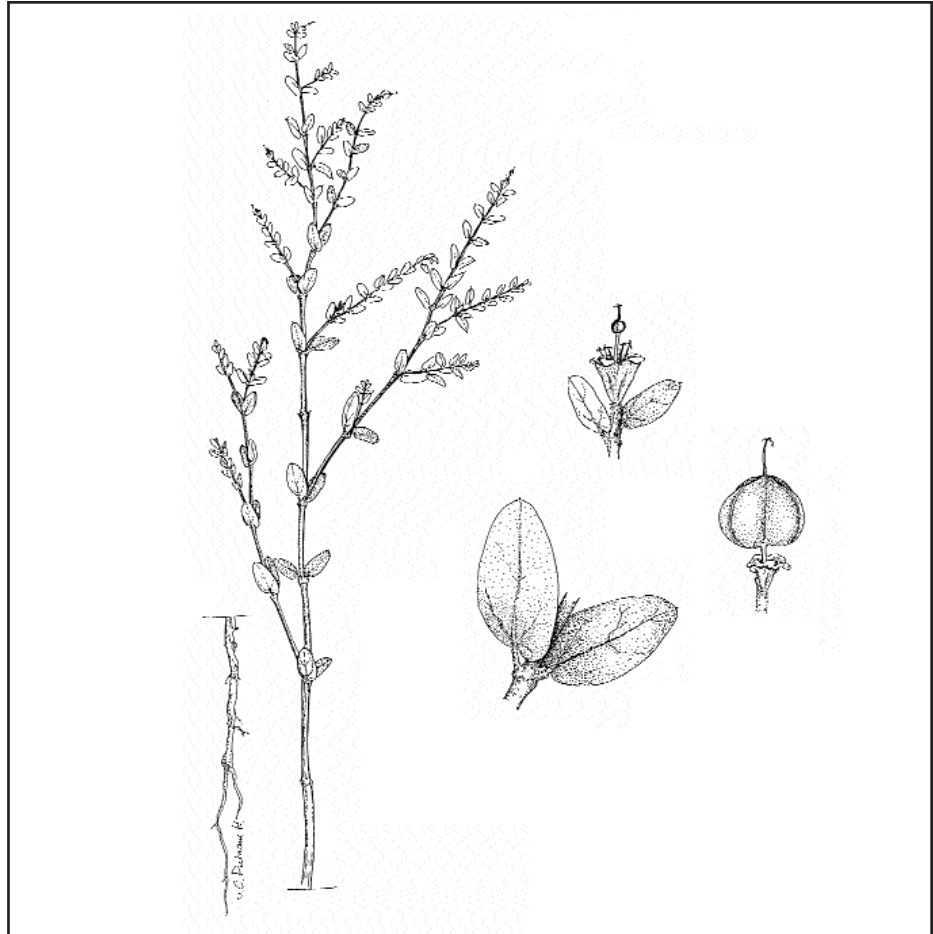
Garber's spurge occurs in association with *Randia aculeata*, *Lantana involucrata*, *Sideroxylon salicifolium*, and *Brysonima lucida* and many more scrub understory species. Relationships to pollinators and seed dispersers are not known.

Status and Trends

Garber's spurge was listed in 1985 because of habitat loss from increased residential and commercial development (50 CFR 29349). A complete status survey has not been performed for Garber's spurge since 1980. In the status survey Austin *et al.* (1981) found five sites; three on Cape Sable (Everglades NP), one on Long Pine Key (Everglades NP), and one on Big Pine Key. Only the Long Pine Key site has been resurveyed, and it was found to contain approximately 150

Garber's spurge.

Original drawing by Ann Murray.



plants (DERM 1994). Cape Sable, in Everglades NP, has an invasive exotics problem that the Park has not, until recently, been able to address (D. Jones, Everglades National Park, personal communication 1997a). The extent of the exotic plant cover was partially assessed in 1996 (Seavey *et al.* 1996). The Park began an exotics control program in 1997. The status of the three Garber's spurge populations on the Cape is not known. A new population was found in 1988 at the Charles Deering Estate, Miami-Dade County, after a burn. It had 250 to 500 plants in 1991, but the population size appears to be getting smaller (K. Bradley, Institute for Regional Conservation, personal communication 1996). Since Herndon's (1993) inclusion of *C. porteri* var. *keyensis* under Garber's spurge, two other sites have been added, Bahia Honda State Park and Long Key SRA. The population sizes and trends at these sites are unknown.

Habitat for the Garber's spurge has been lost to development, fire suppression, and invasive exotics. In addition, the remaining habitat is relatively fragmented and most populations are small. These small, disjunct populations are more susceptible to extirpation from a single disturbance, natural or manmade, without the chance of recruitment from a nearby population. Fire suppression and the invasion of exotic plants can result in over-shading of the understory, reducing the quality of the habitat. Over time this could lead to the extirpation of Garber's spurge at these sites.

