

Britton's Beargrass (*Nolina brittoniana*)

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



Photo of Britton's Beargrass plant courtesy of Kevin Erwin.



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Photo of Britton's Beargrass pods courtesy of Shirley Denton.

**U.S. Fish and Wildlife Service
Southeast Region
Jacksonville Ecological Services Field Office
Jacksonville, Florida**

5-YEAR REVIEW

Britton's Beargrass/*Nolina brittoniana*

I. GENERAL INFORMATION

A. Methodology used to complete the review: This review was completed by the U.S. Fish and Wildlife Service's (Service) lead recovery biologist for this species who is located in the Jacksonville Ecological Services Field Office, Florida. None of the review was contracted to outside parties. All literature and documents used in this review are on file at the Jacksonville Ecological Services Field Office and are cited in the References section. We used peer-reviewed publications; interim and annual reports provided as part of local and Federal government contracts; data and information available on the internet; unpublished data; and personal communications. Public notice of this review was given in the Federal Register on April 9, 2009, and a 60-day comment period was opened. Public comments were received from four individuals, including representatives from two State agencies, Florida Department of Agriculture and Consumer Services (FDACS) and Florida Department of Environmental Protection (FDEP); Florida Natural Areas Inventory (FNAI); and Bok Tower Gardens. The draft of this document was distributed for peer review (see Appendix A) and comments received were addressed.

B. Reviewers

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

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C. Background

- 1. Federal Register Notice citation announcing initiation of this review:** 74 FR 16230, April 9, 2009.
- 2. Species status:** Uncertain (2009 Recovery Data Call). The status of *Nolina brittoniana* cannot be determined definitively because no systematic surveys for this species are conducted. However, the species is likely in decline because about 57 percent of known *N. brittoniana* populations occur on unprotected private lands that are vulnerable to destruction or decline due to habitat degradation resulting from lack of management. Consequently, any losses of *N. brittoniana* populations on unprotected private lands would result in a net decrease in the number of

populations of this species. Therefore, *N. brittoniana* may be in decline due to loss of populations on private lands.

3. Recovery achieved: 2 (25-50 percent recovery objectives achieved)

4. Listing history

Original Listing

FR notice: 58 FR 25746

Date listed: April 27, 1993

Entity listed: Species

Classification: Endangered

5. Associated rulemakings: None

6. Review History:

Recovery Plans (see below): 1996, 1999

Recovery Data Call: 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, and 2009.

7. Species' Recovery Priority Number at start of review (48 FR 43098): 8

A recovery priority number of 8 means that the degree of threat to *N. brittoniana* is moderate and the recovery potential is high.

8. Recovery Plan

Name of plan: Recovery Plan for Nineteen Florida Scrub and High Pineland Plant Species.

Date issued: June 20, 1996

Name of plan: South Florida Multi-species Recovery Plan (MSRP) (identifies recovery contributions for the South Florida Ecological Service's office work area)

Date issued: May 18, 1999

II. REVIEW ANALYSIS

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

1. Is the species under review listed as a DPS? No. The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife that interbreeds when mature. This definition limits listing a DPS to only vertebrate species of fish and wildlife. Because the species under review is a plant, the DPS policy does not apply.

B. Recovery Criteria

1. **Does the species have a final, approved recovery plan containing objective, measurable criteria?** Yes.
2. **Adequacy of recovery criteria:**
 - a. **Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?** No. As indicated in section II.B.3. below, we believe criteria 2 and 3 are unclear or vague and should be revised to be more measurable.
 - b. **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?** No. Disease and predation (Factor C), the inadequacy of existing regulations (Factor D), and lack of recruitment from seeds (Factor E) are not addressed in the recovery criteria.
3. **List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please list which of the 5 listing factors are addressed by that criterion. If any of the 5 listing factors are not relevant to this species, please note that here.**

In this section, we consider the recovery criteria provided in the Recovery Plan for Nineteen Florida Scrub and High Pineland Plant Species (Service 1996). The South Florida Multi-species Recovery Plan (Service 1999) is more current but it only addresses the recovery needs of *N. brittoniana* in South Florida and the contribution that portion of the species' range can provide to the species as a whole. Because the older, but broader recovery plan of 1996 addresses recovery needs of this species throughout its range, we consider it to be the authoritative source for recovery criteria.

