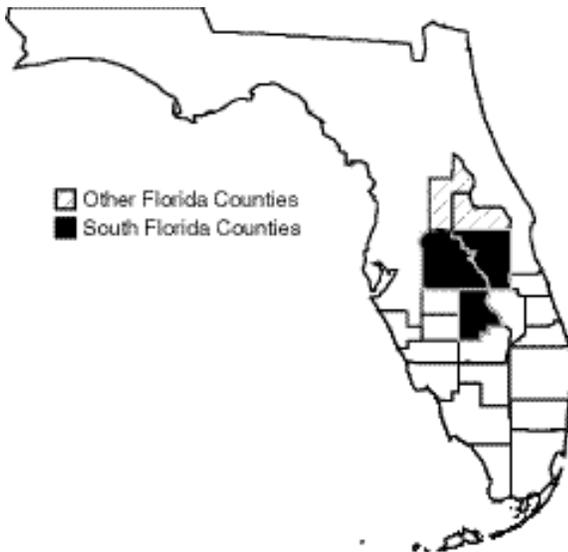

Britton's Beargrass

Nolina brittoniana Nash

Federal Status:	Endangered (April 27, 1993)
Critical Habitat:	None Designated
Florida Status:	Endangered
Recovery Plan Status:	Contribution (May 1999)
Geographic Coverage:	South Florida

Figure 1. County distribution of Britton's beargrass.



Britton's beargrass is a long-lived species of Agavaceae. It is found from the south end of the Lake Wales Ridge in Highlands County north to Orange County and northern Lake County. It is a relatively widespread scrub species with highest concentrations in Polk and Highlands counties. This species is threatened by habitat loss or modification due to land conversions for agriculture and development.

This account represents South Florida's contribution to the existing recovery plan for Britton's beargrass (FWS 1996).

Description

Britton's beargrass (*Nolina brittoniana*) is a perennial that grows from a short, thick, fleshy, bulblike rootstock. The leaves are 1 to 2 m long and 6 to 13 mm wide, forming a rosette with the youngest leaves upright and the oldest lying nearly flat on the ground. The flowering stem, usually solitary, grows 1 to 1.5 m tall from the rosette in April. The inflorescence is a panicle with about 6 to 20 branches. When in bloom, the branches are covered with small, white flowers, making the plant very conspicuous (Wunderlin *et al.* 1980, Kral 1983). The flowers are moderately fragrant when open (The Nature Conservancy 1995). *N. brittoniana* has symmetrical fruits, triangular in cross-section. The species is generally dioecious (*i.e.*, male and female flowers on separate plants), but a few exceptions have been documented.

A similar species, *Nolina atopocarpa*, may occur in the vicinity of *Nolina brittoniana*. *N. atopocarpa* can be distinguished from *N. brittoniana* by its shorter leaves, flowers that are greenish rather than white, and fruits that are asymmetric (FWS 1996).

Taxonomy

The genus *Nolina*, which belongs to the agave family, is centered in western North America (Mabberley 1987). There are three species of *Nolina* that represent an eastern

element in the flora. There are two species in Florida (*N. brittoniana*, and *N. atopocarpa*) and one restricted to Georgia and South Carolina (*N. georgiana*) (FWS 1996). *Nolina brittoniana* was described by Nash in 1895 from a specimen collected in Lake County near Eustis, Florida (Bartlett 1909).

Distribution

Nolina brittoniana occurs from the south end of the Lake Wales Ridge in Highlands County north to Orange County near Orlando and northern Lake County (FWS 1996). An apparently isolated locality was reported from Hernando County, north of Tampa, in 1961 (Wunderlin *et al.* 1980); however this population has not been relocated (R. Yahr, Archbold Biological Station, personal communication 1998). In 1994 there was an unconfirmed report from Brevard County on the east coast. Herbarium records indicate that the historic range of *N. brittoniana* extended north into Marion County. The present range (Figure 1) is concentrated in Polk and Highlands counties with smaller numbers occurring in Lake, Osceola, and Orange counties (FWS 1996).

