
Snakeroot

Eryngium cuneifolium Small

Federal Status:	Endangered (January 21, 1987)
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Critical Habitat:	None Designated
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Florida Status:	Endangered
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Recovery Plan Status:	Revision (May 18, 1999)
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Geographic Coverage:	Rangewide
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Figure 1. County distribution of snakeroot.



Eryngium cuneifolium has a very narrow geographic distribution in an area 39 km long in Highlands County. It is threatened by habitat loss and fire suppression; the small numbers of localities, combined with this species' requirement for nearly barren sand, renders it very vulnerable to future habitat loss. Measures being used to conserve this species include land acquisition and management.

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

Description

Eryngium cuneifolium is an aromatic perennial herb with a long, woody taproot, and persistent rosette of dark green. It usually has several erect, branching, flowering stems. It ranges from 0.25 to 0.5 m in height, rarely reaching as high as 0.9 m. The leaves are clustered at the base of the plant. The basal leaves are long, stalked, and shaped like narrow wedges, with 3 to 5 bristle-tipped teeth at the apex. Stem leaves are smaller and lack leaf stalks. The flowers are small, with white petals, filaments, styles and stigmas but powdery blue anthers form small heads, with bristly bracts. The sepals and petals are each about 1.5 to 2 mm long. The inferior ovary develops into a fruit about 1.5 to 2 mm long. The flowers and bristle bracts form heads 4 to 8 mm in diameter (Bell 1963, Wunderlin *et al.* 1981). Sterile plants are easily recognized in the field by their basal rosettes (Wunderlin *et al.* 1981). Flowering is from August to October (other *Eryngium* species, including *E. aromaticum* and *E. baldwinii* have blue flowers).

Taxonomy

Eryngium cuneifolium is most closely related to *E. aromaticum* (Bell 1963, Wunderlin *et al.* 1981). It was described by J.K. Small (1933) and its status as a species was upheld by O.R. Bell's (1963) review of the genus. Preparers of status reports (Wunderlin *et al.* 1981, Kral

1983) have also concurred that this is a distinct species. There are no synonyms in the botanical literature (Bell 1963, Wunderlin *et al.* 1981).

Other common names for this species include wedged-leaved button-snakeroot (Wunderlin *et al.* 1981) and semantic variations thereof.

Distribution

The present known distribution of *Eryngium cuneifolium* is greatest in southern Highlands County, near the town of Lake Placid. It occurs only on the southern Lake Wales Ridge (Figure 1). The northernmost site is on a dune on the south side of Lake Jackson in Sebring (FWS 1996). All other sites are in an area about 39 km long from the southern side of Josephine Creek to the southern tip of the Lake Wales Ridge. Christman (1988c) reports only about 20 localities, but even this number is misleading since he divided several larger sites. Johnson (1981) and Abrahamson *et al.* (1984) showed that Archbold Biological Station has about 90 rosemary balds. Only about 12 of them have *Eryngium cuneifolium* (E. Menges, Archbold Biological Station, personal communication 1989). A recent 16.2 ha addition to the Archbold property (acquired through a habitat conservation plan for the Florida scrub-jay) has abundant *Eryngium cuneifolium*, which apparently proliferated after the former owner cleared and root-raked the area. *Eryngium cuneifolium* is reported to occur at the site that is being acquired as a state park on the west side of Lake June in Winter (FWS 1996), but has not been relocated after several intensive searches (Archbold Biological Station, personal communication 1998). The past known distribution also included several sites in and around the town of Sebring, Highlands County (Wunderlin *et al.* 1981).

Habitat

Eryngium cuneifolium is a species of sunny sites that readily colonizes bare sand created by fire or other disturbance (Wunderlin *et al.* 1981, Abrahamson *et al.* 1984). *Eryngium cuneifolium* occurs only on bare white sand in scrub, usually with rosemary.

Eryngium cuneifolium is one of the few herbs able to survive the inhibitive effects on growth or reproduction by chemicals secreted into the environment by rosemary (*Ceratiola ericoides*). *Eryngium cuneifolium* also survives in a harsh physical environment, with droughty soil and low nutrient levels. The plant readily colonizes new patches of bare sand created by fire or disturbance by its stout, woody taproot. Possible seed storage in the soil has not been investigated (Kral 1983, Richardson 1985).