The 1996 recovery plan lists three criteria necessary to reclassify *N. brittoniana* from endangered to threatened status: (1) there are eight populations protected at four or more sites (Factor A); (2) genetic monitoring determines the number of individuals within the protected sites; and (3) within the protected populations demographic monitoring is completed for five years. To delist *N. brittoniana*, 20 viable populations must occur at five or more sites and these sites must be located in Highlands, Polk, Orange/Osceola, and Lake Counties.

The following discussion relates to the recovery criteria for reclassification of *N. brittoniana* from endangered to threatened status. Criterion 1 is vague

and it is difficult to assess whether current conditions meet this objective. The term “population” has not been defined so it is not possible to determine whether a population is represented by an individual rosette (one plant) or hundreds of rosette. Similarly, criterion 1 refers to “sites” and it is not clear whether this refers to geographically separated areas or whether two or more populations of *N. brittoniana* could occur within the same area boundary and count as two sites. Furthermore, this criterion does not explicitly state that the eight populations must occur on managed conservation lands, but we assume this was the intent.

Despite the vagueness of criterion 1, there are sufficient data available to reasonably conclude that this criterion has been met. However, we must clarify that for the purpose of this assessment that we consider element occurrence records maintained by FNAI to be synonymous with the terms “population” and “site” as used in defining the recovery objectives and criteria in the 1996 recovery plan. Therefore, knowing that each element occurrence record maintained by the FNAI has a separation distance of at least 1.0 kilometer (NatureServe 2004) leads us to conclude that the known locality records likely represent spatially separated *N. brittoniana* populations, regardless of the number of plants present. Consequently, we believe there to be 34 populations of *N. brittoniana* on 24 managed conservation parcels (Turner *et al.* 2006; M. Jenkins, FDACS, personal communication 2010; E. Gandy, FDEP, personal communication 2009; J.M. Heaney, University of Florida (UF), personal communication 2010), which is substantially more than the requisite eight populations at four sites specified in the recovery plan.

We believe the intent of recovery criterion 2 is to ensure that populations contributing to recovery of *N. brittoniana* are not composed of entirely cloned individuals, but rather contain a genetically diverse group of individual plants. This assessment has not been completed; consequently criterion 2 has not been met.

Recovery criterion 3 requires that demographic monitoring be completed on each of the protected populations for at least five years. However, as written, this criterion only recommends that demographic monitoring be conducted, not that the results show a demographically viable population. We are not aware of any demographic monitoring programs at any of the protected sites; therefore, we do not believe that criterion 3 has been met.

With regard to the delisting recovery criterion, the 34 populations of *N. brittoniana* on managed conservation lands exceed the 20 populations required for consideration of delisting. However, the distribution of protected populations is not consistent with the recovery criteria for delisting. Furthermore, little demographic monitoring has been conducted

so evaluation of the viability of most protected populations is not possible at this time. Therefore, the criteria to delist *N. brittoniana* have not been met.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Abundance, population trends, demographic features, or demographic trends: Turner *et al.* (2006) concluded that there were 71 recent records (representing populations) of *Nolina brittoniana* in central Florida. One additional recent population was reported (FNAI 2009), bringing the total number of populations to 72. Turner *et al.* 2006 determined that 32 of these populations occur on 22 public conservation lands. Additional surveys conducted in 2008 at the Warea Tract of the Seminole State Forest have located a new population of *N. brittoniana* in Lake County (M. Jenkins, FDACS, personal communication 2010). Also, another new population was documented in 2006 at South Fork State Park (formerly known as Beker State Park) in Manatee County (E. Gandy, FDEP, personal communication 2009; J.M. Heaney, UF, personal communication 2010). Therefore, we believe that a total of 34 populations now occur on 24 public conservation lands.

The mean number of plants per population was estimated to be 33 individuals based on a sampling of 52 populations in the mid 1990s (Menges *et al.* 1996). Most populations contained between 10 and 100 individuals, and only a few would be considered large viable populations. (Menges *et al.* 2010). Clones can be measured through field observation and microsatellite analysis of genet size (Prugnolle *et al.* 2008). Once the size of clones is known, it may be determined that certain populations are not distinct, independent of others predominantly or entirely of the opposite sex. Smaller populations are sometimes entirely female, and therefore cannot be counted as a part of this number until demographic surveys determine the extent of skew in sex ratio across smaller populations (J.M. Heaney, UF, personal communication 2010).