Management

Garber's spurge occurs in a few protected areas where it is being managed. The National Key Deer Refuge uses prescribed fire to manage pineland habitats on the refuge. The main focus of their management is for the key deer, but it may benefit Garber's spurge. In Everglades NP, fire is used as a management tool in pine rocklands. However, management at Cape Sable has been limited by the available manpower and funding.

Garber's spurge occurs in a variety of habitats in the Florida Keys and Miami-Dade County and will require management practices specific to each habitat. Although there are differences between the habitats, they are all early successional and require some type of disturbance (*i.e.* fire or wash over). The habitats in the Florida Keys have a slower growth rate than similar habitats in Miami-Dade County and require less frequent disturbance.

Presently, many of the publicly owned lands in the Florida Keys and Everglades NP use prescribed fire as a management tool. Fire management in Everglades NP has shifted to an early wet season burn schedule (D. Jones Everglades NP, personal communication 1997b). In Miami-Dade County pinelands, a fire frequency of 3 to 7 years is generally recommended. However, in the Florida Keys there is very little information available to determine how frequently disturbances are needed. Any prescribed fire management, especially in the Florida Keys, should include a monitoring program to determine the effectiveness of management. Monitoring should include the species distribution (presence/absence), quantitative assessment of abundance or condition, and demographic information on individual plants (Menges and Gordon 1996). There should also be a component to the monitoring that captures the health of the community and species that occur in association with Garber's spurge (C. Kernan, Fairchild Tropical Garden, personal communication 1996).

Invasive exotic plant species, especially Brazilian pepper, Burma reed, and Cogon grass (*Imperata cylindrica*) threaten many of the listed pine rockland species and other rare pine rockland plants. The control of exotic species is a very important part of maintaining the habitat, although it can be very costly once exotics are established in an area. The Florida Keys Invasive Exotics Task Force organized a mapping project where approximately 25 people mapped exotic species from Key West to Key Largo. The group used aerial photographs to map the distribution and degree of infestation of Australian pine, Brazilian pepper, Asiatic colubrina, Burma reed, and melaleuca on the roads and islands in the Florida Keys from Key West to North Key Largo. Everglades NP, Big Cypress National Preserve, Biscayne NP, and others have cooperated on a similar vegetative mapping project using aerial photographs (Welch *et al.* 1995). High resolution vegetation maps were prepared for Long Pine Key, East Everglades (partial), and Taylor Slough (partial) (D. Jones, Everglades NP, personal communication, 1998). This information will give a better understanding of the degree of infestation and help identify areas of high priority for exotics plant control.

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Recovery for the Garber's Spurge

Chamaesyce garberi (Engelman ex Chapman) Small

Recovery Objective: STABILIZE, then delist.

Recovery Criteria

Chamaesyce garberi may be considered stabilized when existing populations, within the historic range of *C. garberi*, are adequately protected from further habitat loss, degradation, exotic plant invasion, and fire suppression. These sites must also be managed to maintain pine rocklands to support *C. garberi*.

Once the existing populations are stabilized, *C. garberi* may be considered for delisting. Delisting will be considered when: enough demographic data are available to determine the appropriate numbers of self-sustaining populations required to ensure 95 percent probability of persistence for 100 years; when these populations, within the historic range of *C. garberi*, are adequately protected from further habitat loss, degradation, exotic plant invasion, and fire suppression; when these sites are managed to maintain the pine rocklands to support *C. garberi*; and when monitoring programs demonstrate that populations of *C. garberi* on these sites support sufficient population sizes, are distributed throughout the historic range, and are sexually or vegetatively reproducing at sufficient rates to maintain the population.

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

Species-level Recovery Actions

- S1. Conduct surveys to determine distribution of pine rockland plants.** Pine rockland plants were thoroughly surveyed in Miami-Dade County; however, the status of *Chamaesyce garberi* is not known over its entire range.
 - S1.1. Inventory known populations.** Conduct thorough ground surveys to determine the distribution of *C. garberi*. Collect and archive herbarium voucher specimens for all populations. Initiate a quarterly monitoring program. Use existing standardized monitoring protocols developed by the Florida Natural Areas Inventory to record baseline data regarding the biology and ecology of *C. garberi*.
 - S1.2. Resurvey historic locations.** Search for additional populations of *C. garberi* in the Florida Keys. Resurvey historic locations. Conduct thorough ground surveys to locate unrecorded individuals and populations of *C. garberi*.
 - S1.3. Map distribution of known populations and suitable habitat.** Map populations, including obtaining GPS coordinates and developing GIS coverages.