Eryngium cuneifolium is restricted to sand or fine sand soils with little clay or silt, rapid permeability, and low available water capacity. At Archbold Biological Station the plant occurs in rosemary scrub, mostly on Psamment soils of the Archbold Series which are moderately well drained, acid (pH 4.2), and with low soil nutrient levels (phosphorus: trace; potassium 5.6 kg/ha). Other soils in the area are also infertile. A small portion of the rosemary scrub at Archbold has soils of the St. Lucie Series, which are deep fine sands. This appears to be the major series in which *E. cuneifolium* is found outside of Archbold Biological Station (Wunderlin *et al.* 1981, Abrahamson *et al.* 1984).

Snakeroot.

Original photograph by Jeff Ripple; original flower photograph by Steve Shirah.

**Reproduction**

Reproduction in *E. cuneifolium* is sexual. The species can reproduce readily by seed (Kral 1983). There seems to be no special seed-dispersal mechanism (other than gravity) and pollination is likely to be similar to that of other members of Apiaceae, most likely by generalist insects (Wunderlin *et al.* 1981, Kral 1983).

Germination and leafing dates are unknown. Budding is believed to occur in July. The plant flowers vigorously from September through October. Anthesis occurs from August to October (Wunderlin *et al.* 1981). Fruiting and seed dispersal is believed to occur between October and January (Wunderlin *et al.* 1981, Kral 1983). Seeds are mature in November (T. Race, personal communication 1996). Specimens have been collected in late November and December (Wunderlin *et al.* 1981).

Relationship to Other Species

This species is restricted to sand pine scrub vegetation, usually with much rosemary (*Ceratiola ericoides*) and inopina oak (*Quercus inopina*). The community is open, with herbs such as *Liatris ohlingerae*, *Hypericum cumulicola*, and *Lechea cernua*. *Cladonia* lichens cover more of the area between shrubs than do the herbs. The community burns to the ground at intervals greater than 15 years. The oaks resprout from the roots; rosemary and sand pine recolonize by seed. Fire in this vegetation is not a succession-initiating disturbance in the Clementsian sense (Abrahamson *et al.* 1984; Abrahamson 1984a, 1984b).

Various shrubs and trees may affect *Eryngium cuneifolium* by shading it; *Ceratiola ericoides* may affect *E. cuneifolium* through allelopathy (Wunderlin *et al.* 1981, Kral 1983, Richardson 1985). Generalist insects are probable pollinators (Wunderlin *et al.* 1981, Kral 1983).

Status and Trends

Eryngium cuneifolium is threatened primarily by the conversion of its scrub habitat to citrus groves or residential subdivisions. In Highlands County, 64.2 percent of the xeric vegetation (sand pine scrub, scrubby flatwoods, and southern ridge sandhills) present before settlement was destroyed by 1981. An additional 10.3 percent of the xeric vegetation was moderately disturbed, primarily by building roads to create residential subdivisions (Peroni and Abrahamson 1985). This species benefits from the effects of fires or mechanical clearing of trees and shrubs, which creates areas of bare, sunny sand that *E. cuneifolium* and other herbs can colonize (Wunderlin *et al.* 1981, Kral 1983). Therefore, fire prevention or fragmentation of the vegetation that prevents the spread of fire may indirectly threaten this species.

Eryngium cuneifolium is also vulnerable to destruction by off-road vehicles that pass through the open spaces between shrubs. Another past and present problem for *E. cuneifolium*, as for several other herbs of the same habitat, is that this species does not tolerate shading or extensive competition from other plants.

Management

Eryngium cuneifolium is currently protected at Archbold Biological Station and the State's Lake Placid Scrub, Gould Road and Lake Apthorpe preserves (Robert Burns, The Nature Conservancy, personal communication October 1989). It is also protected in the Bok Tower Gardens national endangered species collection. Acquisition of the Holmes Avenue tract for the state preserve system is proceeding. The plant is present on a right-of-way managed by Florida Power and Light Company (FWS 1996).

Eight years of demographic data have been collected for this species (E. Menges, Archbold Biological Station, personal communication 1998). *Eryngium cuneifolium* is short-lived, its populations crash following fire, and other forms of disturbance may have positive effects. Its microhabitat was shown to significantly affect its survival, growth, and fecundity over a 4-year period. This species is most abundant in gaps at larger distances from shrubs, particularly *Ceratiola ericoides* and *Calamintha*, both putative allelopathic species. As time-since-fire increases, open patches in rosemary scrub tended to close, and *Eryngium* underwent a rapid decline (Hawks and Menges 1996). Pedro Quintana-Ascencio's current studies on rosemary scrub may demonstrate that *Eryngium* is particularly sensitive to gap closure, even compared with other gap species such as *Hypericum cumulicola* and *Polygonella basiramia* (Menges and Kimmich 1995). The exacting habitat requirements of *Eryngium cuneifolium* mean that, despite large populations at several sites (possibly millions of individual plants in its range), its habitats must be managed aggressively to maintain the gaps that *Eryngium* needs. Eric Menges and his associates are experimenting with fire at Archbold Biological Station and Lake Apthorpe. *Eryngium cuneifolium* recovers from fire by resprouting and by seedling recruitment from the seed bank (Menges and Kimmich 1996).