Few systematic demographic surveys have been conducted for this species, but limited data suggest that *N. brittoniana* persists long-term even in the absence of fire (Weekley and Menges 2003). The demographic response of *Nolina* to fire on recruitment is unknown; however, some data indicate that flowering peaks the year following fire and declines thereafter (Menges *et al.* 1996, Evans *et al.* 1998) while other data suggest no correlation between time since fire and flowering (Menges and Gordon 1996, Weekley 1997, Slapcinsky *et al.* 2010). While typical scrub fires are likely beneficial to *N. brittoniana*, high intensity fires cause high mortality and low post-burn growth (Weekley 1997). We found no data on seedling recruitment and survival and it appears that most

recruitment occurs due to cloning. However, existing genetic variation in this species suggests that there must be occasional seedling recruitment (Menges *et al.* 2010).

Several early monitoring efforts indicated that populations of *N. brittoniana* were stable or increasing. Weekley (1997) observed a slight increase at the Arbuckle Tract of the Lake Wales Ridge State Forest; however, the increase was likely due to finding additional untagged plants from previous surveys. At this same site, 2002 surveys found that the number of individual plants continued to increase (Cox 2003). Additional populations were observed at this site in 2008 (Clanton 2009). Observed increases in population size were likely the result of clonal recruitment or expanded surveys (Weekley 1996, 1997) since earlier reports do not indicate that seedling recruitment was observed. Long-term surveys and demographic monitoring have not been conducted so assessments of population and demographic trends are not possible.

Surveys for *N. brittoniana* and other rare plants on the Lake Wales Ridge State Forest have focused on finding plants and documenting abundance of *N. brittoniana* and have not included intensive efforts to evaluate demographic performance. Furthermore, repeated surveys have not been conducted in the same areas to assess population trends. Nonetheless, in prioritizing available funding and staff resources, the Florida Division of Forestry (FDOF) does not anticipate conducting more intensive demographic monitoring because *N. brittoniana* is relatively abundant and apparently responding positively to ongoing management activities (Clanton 2007).

b. Genetics, genetic variation, or trends in genetic variation: Life history traits (long-lived perennial, outcrossing, widely dispersing pollinators, and stable demography) of *N. brittoniana* suggest that it should have high genetic variation (Dolan and Menges 1998). Conversely, small local population sizes and widespread clonal growth are thought to limit genetic variation (Menges *et al.* 2001). Early allozyme analyses indicated that *N. brittoniana* populations had relatively low genetic diversity and no unique alleles; however, there was some indication of population differentiation based on local alleles and clines in allele frequencies (Menges *et al.* 2001, Dolan *et al.* 2004). Subsequent protein electrophoresis analysis concluded that *N. brittoniana* had low values for species- and population-level genetic diversity; percentage of polymorphic loci, average numbers of alleles per locus, and expected heterozygosities were lower than reported for plants, including plants with limited geographic distribution (Dolan *et al.* 2004). Furthermore, this analysis indicated that *N. brittoniana* had less genetic variation than plants in general and only 10.4 percent of the populations had a larger number for percent of polymorphic loci than the average reported for endemic

plants (Dolan *et al.* 2004). Interestingly, however, although the absolute levels of genetic variation were low when compared with other endemic plants in general, *N. brittoniana* was more genetically diverse than most other endemic plants restricted to the Lake Wales Ridge (Dolan *et al.* 2004). At present, it does not appear that habitat loss and fragmentation has resulted in a substantive loss of genetic structure in this species (Menges *et al.* 2010), but the apparent linear distribution based on clines in allele frequencies suggests that protection of extant populations throughout the range of *N. brittoniana* may be important to conserving genes that are critical to the fitness of this species (Dolan *et al.* 2004).

For purposes of comparison of a plant with almost identical life history traits (clonal, outcrossing, widely dispersing pollinators, not necessarily stable demography), *Nolina interrata* is listed as endangered by the State of California (California Department of Fish and Game 2009), with three isolated, clonal (Dice 1988, Bauder 1993) populations in the foothills of Ensenada, Baja California, and a handful of populations in San Diego National Wildlife Refuge. Many *Nolina* species often have skewed sex ratios (Dice 1988, Dolan *et al.* 2004). A preliminary allozyme study of a population (n=2000) of *N. interrata* did not preclude an effective population size of zero in clonal, all-female populations (Bauder 1993). However, potential barriers to gene flow leading to isolation of small populations and increased susceptibility to stochastic events are often not detectable with lack of polymorphisms among allozyme loci, and thus microsatellite data are needed. Clones can be measured through field observation and microsatellite analysis of genet size (Prugnolle *et al.* 2008). Otherwise, we really do not know what the effective population size is, and therefore the number of populations we are protecting on conservation land.