- S2. Protect and enhance existing populations.** It is imperative for the recovery of pine rockland plants that additional populations not be lost.
- S2.1. Augment natural populations of listed pine rockland plants, where appropriate.** *Ex situ* collections exist for many rare pine rockland species. These collections should be used to cultivate pine rockland plants and augment sparse populations in protected areas. These experiments with reintroductions will be useful in the future, and could be essential for the recovery of pine rockland plant species. The principles of restoration genetics should be understood and applied when carrying out this task.
- S2.1.1. Continue work with *ex situ* propagation and seed banks.** Seeds should continue to be banked for all the listed species possible, and should be identified precisely as to collection location. A genetic ally representative *ex situ* conservation collection does not exist for *C. garberi*. Initiate work with *ex situ* propagation and seed storage banks. Identify seed storage potential and methods. Identify germination and propagation protocols.
- S2.1.2. Identify potential reintroduction sites and reintroduce *C. garberi*, where appropriate.** Sites identified as suitable for reintroduction within the known historic range of *C. garberi* should be surveyed and prepared to receive plants. Study the feasibility of translocating propagules into historically appropriate and protected natural habitats. Federal lands under proper management regimes may be good recipient sites. Use reintroduction protocols established by the conservation community.
- S2.1.3. Monitor the experimental outplantings.** Monitoring of reintroduced plants is essential for assessing the success of recovery efforts. Growth and survivorship should be measured.
- S2.2. Enforce available protective legislation.** State, Federal, and local regulations should be used to protect the pine rockland ecosystem and the listed plants.
- S2.2.1. Initiate section 7 consultation when applicable.** section 7 of the Endangered Species Act applies to Federal activities which might impact listed species, especially on Federal lands (Everglades NP, National Key Deer Refuge).
- S2.2.2. Encourage implementation of management plans.** Federal agencies are obligated under section 7(a)(1) of the ESA to perform positive conservation programs for the benefit of listed species. Development of management plans to benefit pine rocklands in Everglades NP and areas in the Florida Keys would constitute positive conservation programs.
- S2.2.3. Continue to enforce take and trade prohibitions.** The listed pine rockland plants are protected by take and trade restrictions of the ESA, the Preservation of Native Flora Act, and the regulations of Everglades NP. Since these are inconspicuous plants, take and trade are nonexistent or uncommon.
- S3. Collect biological information important to species recovery.** Additional information on the ecology and life history of pine rockland plants needs to be collected. The size and viability of known populations of *C. garberi* needs to be evaluated.

- S3.1. Investigate the reproductive biology of *C. garberi*.** A better understanding of the genetics and reproduction of this species is needed.
- S3.2. Identify demographics and gene flow in *C. garberi*.** Determine the size and viability of all populations. Conduct studies to document the genetic variation within and between populations.
- S3.3. Study the response of *C. garberi* to habitat management treatments.** Study the fire ecology of *C. garberi*.
- S3.4. Characterize the habitat and identify suitable sites for experimental outplantings.** Apply and modify, if need be, reintroduction protocols established by the conservation community.
- S4. Monitor *C. garberi* populations.** Use existing standardized monitoring protocols developed by the Florida Natural Areas Inventory to record baseline data regarding the biology and ecology of *C. garberi*. Determine the effects of management actions on *C. garberi*. Initiate quarterly monitoring programs.
- S4.1. Collect existing and historical data and place in a central location.** Contact former researchers for historical data, gather information from herbaria and museums, and contact all present researchers to compile data and place in GIS database in the FWS South Florida Ecosystem Office. This location will allow all researchers access to both historic and current data, and provide the FWS with a means to monitor the success of recovery tasks.
- S4.2. Convene a meeting of all researchers.** A meeting of current pine rockland researchers and land managers would enable the FWS to locate information sources, and begin the process of compiling those data. The meeting would also afford cooperators an opportunity to discuss monitoring and management procedures and set realistic species-level goals.
- S4.3. Monitor status and success of all populations and change management practices if so indicated.** Because of the varying vegetation conditions and fire history, different management may be required at different pine rockland sites. Different prescribed burn intervals may be necessary for best results. Intervals should be adjusted over the years to promote pine re-establishment and hardwood reduction.
- S4.4. Monitor reintroduction success and modify procedures as necessary.** Plant reintroductions should be monitored to determine the success of the procedure. The goal of reintroduction should be to establish a viable population. Management of the reintroduction sites should be modified as necessary to improve results.
- S5. Continue implementation of the fire education program and modify as necessary any fire management education program that has been developed.** Future modifications to this program may include tri-lingual distribution (Spanish, English, and Haitian Creole).