Habitat

N. brittoniana occurs in a wide range of habitat types, from relatively open scrub to hammocks with closed canopies. It has been reported in scrub, high pine and occasionally in hammocks (Christman 1988). At Lake Wales Ridge SF it was reported in a dense oak grove where trees were 2 to 4 m tall with a very dense thicket of vegetation in the understory (C. Weekly, Lake Wales Ridge SF, personal communication 1996). The wide range of habitat types that *N. brittoniana* occupies are very different in appearance, physiognomy, species composition, fire dynamics, and land use history, but are closely linked ecologically and historically (Myers 1990). In all habitats where *N. brittoniana* occur, the soil is droughty and infertile, and all are considered upland sites (Myers 1990, C. Weekly, Ridge SF, personal communication 1996). These habitats are also fire-maintained and fire-dependent ecosystems that are presumably replaced by hardwoods in the absence of fire (Myers 1990).

Reproduction

Britton's beargrass normally has either all male or all female flowers. There are a few cases where a plant will have both male and female flowers. A recent study by Menges *et al.* (1996) reconfirmed Small's (1933) report of it being "polygamodioecious."

Britton's beargrass only produces seeds through pollination, not apomictically. It flowers from early March to mid-May. The male plants shed their pollen in the early morning (The Nature Conservancy 1995). The female flowers exude nectar about 24 hours after opening during the evening or before sunrise (The Nature Conservancy 1995). Britton's beargrass exhibits a generalist pollination syndrome, being pollinated throughout the day by a variety of visitors. At Archbold Biological Station and Lake Apthorpe Preserve there were 34 pollinators from six different families observed visiting *N. brittoniana* plants (Menges *et al.* 1996).

Britton's beargrass.

Original photograph by Betty Wargo; original flower photograph by Steve Shirah.



Flowering of *N. brittoniana* peaks 1 year after burning. Flowering quickly drops during the second year post burn (Menges *et al.* 1996). At the Lake Apthorpe Preserve, 75 percent of the population flowered the year after burning (Menges *et al.* 1996). This dropped to 13 percent 2 years following a burn (Menges *et al.* 1996).

Although *N. brittoniana* responds to fire with increased flowering, recruitment does not follow. Dr. Gordon (The Nature Conservancy, personal communication 1997) feels there are several possibilities for the lack of recruitment: sterile seeds, high seed predation, or delayed germination (seed bank). Studies on the demographics of *N. brittoniana* are continuing and the lack of recruitment is an issue in the research. Plants bear abundant seed, hundreds of seeds per flowering plant, which are easily germinated. These characteristics make propagation of this species easy.

Relationship to Other Species

Nolina brittoniana is typically associated with evergreen oaks such as *Quercus geminata*, *Q. myrtifolia*, *Q. chapmanii*, and *Q. inopina*. Saw palmetto (*Serenoa repens*), and various shrub heaths, *Osmanthus*, *Lyonia*, *Garberia*, *Ilex*, and *Polygonella* also occur with this species. The herbaceous layer is usually dominated by several xerophytic members: *Aristida stricta*, *Aristida spiciformis*, *Helianthemum nashi*, *Rhynchospora megalocarpa*, *Stillingia sylvatica*, *Polygonella fimbriata*, and *Sisyrinchium solstitiale* (Wunderlin *et al.* 1980). *Nolina brittoniana* occurs in association with several rare and/or federally listed species: *Polygala lewtonii*, *Polygonella myriophylla*, *Polygonella basiramia*, *Paronychia chartacea* ssp. *chartacea*, *Persea humilis*, *Liatris ohlingerae*, *Hypericum cumulicola*, *Conradina brevifolia*, *Calamintha ashei*, *Bonamia grandiflora*, and *Ilex opaca* var. *arenicola* (Wunderlin *et al.* 1980).

Status and Trends

Nolina brittoniana was listed as endangered because of habitat loss from agricultural and residential development. Two-thirds of the original scrub habitat has been destroyed and the remainder is threatened by agriculture and residential development (Christman 1988). Peroni and Abrahamson (1985) reported that about three-quarters of the upland habitats (scrub, scrubby flatwoods, and high pine) on the Lake Wales Ridge in Highlands County had been lost to agricultural development or subdivided for residential development by 1983. The Lake Wales Ridge continues to experience population growth and expansion of citrus groves, resulting in further destruction of scrub habitats. Fire exclusion is also degrading much of the remaining scrub habitat. Overgrown scrub can shade this species, which results in a reduction in sexual reproduction (Wunderlin, *et al.* 1980). *Nolina brittoniana* can remain vigorous in fire-suppressed habitat, but the trends of populations under these conditions are unknown (Reese and Orzell 1995).