New genetic research will evaluate the diversity of microsatellites, which have typically given much better resolution within populations, can give a better estimate of effective population size, and will link population level work to the broader phylogeny of *Nolina* species. This research will also include using genetic markers such as microsatellites, currently used in capture-mark-recapture and parentage studies in animals, to demonstrate the ability to discern fine-scale geographical and population genetic patterns, and could eventually lead to the ability to perform parentage analyses in endangered plants (M. Heaney, UF, personal communication 2010).

c. Taxonomic classification or changes in nomenclature: No new information exists.

d. Spatial distribution, trends in spatial distribution or historic range: *Nolina brittoniana* is found on the Mount Dora Ridge in the Ocala National Forest (eastern Marion County), Orlando Ridge (western Orange

and east Lake Counties), Winter Haven Ridge (eastern Polk County), and on the Lake Wales Ridge (Highlands, eastern Polk, and northwestern Osceola Counties). It was also recently found in northeastern Pasco County and northern Manatee County, and was historically reported from one location in eastern Hernando County (Turner *et al.* 2006; FNAI 2009; E. Gandy, FDEP, personal communication 2009).

The distribution of most central Florida xeric ridge plant species, including *N. brittoniana*, was probably never continuous within their ranges because of specializations for soil types, fire regime, canopy gaps, and soil drainage (Dolan and Menges 1998, Menges *et al.* 2010). Only 13 percent of the historic xeric uplands of the Lake Wales Ridge remained as of 2003 (Turner *et al.* 2006) and if we assume that potentially suitable soils for *N. brittoniana* were evenly distributed we can extrapolate that about 87 percent of the historic distribution has been destroyed.

Compared with other extant scrub endemic plants, *N. brittoniana* is relatively widespread. Recent records in Marion County (Ocala National Forest) substantially extended the northern extent of the species' known range, while a 2005 record in Pasco County and a 2006 record in Manatee County reestablished the western extent of its distribution (it was historically recorded in eastern Hernando County but had not been located there since the early 1960s).

N. brittoniana populations located on the northern Lake Wales Ridge (western Orange and central Lake Counties) are most vulnerable due to current urban development pressures, but long-term assessment of human population growth suggests most of Florida's interior uplands will be converted to urban uses by the middle of this century (Zwick and Carr 2006). Extirpation of populations in the most vulnerable northern Lake Wales Ridge area would not reduce the known range of *N. brittoniana*, but it would result in increased distances between the remaining populations, which could affect gene flow (Bauder 1993, Dolan *et al.* 2004).

e. Habitat or ecosystem conditions: *N. brittoniana* occurs in a wide range of habitat types, including relatively open scrub, sand pine scrub, and sandhill with almost complete canopy cover due to woody encroachment, and in very few cases xeric hammock. The habitat types that *N. brittoniana* occupies are very different in appearance, species composition, fire dynamics, and land use history, but are closely linked ecologically and historically (Myers 1990). In all habitats where *N. brittoniana* occurs, the soil is xeric and with low nutrient load, and all are considered upland sites. These habitats are also fire-maintained and fire-dependent ecosystems that are replaced by hardwoods in the absence of fire (Myers 1990).

N. brittoniana historically occurred in fire-maintained white and yellow sand xeric vegetative communities, including oak scrub and sandhill (Service 1999, Weekley and Menges 2003, Menges *et al.* 2007). Menges (2007) described natural fire return intervals of 2-5 years in sandhill, 8-16 in scrubby flatwoods, and 5-12 years in oak-hickory scrub and indicated that these intervals would likely maintain suitable habitat for *N. brittoniana*, although population fluctuations might be greater in oak scrub because plants probably will decline in habitats with longer fire-return intervals. Also, flowering at sites with longer fire-return intervals seems rare if not non-existent; however, large populations suggest that clonal growth continues in these populations (Weekley 1997; C. Weekley, Archbold Biological Station (ABS), personal communication 2010).

Successful restoration of xeric vegetative communities on many public lands will take several years to accomplish because multiple prescribed fires are necessary to achieve the desired vegetative structure of early successional stages. In many cases, while fire return intervals may be restored, fire intensity or completeness of burn may not be sufficient for community restoration in cases where pyrogenic ground cover has been replaced by fire resistant woody species, or fire retardant hardwood leaf litter. Roller chopping in particular reduces incidence of pyrogenic ground cover, which is replaced by more weedy, less pyrogenic herbaceous species. In some cases the open areas preferred by xeric species such as *N. brittoniana* are found in fire breaks, which do not burn by design. These are regularly disked or mowed, resulting in reduced fecundity. Lack of fire in these cases may not only lead to complete lack of growth or recruitment, but could also lead to a skew in sex ratio (due to lack of fire or other unknown cause). In cases where fuel loads are so high as to be an impediment to complete burns, large organic debris loads in soils are likely to be a detriment to pyrogenic ground cover species and *N. brittoniana* (J.M. Heaney, UF, personal communication 2010).