Habitat-level Recovery Actions

- H1. Continue to protect pine rockland plant habitat in order to prevent degradation.** The decline of the five listed pine rockland plants is due to alteration of pine rocklands in South Florida. Without protection and proper management, the rockland sites in the Keys may undergo the same destruction.

- H1.1. Protect pine rockland habitat.** Acquisition of remaining private sites is an effective way to protect or conserve pine rockland habitat. Purchase of additional parcels in the Lower Keys would also benefit the Key deer. It should be noted that public lands may still be subject to development for recreational, maintenance, or other purposes. Such disturbances, unless carefully planned, may directly destroy pine rockland and may secondarily result in exotic plant infestations as well as destructive human uses.
- H1.2. Protect or acquire privately owned sites.** Less-than-fee-simple acquisition should be used where appropriate as an alternative means of protecting pine rockland habitat. Miami-Dade County DERM is developing a private lands management and grant program for pine rockland protection and restoration. Monroe County should develop and implement a similar program.
- H1.3. Develop and implement best management practices for pine rocklands.** This would include development of fire management strategies that would best benefit pine rockland species. Without active fire and exotic plant management, pine rocklands will continue to disappear or degrade. Because of the restricted nature of pine rocklands, intensive management may be necessary at many of the remaining sites.
- H1.4. Continue to conduct prescribed burns.** Fire should be conducted at appropriate times of year to lower fuel loads. Growing season burns should be employed most often after fuel levels are under control. Special consideration must be included when planning prescribed fire for pine rocklands invaded by Burma reed or Cogon grass (*Imperata cylindrica*). Incorporate appropriate actions to minimize additional Burma reed or Cogon grass infestations in these areas. Due to the highly urbanized lands surrounding some of the pine rockland sites in the Keys, burning involves risks of smoke damage and annoyance, or worse, losing control of the fire. The Florida Division of Forestry has expertise in carrying out controlled burns in Miami-Dade County, and should be contacted to assist with burns in Monroe County. A regional pine rockland burn plan needs to be developed between the Federal, State, and County resource agencies and funding provided.
- H1.5. Implement additional management to meet habitat needs.**
- H1.5.1. Eliminate human-caused degradation.** Preventing trash dumping or other destructive human activities in pine rocklands is important. In order to accomplish this task, fencing and access restrictions may be necessary.
- H1.5.2. Control invasive plant species, particularly exotics.** Burma reed, Cogon grass, and persistent hardwoods need to be controlled and may require special techniques including herbicide, fire, mechanical, and hand clearing at most sites. Other management needs indicated by ongoing research should also be implemented.
- H2. Restore areas to suitable habitat.**
- H2.1. Eliminate physical degradation of habitat and restore to optimal conditions.** Physical degradation of pine rocklands continues to occur. Hurricane Andrew, in 1992, killed most of the adult pines in Miami-Dade County. The adult pines on Long Pine Key in Everglades NP were not as severely damaged (Herndon, 1998). The continued degradation of these areas should be curtailed and restoration of uneven-aged pine stands undertaken. Tubelings or direct seeding experiments may be used

to accomplish this task. In order to use direct seeding techniques, collection of local pine seeds must continue.

H2.2 Continue to refine management practices for pine rocklands. Management plans for sites including *C. garberi* should be implemented and modified as necessary for the benefit of this species.

H2.3. Continue to conduct prescribed burns. Prescribed burns should be conducted at sites where *C.garberi* occurs at appropriate time of the year to lower fuel loads. Growing season burns should then be employed after fuel loads are under control. The response to *C. garberi* to prescribed burns should be studied.

H3. Conduct habitat-related research.

H3.1. Continue to investigate and refine the habitat needs of each species. The habitat needs of these species have been studied, but are still not completely understood. The pollination, germination, and growth requirements have not been fully investigated. Research should address how light levels affect survival and how fire management affects light levels, reproduction, and regeneration of these species.

H3.2. Investigate fire history and incorporate into management strategies. Look at fire history for pine rocklands in Miami-Dade County, Everglades NP, and Monroe County. Incorporate results into GIS database and analyze fire history relative to healthy populations. This exercise will provide adequate information on fire history and intervals in urbanized and non-urbanized settings and enable assessment of the appropriateness of proposed management regimes.

H3.3. Monitor sites with *C. garberi* to determine success. A protocol developed by Fairchild Tropical Garden for monitoring plant communities at sites where *C.garberi* occur should be implemented.

H3.4. Develop a GIS database on the five listed pine rockland species and their habitats. Distribute the database to researchers, land managers, and conservationists.

H3.2.1. Assess the availability of GIS data. Create coverage of population locations, acquire recent imageries of the sites, and distribute the coverages to researchers, land managers, and conservationists.

