U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Festuca ligulata

Common Name:

Guadalupe fescue

Lead region:

Region 2 (Southwest Region)

Information current as of:

04/06/2012

Status/Action

___ Funding provided for a proposed rule. Assessment not updated.

___ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

___ New Candidate

_X_ Continuing Candidate

___ Candidate Removal

> ___ Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status
>
> ___ Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species
>
> ___ Range is no longer a U.S. territory
>
> ___ Insufficient information exists on biological vulnerability and threats to support listing
>
> ___ Taxon mistakenly included in past notice of review
>
> ___ Taxon does not meet the definition of "species"
>
> ___ Taxon believed to be extinct
>
> ___ Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

Petition Information

___ Non-Petitioned

_X_ Petitioned - Date petition received: 05/11/2004

90-Day Positive:05/11/2005

12 Month Positive:10/26/2011

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing? **Yes**

Explanation of why precluded:

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for this species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The Progress on Revising the Lists section of the current CNOR (http://endangered.fws.gov/) provides information on listing actions taken during the last 12 months.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories**: Texas
- **US Counties**: Brewster, TX, Culberson, TX
- **Countries**: Mexico

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories**: Texas
- **US Counties**: Brewster, TX, Culberson, TX
- **Countries**: Mexico

Land Ownership:

The only known extant population in the United States occurs on Federal land in Big Bend National Park (BIBE), where about 200 individuals are scattered over 2 hectares (ha) (5 acres (ac)). Another population of unknown size and area persists in Coahuila, Mexico, at Maderas del Carmen, a protected natural area owned by CEMEX, a cement manufacturer.

Lead Region Contact:

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Lead Field Office Contact:

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Biological Information

Species Description:

Festuca ligulata (Guadalupe fescue) is a perennial rhizomatous bunchgrass endemic to a few high mountains of the Chihuahuan desert. The stems range from 40 to 100 centimeters (cm) (16 to 40 inches (in.)) tall, and the leaf blades are less than 3 millimeters (mm) (0.12 in.) broad (Poole et al. 2007, p. 228). The flower stalks have up to three branches bearing a few awnless spikelets, each with a cluster of 2 to 3 flowers. *Festuca ligulata* is distinguished from other *Festuca* species by its longer ligule (3 to 4 mm or 0.12 to 0.16 in.); the ligule is a membranous or hairy appendage at the junction of the sheath and blade (Gould 1975, pp. 100-101, 633). For the purposes of this document, we will refer to *Festuca ligulata* as Guadalupe fescue.

Taxonomy:

Guadalupe fescue, a member of the Poaceae (grass family), was described from specimens collected in 1931 in the Guadalupe Mountains, Culberson County, Texas (Swallen 1932, p. 436). We have rigorously reviewed the available taxonomic information and conclude that *Festuca ligulata* is a valid, distinct species classified in the subgenus Leucopoa; its closest relative is *F. thurberi* (Swallen 1932, p. 436; Aiken and Consaul 1995, pp. 1290, 1292, 1296; Aiken et al. 1996, p. 1; Tropicos 2010, p. 1; Integrated Taxonomic Information System 2011, p. 1; Natural Resources Conservation Service 2011, p. 1).

Habitat/Life History:

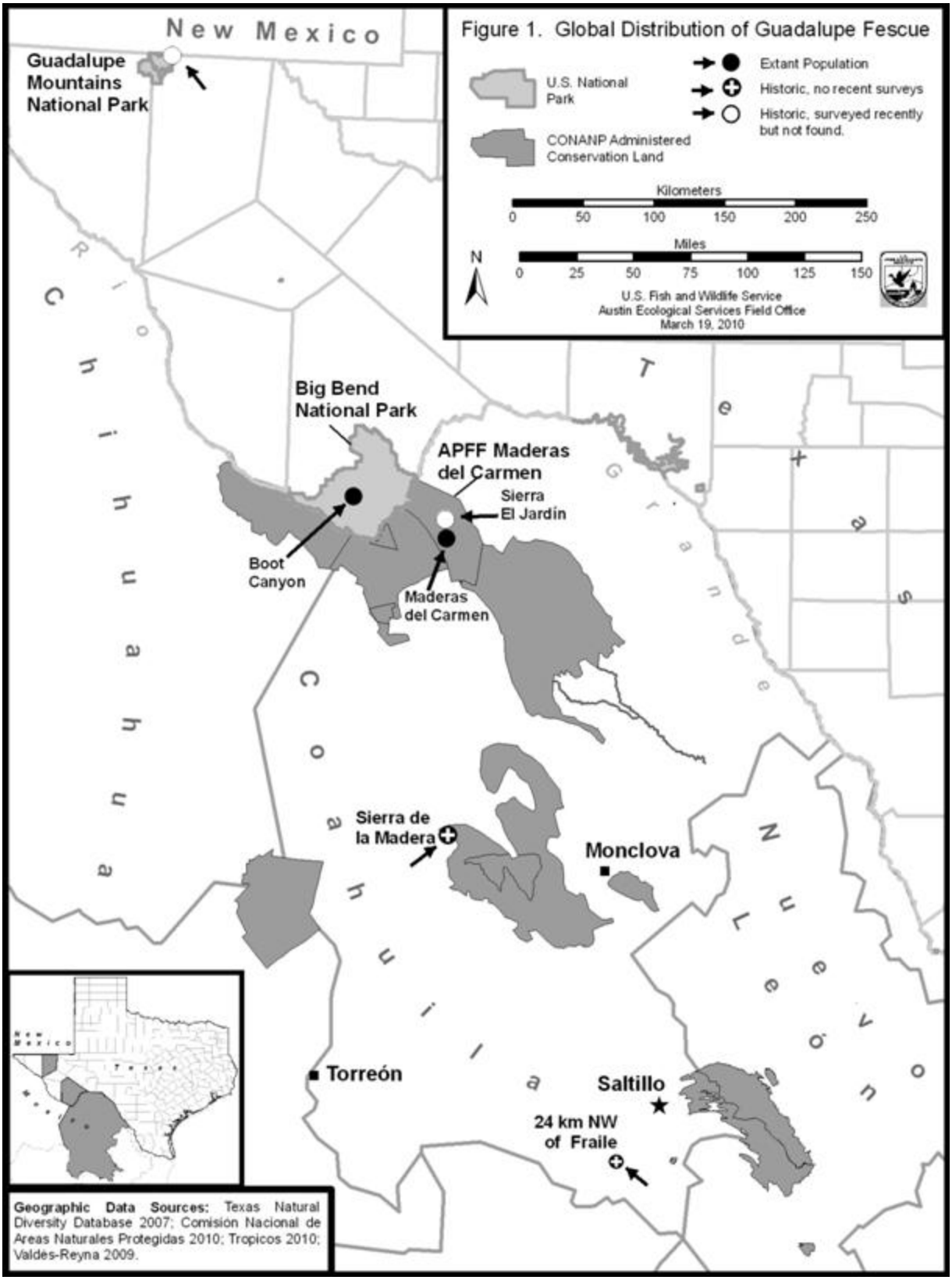
The known habitats of Guadalupe fescue are pine-oak-juniper woodlands of talus slopes above 1,829 meters (m) (6,000 feet (ft)) elevation in trans-Pecos Texas and Coahuila, Mexico (Poole 1989, p.8). The vegetation of the extant populations in the Chisos Mountains in Texas and the Coahuilan sites is similar. The associated tree species in the Chisos site include *Quercus gravesii* (Chisos red oak), *Q. grisea* (gray oak), *Pinus cembroides* (Mexican pinyon), *Juniperus deppeana* (alligator juniper), *J. flaccida* (drooping juniper) and *Acer grandidentatum* (bigtooth maple); the characteristic trees at the historic Sierra de la Madera site in Coahuila include *Q. laceyi* (Lacey oak), *Q. gravesii*, *Cupressus arizonica* (Arizona cypress), *P. arizonica* (Arizona pine) and *P. strobiformis* (southwestern white pine) (Poole et al. 2007, p. 228). At Maderas del Carmen, Coahuila, *Q. hypoleucoides* (silverleaf oak) replaces *Q.grisea* as a dominant species (BIBE and U.S. Fish and Wildlife Service (Service) 2008, p. 4). At these sites, Guadalupe fescue occurs in scattered patches in the understory (Poole 1989, p. 10; BIBE and Service 2008, p. 4). Annual precipitation averages 44.2 centimeters (cm) (17.4 in.) at the Chisos site, with the majority falling during the monsoon months of June to October; the average daily high temperature is 30.3 degrees Celsius (°C) (86.6 degrees Fahrenheit (°F)) in June and 14.7°C (58.5°F) in January (BIBE and Service 2008, p. 4). Fire scars on tree stumps at the Chisos site indicate that as many as nine wildfires have occurred over a 290-year span; however, the last wildfire was in 1944 (Zimmerman and Moir 1998, p. 12).