On public lands that have only recently begun to implement prescribed fire, habitat conditions for *N. brittoniana* may take several more years to become favorable for sexual reproduction. Elsewhere, some public land managers do not currently have the resources to implement effective habitat management programs (Howell *et al.* 2003, Service 2006) even though 98 percent of evaluated public lands were determined to be appropriately managed given resource availability and environmental conditions (FDEP 2007). However, less than 25 percent of public land managers have been ranked as having an excellent prescribed burn program (Howell *et al.* 2003). On most public lands, scrub habitat is likely to continue to degrade unless resources are available so land managers can continue to conduct appropriate management. Furthermore, some scrub conservation lands on the Lake Wales Ridge may not be managed in the near future because there are multiple private landowners

with inholdings. These patchworks of private and public land make use of prescribed fire as a management tool difficult (R. Bowman, ABS, personal communication 2007).

2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

a. Present or threatened destruction, modification or curtailment of its habitat or range: The most pervasive threat to *N. brittoniana* on public land is habitat degradation due to fire suppression resulting in the lack of flowering needed for reproduction. Most land managing agencies in Florida are not able to use prescribed fire at the rates, frequency, and/or intensity needed to restore and maintain most of Florida's fire-adapted ecosystems (Service 2006). Consequently, the difficulties land managing agencies currently face in implementing prescribed fires probably have resulted in the degradation of *N. brittoniana* habitat in some areas.

Nolina brittoniana on private lands is also threatened long-term with fire suppression, but habitat destruction is a more immediate concern in many locations. Except for several privately owned conservation parcels, most other private landowners are unlikely to use habitat management techniques such as prescribed fire to maintain or enhance *N. brittoniana* habitat. At present, there are no incentives available that would encourage private landowners to undertake prescribed fire, especially those who own relatively small parcels embedded in urban matrices. As a result, we believe that many locality records for *N. brittoniana* on non-conservation parcels in private ownership are threatened with habitat modification due to fire suppression.

Nolina brittoniana that occur on non-conservation private lands also are vulnerable to destruction due to development, such as construction of roads; installation of utilities and other infrastructure; and residential, commercial, and industrial construction. *N. brittoniana* on each private parcel is vulnerable to this threat at any time.

b. Overutilization for commercial, recreational, scientific, or educational purposes: *Nolina brittoniana* is cultivated for horticultural purposes and can be found at native plant nurseries in Florida. However, we are not aware of commercial exploitation of extant wild populations. Therefore, overutilization is not currently thought to be a significant threat to *N. brittoniana*.

c. Disease or predation: Although more research is needed regarding predation on *N. brittoniana*, Weekley (1997) reported vertebrate predation rates over 30 percent in one population for one year on the Lake Wales Ridge State Forest. Post-dispersal fruit/seed predation might help explain

the absence of seedling recruitment (Service 1999; C. Weekley, ABS, personal communication 2010). More information is needed to determine if the threat of vertebrate predation on this species has increased beyond what has naturally occurred and is causing a decline in the populations.

d. Inadequacy of existing regulatory mechanisms: Florida Administrative Code (FAC) 5B-40 (Preservation of Native Flora in Florida) provides the FDACS with limited authority to protect *N. brittoniana* from illegal harvest on State and private lands. However, this regulatory mechanism does not prevent destruction of habitat due to land use changes on private lands.

Title 62D-2.013 of the FAC prohibits the removal, destruction, or damage of plants from FDEP, Division of Recreation and Park properties. Titles 68A-15.004 and 68A-17.004 FAC prohibit the destruction or removal of any protected State plant from any Wildlife Management Area or Wildlife and Environmental Area, respectively, without the written consent of the land manager, FWC, or fee title holder of private property managed by the FWC. Title 5I-4.005 FAC prohibits the destruction, injury or disturbance of plants on lands managed by the FDOF. Title 40E-7.537 FAC prohibits the destruction or removal of any native plant on lands owned by Florida's Water Management Districts. *N. brittoniana* also occurs on private land owned by a research entity and conservation organization. Protection of *N. brittoniana* occurs through applicable State regulations requiring private landowner authorization to remove plants from private property. Because *N. brittoniana* is listed as an endangered species by the State of Florida, these protective regulations apply to this species on the above mentioned State properties and private properties.