In recent surveys, about 500 plants were found at The Nature Conservancy's Lake Apthorpe Preserve. This suggests that the species does not always occur as scattered individuals. In other surveys, *N. brittoniana* was found in overgrown habitats that were probably not surveyed previously (Christman 1988, C. Weekly, pers. comm. Arbuckle SF, 1996). In 1989, the total number of *N. brittoniana* was estimated to be less than 1,000 plants (Muller *et al.* 1989).

Management

Like many of Florida's ecosystems, scrub is pyrogenic and its flora and fauna have developed adaptations to fire (Myers 1990). The mosaic of scrub habitats is attributed to variable fire frequencies and patchiness of burn-intensity (Myers 1990). *Nolina brittoniana* occupies a wide range of habitat types that are very different in appearance, physiognomy, species composition, fire dynamics, and land-use history, but are closely linked ecologically and historically (Myers 1990). The habitats all have similar soil characteristics (droughty and infertile),

are upland sites, and are fire-maintained and fire-dependent ecosystems that are presumably replaced by hardwoods in the absence of fire (Myers 1990; C. Weekly, Ridge SF, personal communication 1996).

Studies have shown that *N. brittoniana* responds to fire with increased flowering one year post fire (Menges *et al.* 1996). This is important in that it represents a pulse of reproduction and potentially, recruitment of new individuals to the population. Although *N. brittoniana* can persist in an area that has experienced fire suppression for many years, it may only exist in a vegetative state under these conditions. Adequate fire management is needed at protected sites to maintain population diversity.

Nolina brittoniana is protected and managed in eight to 10 areas in an attempt to recover scrub species. It is also present in most of the tracts targeted for acquisition by the State and FWS in Polk and Highlands counties. The recovery team participants recommended that the species be reclassified to threatened after 25 sites have been protected for 20 years. Reclassification required that half of these sites be larger than 202 ha (499 acres) and the rest at least 4 ha (10 acres). The protected sites must also represent the plant's entire geographic range. In an ongoing study of the demography, breeding system, and genetics of *N. brittoniana*, Menges *et al.* (1996) discusses the use the spatial locations of *N. brittoniana* to analyze the geographic factors affecting genetic variation. The spatial data will also be used to evaluate the success of currently protected lands and proposed reserve systems in preserving the genetic diversity of *N. brittoniana* and other scrub endemics.

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Recovery for the Britton's Beargrass

Nolina brittoniana Nash

Recovery Objective: DELIST the species once recovery criteria are met.

South Florida Contribution: STABILIZE and increase the population.

Recovery Criteria

The South Florida recovery objective can be achieved when sites, within the historic range of *N. brittoniana*, are adequately protected from further habitat loss, degradation, and fragmentation; when these sites are managed to maintain the seral stages of high pine and xeric oak scrub communities to support *N. brittoniana*; and when monitoring programs demonstrate that 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 ways of re-establishing populations of this species to expand its current distribution within its historic range.

Species-level Recovery Actions

- S1. Determine current distribution and status of *N. brittoniana*.** Some portions of *N. brittoniana*'s range have been well surveyed yet a total distribution has not been ascertained for this species. A thorough survey is needed to determine the distribution of this species.
- S1.1. Conduct surveys for populations of *N. brittoniana*.**
- S1.1.1. Survey scrub habitat in Osceola County.** Adequate survey work has not been performed off the Lake Wales Ridge. Sites on private property cannot be protected without survey knowledge.
 - S1.1.2. Continue surveys in Polk and Highlands counties.** This species is found sparsely in scrub, high pine, and hammock. During surveys, this species could be overlooked. Many sites with *N. brittoniana* may still be undiscovered.
 - S1.1.3. 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 and new sites as they are purchased.