Literature Cited

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Recovery for the Snakeroot

Eryngium cuneifolium Small

Recovery Objective: RECLASSIFY to threatened.

Recovery Criteria

Eryngium cuneifolium may be reclassified from endangered to threatened when: enough demographic data are available to determine the appropriate numbers of self-sustaining populations and sites needed to assure 20 to 90 percent probability of persistence for 100 years; when these sites, within its historic range, are adequately protected from further habitat loss, degradation, and fragmentation; when these sites are managed to maintain the rosemary phase of xeric oak scrub communities to support *E. cuneifolium*; and when monitoring programs demonstrate that populations of *E. cuneifolium* on these sites support the appropriate numbers of self-sustaining populations, and those populations are stable throughout the historic range of the species.

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

Species-level Recovery Actions

- S1. Determine current distribution of *E. cuneifolium*.** This species has been relatively well surveyed and a distribution has been ascertained. Additional surveys will confirm the species' distribution and locate new sites.
- S1.1. Conduct surveys of *E. cuneifolium*.**
- S1.1.1. Continue surveys in Highlands County.** The Lake Wales Ridge has probably been adequately surveyed, though new sites for *E. cuneifolium* may still be found.
- S1.1.2. Continue surveys on protected lands.** New sites for listed species are still being found on protected lands. This survey work should be continued to catalog all existing protected sites.
- S1.2. Maintain distribution of known populations and suitable habitat in GIS database.** Use GIS to map existing populations and to assess the species' status and trends over time. The database should contain information on locations, population sizes, and status. This information should also be used for project review and in land acquisition activities.

- S2. Protect and enhance existing populations.** Much of the native xeric uplands on the Lake Wales Ridge and surrounding counties has been converted to agriculture or urban development. The remaining habitat is fragmented into small parcels and in many cases, isolated. For this reason, existing populations are in need of protection from a variety of threats.
- S2.1. Protect habitat** through acquisition, conservation easements, or agreements with landowners.
 - S2.2. Protect populations on public lands.** Develop management guidelines that allow for a fire regime that includes a mosaic of successional stages.
 - S2.3. Use local or regional planning to protect habitat.** Utilize available regional and County planning processes to encourage protection of suitable habitat, both unoccupied and occupied of *E. cuneifolium*.
 - S2.4. Conserve germ plasm.** The Center for Plant Conservation provides long-term seed storage for this species. Long-term storage of seeds and live collections decreases the likelihood of extinction due to natural stochastic events. Germ plasm conservation also preserves genetic diversity and provides valuable information regarding the reproductive biology of rare species. The local abundance of this species makes an *ex situ* garden collection a low priority for this species.
 - S2.5. Enforce available protective measures.** Use local, State and Federal regulations to protect this species from overcollecting and damage from off-road vehicle use. Regulations should also be used to protect xeric vegetative communities where *E. cuneifolium* lives.
 - S2.5.1. Initiate section 7 consultation when applicable.** Initiate section 7 consultations when Federal activities may affect this species.
 - S2.5.2. Enforce take and trade prohibitions.** This species is protected by take provisions of the ESA (including its prohibition against removing and reducing to possession any endangered plant from areas under Federal jurisdiction; maliciously damaging or destroying any such species on any such area; or removing, cutting, or digging up any such species), by the Preservation of Native Flora of Florida Act, and by the Florida rules regarding removal of plants from State lands.
- S3. Conduct research on life history characteristics of *E. cuneifolium*.** Continue the study of basic biology and ecology of this species. To effectively recover this species, more specific biological information is needed.
- S3.1. Continue research to determine demographic information,** such as numbers of populations, numbers of individuals in a population, recruitment, dispersal, growth, survival, and mortality.
 - S3.2. Once demographic data are known, conduct population viability and risk assessment analysis** to determine the numbers of plants, sites, subpopulations/populations, and spatial distribution needed to ensure persistence of the species.
 - S3.3. Conduct research to assess management requirements of *E. cuneifolium*.** Determine which natural populations can be stabilized or increased by habitat management. Data from surveys, research, and monitoring will yield information about *E. cuneifolium* sites and will provide factors contributing to any declines at each site. Site-specific management guidelines should be provided to land managers.