The National Wildlife Refuge System Administration Act (NWRAA) represents organic legislation that set up the administration of a national network of lands and water for the conservation, management, and restoration of fish, wildlife, and plant resources and their habitats for the benefit of the American people. Amendment of the NWRAA in 1997 required the refuge system to ensure that the biological integrity, diversity, and environmental health of refuges be maintained. Therefore, *N. brittoniana* is protected on Refuge property.

On private properties, Federal or State laws provide little protection for *N. brittoniana*. Since the majority of extant *N. brittoniana* populations occur on unprotected private lands, we conclude that existing regulatory mechanisms are inadequate to protect this species.

e. Other natural or manmade factors affecting its continued existence: There are no records of seedling recruitment in any wild population even though genetic assessments indicate seedling recruitment

must take place (Menges *et al.* 2010). Limited seedling recruitment will affect the long-term persistence of some populations and could affect the extent of genetic variation should habitat fragmentation continue.

D. Synthesis

The recovery criteria for considering the reclassification of *N. brittoniana* from endangered to threatened status has not been met. Although we believe there are 34 populations of *N. brittoniana* on 24 managed conservation parcels, which is substantially more than the requisite eight populations at four sites specified in the recovery plan, long-term monitoring has not been undertaken on most public lands so information about status and trends is not available. The 34 populations of *N. brittoniana* on protected, managed lands exceed the 20 populations required for delisting. However, the distribution of protected populations is not consistent with the recovery criteria for delisting. Furthermore, little demographic monitoring has been conducted so evaluation of the viability of most protected populations is not possible at this time. Therefore, the criteria to delist *N. brittoniana* have not been met.

Existing threats include habitat degradation on both public and private lands due to fire exclusion and application of fire at insufficient intervals or intensity. *N. brittoniana* on private lands is also vulnerable to destruction due to land use changes.

Overutilization for commercial, recreational, scientific, or educational purposes is not currently believed to be a threat to *N. brittoniana*. Impacts to the species from disease or predation have been documented as a threat due to the vertebrate herbivory on flowering plants. Predation on seeds by herbivores may be one of the causes for the lack of recruitment in some populations. More information is needed to determine if the threat of vertebrate predation on this species has increased beyond what has naturally occurred and is causing a decline in the populations.

Existing regulatory mechanisms do not adequately protect *N. brittoniana* on private lands. Consequently, inadequacies of existing regulatory mechanisms represent a current threat to this species.

In summary, *N. brittoniana* is a long-lived herb that requires high fire return intervals to maintain growth and recruitment. It appears to be well represented on public conservation lands but increased monitoring and management efforts are needed to determine whether the populations are stable or increasing. All *N. brittoniana* populations on private lands are threatened with habitat destruction and degradation. Habitat degradation and habitat loss currently pose the most significant threats to this species. Consequently, *N. brittoniana* continues to be in danger of extinction throughout all or a significant portion of its range.

III. RESULTS

A. **Recommended Classification:** No change is needed.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

Revise the recovery criteria to establish measureable goals for demographic monitoring, including but not limited to: the number of populations that should be monitored, the demographic parameters that should be measured, the demographic performance levels/rates that should be met, and the timeframe within which these levels/rates should be attained/maintained. Population viability analysis (modeling) should be conducted to assess the long-term persistence probability of populations.

Continue demographic monitoring on the Lake Wales Ridge and initiate demographic monitoring at other conservation lands where this species occurs. Conduct Level 2 (see Menges and Gordon 1996) monitoring on multiple sites using populations in different habitats and with different management regimes. Work with ABS on their Population Dynamics of Endangered Plants project which is conducting Level 2 monitoring at several sites across the range of *N. brittoniana*.

Conduct a range wide survey of genetic diversity in *N. brittoniana*. Such a survey could help in identifying populations that should be targeted for acquisition or included as a source for creation of new populations on sites undergoing restoration.

Implement management activities on public lands that contain *N. brittoniana*, including prescribed fire at return intervals and intensities necessary to restore and/or maintain the various xeric vegetative communities that support this species. Update natural community maps, which describe through field data collection (FNAI natural community mapping protocols, for example) community composition and structure along with management recommendations for managed areas where *N. brittoniana* occurs.