- 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, in land acquisition activities, and to coordinate updates with the Florida Natural Areas Inventory database. Currently, the Lake Wales Ridge Ecosystem Working Group and Archbold Biological Station are proposing to map the entire central ridge. This information would show potential habitat for scrub endemics based on their habitat needs.
- S2. Protect and enhance existing populations.** Much of the native xeric uplands on the Lake Wales Ridge and surrounding counties have 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 privately owned habitat through acquisition, conservation easements, or agreements with landowners.**
- S2.2. Protect populations on public lands.** Develop management guidelines that allow for an appropriate fire regime for *N. brittoniana* habitats 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 *N. brittoniana*.
- S2.4. Continue *ex situ* conservation.** *Ex situ* collections are important for preserving genetic diversity, preventing extirpation, and determining ecological characteristics and habitat management needs of species.
- S2.4.1. Conserve germ plasm.** The seed for this species is not presently in long-term storage.
- S2.4.2. Maintain *ex situ* collection.** Currently, the Center for Plant Conservation coordinates conservation activities and maintains a database for the National Collection. Bok Tower Gardens, as a participating institution, maintains and propagates *N. brittoniana* as part of the National Collection.
- 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 *N. brittoniana* 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 prohibitions.** This species is protected by trade 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. Continue research on life history characteristics of *N. brittoniana*.** Although recent work has answered some life history questions, much of the basic biology and ecology of this species remains poorly understood. To effectively recover this species, more specific biological information is needed.
- S3.1. Continue research to determine demographic information,** such as numbers of sites and populations, numbers of individuals in a population, gender structure, 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 *N. brittoniana*.** Determine which natural populations can be stabilized or increased by habitat management. Surveys, research, and monitoring information on the localities of *N. brittoniana* sites will provide factors contributing to any declines at each site. Monitoring of populations should be in reference to various habitat management practices. Site-specific management guidelines should be provided to land managers and close coordination among land managers is essential to develop adaptive management techniques.
- S4. Monitor existing populations of *N. brittoniana*.**
- S4.1. Develop monitoring protocol to assess population trends for *N. brittoniana*.**
- S4.1.1. Monitor to detect changes in demographic characteristics,** such as gender structure, clonal growth, reproduction, recruitment, growth, seed dormancy, germination, dispersal, survival, and mortality. Also monitor for pollinators, herbivory, disease and injury.
- S4.1.2. Monitor the effects of various land management actions on *N. brittoniana*.** Assess any changes in demographic characteristics of *N. brittoniana* 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 *N. brittoniana*.** 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. Data about each plant's microsite (vegetation cover, litter depth, substrate, and closest neighbors) should also be included.
- S5. Provide public information about *N. brittoniana*.** 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. 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 *N. brittoniana* and other rare species requires a self-sustaining, secure, number of natural populations.

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 urbanization and fire suppression have decreased the available habitat. To date, there are 19 protected sites for *N. brittoniana* in Polk and Highlands counties.
- 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 *N. brittoniana* populations by preventing damage from off-road vehicle use and overcollection, 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. In addition, spatial variation in fire intensity and unburned patches is necessary to construct a natural fire landscape. The scrub 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. *N. brittoniana* can withstand a wide range of fire frequencies within its diverse habitats.
 - H1.2.2. Control and eliminate exotic and invasive plants and animals.** Exotic plant and animal species are not yet a major threat in Florida 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 *N. brittoniana*. Cogon grass is present in some of the high pine and hammock habitats with *N. brittoniana*.
 - H1.2.3. Control access to areas where listed plants are 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. Conduct habitat-level research projects.** Study the response of *N. brittoniana* to various land management practices, such as prescribed fire regimes, vegetative thinning, and control of exotic/invasive vegetation. Although recently studied, questions still exist on management reactions. For example after a burn, the plants experience a flowering peak one year post burn, but no recruitment increase has been detected. More information is needed on the response to management activities for this species.

- H4. Monitor habitat/ecological processes.** Monitor the effects of land management actions, such as prescribed fire, exotic plant control, *etc.*, on the habitats where *N. brittoniana* 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 successful efforts, the Lake Wales Ridge NWR would not have been created. Florida's system of biological preserves depends on a broad base of public understanding and support for its funding and future success. In addition to past and ongoing educational efforts by The Nature Conservancy, Bok Tower Gardens, and Archbold Biological Station, future efforts by these organizations, and the Florida Park Service, the Florida Division of Forestry, the SFWMD, the Florida Native Plant Society, and local garden clubs are crucial in increasing public appreciation of scrub and high pine communities, and their associated plant species. The Arbuckle Appreciation Day sponsored by the Florida Division of Forestry has been especially successful in disseminating knowledge about these unique communities.