- S4. Monitor existing populations of *E. cuneifolium*.**
- S4.1. Develop monitoring protocol to assess population trends for *E. cuneifolium*.**
- S4.1.1. Monitor to detect changes in demographic characteristics,** such as reproduction, recruitment, growth, dispersal, survival and mortality. Also monitor for pollinators, herbivory, disease, and injury.
- S4.1.2. Monitor the effects of various land management actions on *E. cuneifolium*.** Assess any changes in demographic characteristics of *E. cuneifolium* in response to land management activities, such as prescribed fire, exotic plant control, *etc.*
- S4.2. Develop a quantitative description of the population structure of *E. cuneifolium*.** This description will provide a baseline for monitoring population dynamics in response to natural environmental changes and management treatments. Data recorded should include morphology, survivorship, mortality, and reproduction for individual plants. Include data about each plant's microsite (vegetation cover, litter depth, substrate, and closest neighbors).
- S5. Provide public information about *E. cuneifolium*.** It is important for the recovery of this species that governmental agencies, conservation organizations such as the Florida Native Plant Society, and private landowners be appropriately informed about this species. Care is needed, though, to avoid revealing specific locality information about *E. cuneifolium*.
- Public outreach efforts must also continue to address the increasing concern that horticultural demand for this and other rare species may not benefit conservation of threatened and endangered species. Public education should identify that commercial production and horticultural uses of endangered species provide little benefit to species, since the recovery of *E. cuneifolium* and other rare species requires a self-sustaining, secure, number of natural populations.
- S6. Develop delisting criteria.** Once reclassification is achieved, research and monitoring results may provide data necessary to develop delisting criteria.

Habitat-level Recovery Actions

- H1. Prevent degradation of existing habitat.** Extensive habitat loss, degradation, and fragmentation have already occurred throughout the range of this species. Both development and fire suppression have decreased the available habitat. To date, there are three protected sites for *E. cuneifolium* in Highlands County.
- H1.1. Secure habitat through acquisition, landowner agreements, and conservation easements.** With so little xeric scrub habitat left, any method of securing protected populations should be sought.
- H1.2. Manage and enhance habitat.** Manage habitat to maintain *E. cuneifolium* populations by preventing damage from off-road vehicle use and by providing proper management of habitat, including prescribed fire.
- H1.2.1. Conduct prescribed burns.** Fire is a necessary and integral characteristic of the scrub community. A variable interval in fire return and in season is important to mimic the natural fire regime. The scrub

landscape is naturally made up of islands of suitable and unsuitable habitat. To repeat this landscape pattern, sites should be burned as a mosaic when possible to allow for variation.

- H1.2.2. Control and eliminate exotic and invasive plants and animals.** Exotic plant and animal species are not yet a major threat in xeric scrub as compared to other communities in South Florida. However, in isolated areas, exotic species are becoming established. Without control, exotic/invasive plants may become a threat to the survival and recovery of *E. cuneifolium*.
- H1.2.3. Control access** to areas where snakeroot is growing. Trampling and off-road vehicles can severely threaten individual populations.
- H2. Restore areas to suitable habitat.** Native habitats that have been disturbed or that have experienced a long history of fire suppression may be good candidates for future reserves.
 - H2.1. Restore natural fire regime.** Long periods without fire can change the species composition and the ability of the site to carry fire. Rehabilitation of a site may be a lengthy process, but with fewer and fewer sites remaining, these sites may become more valuable for future recovery.
 - H2.2. Enhance sites with native plant species.** Because of logging or long periods without fire, certain native plant species that were present historically may now be absent from the natural composition of the community. These species can be reintroduced if natural colonization is not possible.
- H3. Continue habitat-level research projects.** Study the response of *E. cuneifolium* to various land management practices, such as prescribed fire regimes, vegetative thinning, and control of exotic/invasive vegetation.
- H4. Monitor habitat/ecological processes.** Monitor the effects of land management actions, such as prescribed fire, exotic plant control, *etc.*, on the habitats where *E. cuneifolium* occurs.
- H5. Provide public information about scrub and its unique biota.** Educational efforts, especially those conducted by Archbold Biological Station, have been successful. Without these efforts, the Lake Wales Ridge NWR would not have been created. The State's system of biological preserves depends for its funding and future success on a broad base of public understanding and support. In addition to past and ongoing educational efforts by The Nature Conservancy, Bok Tower Gardens, and Archbold Biological Station, future efforts by these organizations, the Florida Park Service, the Florida Native Plant Society and local garden clubs play crucial roles in increasing public appreciation of scrub, high pine vegetation, and their plant species.