Purchase or otherwise protect large *N. brittoniana* populations on unprotected lands. Protection should target *N. brittoniana* populations that are sufficiently large, or could be large if adequately managed, as to be self-sustaining and viable long-term.

Encourage private landowners to conserve and manage property known to contain this species.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Britton's beargrass (*Nolina brittoniana*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review: No change is needed.

Review Conducted By: Annie Dziergowski

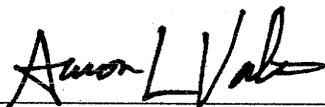
FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve  Date 5/10/10

REGIONAL OFFICE APPROVAL:

Acting
Lead Regional Director, Fish and Wildlife Service

Approve  Date 5-10-10

APPENDIX

Summary of peer review for the 5-year review of Britton's beargrass (*Nolina brittoniana*)

A. Peer Review Method: See B. below.

B. Peer Review Charge: On March 4, 2010, the following letter and Guidance for Peer Reviewers of Five-Year Status Reviews were sent via e-mail to potential reviewers requesting comments on the 5-year review. Requests were sent to Michael Jenkins (Florida Division of Forestry), Carl Weekley (Archbold Biological Station), Amy Jenkins (Florida Natural Areas Inventory), Eric Menges (Archbold Biological Station), and James M. Heaney (University of Florida).

*We request your assistance in serving as a peer reviewer of the U.S. Fish and Wildlife Service (Service) 5-year status review of the endangered Britton's beargrass (*Nolina brittoniana*). The 5-year review is required by section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 et seq.). A 5-year review is a periodic process conducted to ensure the listing classification of a species as threatened or endangered on the Federal List of Endangered and Threatened Wildlife and Plants is accurate. The initiation of the 5-year review for the Britton's beargrass was announced in the Federal Register on April 9, 2009, and the public comment period closed on June 8, 2009. Several comments were received on the notice for this species.*

The enclosed draft of the status review has been prepared by the Service pursuant to the Act. In keeping with Service directives for maintaining a high level of scientific integrity in the official documents our agency produces, we are seeking your assistance as a peer reviewer for this draft. Guidance for peer reviewers is enclosed with this letter. If you are able to assist us, we request your comments be received in this office on or before April 2, 2010. Please send your comments to Annie Dziergowski at the address on this letter. You may fax your comments to Annie Dziergowski at (904)731-3045 or send comments by e-mail to Annie_Dziergowski@fws.gov.

We appreciate your assistance in helping to ensure our decisions continue to be based on the best available science. If you have any questions or need additional information, please contact Annie Dziergowski at (904)731-3089. Thank you for your assistance.

Sincerely yours,

*David L. Hankla
Field Supervisor*

Enclosures

Guidance for Peer Reviewers of Five-Year Status Reviews
U.S. Fish and Wildlife Service, Jacksonville Ecological Services Field Office

July 5, 2007

As a peer reviewer, you are asked to adhere to the following guidance to ensure your review complies with Service policy.

Peer reviewers should:

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

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

Questions regarding this guidance, the peer review process, or other aspects of the Service's recovery planning process should be referred to Annie Dziergowski, U.S. Fish and Wildlife Service, at 904-731-3089 email: annie_dziergowski@fws.gov.

C. Summary of Peer Review Comments/Report

A summary of peer review comments is provided below. The complete set of comments is available at the Jacksonville, Ecological Services Field Office, U.S. Fish and Wildlife Service, 7915 Baymeadows Way, Suite 200, Jacksonville, Florida 32256-7517.

Mr. Weekley

Mr. Weekley provided a comprehensive review of the Britton's beargrass 5-year review. He recommended that the 5-year review include more of the biology described in the Service's 1999 MSRP because that information was not included in the 1996 recovery plan. Also under section II.B.3, he felt that the Service's 1999 MSRP recognized the importance of population viability analysis (PVA). He also recommended changing how we refer to individual plants from "stem" to "rosette". Mr. Weekley recommended that information from The Nature Conservancy's demographic monitoring data be included in the review. He also suggested that there needs to be PVA conducted as well as additional demographic monitoring for this species.

In section C.1.a, he indicated that we should include more information on the reproductive ecology of this species. He recommended additional genetic information be incorporated to clarify what constitutes a genet for this clonal species and to identify what constitutes a genetically distinct individual. He commented that the effect of fire on this species is still unknown and questioned whether there are additional data to show elevated post-burn mortality. He clarified some monitoring data that were used in the draft 5-year review. He questioned the dramatic increase in the population in 7 years. He also provided information on ABS's Population Dynamics of Endemic Plants (PDEP) project that is collecting Level 2 monitoring data for this species at several sites.

In section C.1.b, Mr. Weekley had several editorial comments. He also provided clarification on some of the new genetic research that is taking place.

Mr. Weekley provided several comments regarding soil preference in section C.1.d.

In section C.1.e., Mr. Weekley indicated that there may not be enough information to show population declines are a result of long fire return intervals. He suggested that populations have persisted in long-unburned sites but that flowering seems rare or non-existent. He mentioned that The Nature Conservancy may have additional information on fires and reproduction from their years of monitoring at Tiger Creek Preserve.

For section C.2.a., Mr. Weekley questioned whether fire suppression was a threat to this species as it is with other Lake Wales Ridge endemics.

In section C.2.b, Mr. Weekley indicated that he was unaware of any cultivation for this species for horticultural purposes and asked for clarification.

Mr. Weekley provided information on predation by vertebrates for section C.2.c. He also indicated that the absence of seedling recruitment may be a result of predation.

In section C.2.e, Mr. Weekley provided clarification that lack of seedling recruitment will affect the long term persistence of this species.

In the Synthesis section (II.D), Mr. Weekley questioned and provided changes to the use of some words and wanted us to include predation as a threat due to evidence of vertebrate predation on this species.

In section IV, Recommendations for Future Actions, Mr. Weekley indicated that more genetic analysis is needed to increase our confidence of what the definition of “individual” is based on proximity of ramets. He also mentioned that the PDEP project is working on Level 2 monitoring at multiple sites, which will address the need for demographic monitoring.

Mr. Jenkins

Mr. Jenkins felt that the information provided in the document was appropriate and provided one additional summary of field surveys conducted by FDOF at the Warea Tract of the Seminole State Forest.

Mr. Heaney

Mr. Heaney provided a comprehensive review of the draft Britton’s beargrass 5-year review. In section C.1.a., he provided clarification on how clonal species can be measured to determine if certain populations are distinct.

In section C.1.b., Mr. Heaney suggested that we include information on the comparison of a plant with identical life history traits to help explain how we need to determine what an effective population size should be. He also included additional information on new genetic research that will further help us determine an effective population size.

In section C.1.d., Mr. Heaney provided clarification on the distribution of this species.

For section C.1.e., he provided some alternative language to describe the habitat for this species. He also provided some extensive text on the effect prescribed fire has or lack of fire has on the habitat where this species occurs.

In section C.2.d., Mr. Heaney provided text regarding the lack of regulations that apply to private landowners who would like to remove listed plants. He also indicated that no mitigation is necessary when development occurs on areas adjacent to occupied areas and provided an example.

Under section C.2.e., Mr. Heaney questioned the literature used in this section and wondered if there was a citable report.

In the Synthesis section (II.D.), Mr. Heaney provided some minor editorial changes.

In section IV, Recommendations for Future Actions, Mr. Heaney included the need to update natural community maps as well as management recommendations for managed areas where this species occurs. He also suggested that community quality should be taken into account for acquisition of unprotected lands.

He also provided us with information on the recent occurrence of this species on the northern tract of South Fork State Park (formerly known as Beker State Park). This population was found in 2006 by Elizabeth Gandy with FDEP. He stated that he believes this is a significant population for this species but was uncertain if the small numbers and marginal habitat are enough to call this a viable population.

D. Response to Peer Review:

Mr. Weekley

In section B.3, the information described in the MSRP was written by the South Florida Ecological Services Office to assist in the recovery of *N. brittonana*, but this information does not reflect the Service's information for the species throughout its listed range. However, we have included some information from the MSRP that we believe to be appropriate.

We agree with Mr. Weekley's comments on the Updated Information and Current Species Status section and have modified that section and other appropriate sections accordingly.

We have modified the Five-Factor Analysis section, to include the information Mr. Weekley provided. In sections C.2.a. and C.2.b, we revised the text to address his comments.

We agree with Mr. Weekley's comments in the Synthesis section and have modified this section accordingly.

We agree with Mr. Weekley's suggestion to include a recommendation to conduct more genetic analysis on *N. brittoniana* populations as well as include information on the PDEP project.

Mr. Jenkins

We made the edits recommended by Mr. Jenkins and reviewed the survey information he provided. We incorporated applicable information into pertinent sections of the document.

Mr. Heaney

We made the edits recommended by Mr. Heaney. We clarified and revised sections based on his comments. We also incorporated applicable information into pertinent sections of the document.