Guadalupe fescue flowers primarily in August and September, or occasionally earlier, in response to rainfall (Gordon and Poole 2009, p. 1). The Chisos population has produced from 0 to 19,000 seeds annually (BIBE and Service 2008, p. 3). Interestingly, the greatest amount of seeds matured after the very dry 2000 – 2001 season, while none of the plants flowered in 2006, following three years of normal or above-normal precipitation (BIBE and Service 2008, p. 3). Soil samples collected in 2003 contained several hundred seeds of other plant species, but none of Guadalupe fescue (BIBE and Service 2008, pp. 3-4). This suggests that the

seeds do not persist long in the soil seed bank.

Historical Range/Distribution:

Figure 1 (below) shows the species' historic and current distributions. J. A. Moore and J. A. Steyermark collected Guadalupe fescue in 1931 in McKittrick Canyon in the Guadalupe Mountains, Culberson County, Texas (Swallen 1932, p. 436). This site is now within Guadalupe Mountains National Park (GUMO), which was established in 1972. C. H. Muller also collected the species in 1931 near Boot Springs in the Chisos Mountains, Brewster County, Texas (Specimen C.H. Muller #7815) (Texas Natural Diversity Database 2007, pp. 3071-3072); this area became part of BIBE in 1944. D. J. Appelhons' (1973, p. 40) report of Guadalupe fescue from the Franklin Mountains in extreme west Texas is probably a misidentification (Worthington 1991, p. 1; Poole et al. 2007, p. 229). The species has been documented at four sites in Coahuila, Mexico. In 1941, L. R. Stanford, K. L. Retherford, and R. D. Northcroft collected Guadalupe fescue 24 kilometers (km) (15 miles (mi)) northwest of Fraile, in southern Coahuila (specimen numbers ARIZ 15004, MoBot L. R. Stanford 405) (Tropicos 2011, p. 1). M. C. Johnston collected specimens in the Sierra El Jardín in 1973 (Poole 1989, pp. 8, 12). T. Wendt and J. Valdés-Reyna collected the species in 1977 in the Sierra de la Madera (specimen ARIZ 237645) (Poole 1989, pp. 8, 12). Three patches of several hundred Guadalupe fescue plants were documented in 2003 at the north end of the Maderas del Carmen range at an elevation of 1,981 m (6,500 ft) (BIBE and Service 2008, p. 3).



Current Range Distribution:

The Chisos Mountains population in BIBE is the only known population remaining in the United States. Botanists have extensively surveyed the limited amount of potential habitat at BIBE, where the elevation exceeds 1,829 m (6,000 ft), as well as most of the potential habitat in the Davis Mountains of Texas, but have not found additional populations (BIBE and Service 2008, p. 3). Despite intensive searches, Guadalupe

fescue was last observed in the Guadalupe Mountains in 1952 (Texas Natural Diversity Database 2007, pp. 3073-3074). Botanists periodically continue surveys at McKittrick Canyon, but this population may have been extirpated. However, undiscovered populations might exist in the New Mexico portion of GUMO where the habitat appears suitable. In Mexico, Valdés-Reyna (2009, pp. 2, 3, 13, 15) collected Guadalupe fescue in the Sierra Maderas del Carmen in 2007 and September 1 - 3, 2009, but did not determine the population size. He also visited Johnston's 1973 collection site in the Sierra El Jardín, but did not find the species there. Both of these mountain ranges are within the Area de Protección de Flora y Fauna Maderas del Carmen, a protected natural area owned by CEMEX, a cement manufacturer. In 2008 and 2009, Valdés-Reyna was unable to obtain access to the Sierra de la Madera site where he and Wendt collected the species in 1977 (Valdés-Reyna 2009, p. 13). We do not know if the population northwest of Fraile has been surveyed since 1941; Valdés-Reyna (2010, p. 1) did not have information on that collection. Many potentially suitable sites in the mountains of Coahuila, where other populations may exist, have not been surveyed.

Population Estimates/Status:

Personnel from TPWD and the National Park Service (NPS) have monitored the BIBE population continuously since 1993 (Gordon and Poole 2009, p. 2; BIBE and Service 2008, p. 3). Since 1993, the population of sample plots that contain about half the total population has ranged from 66 to 136 individuals, varying within 67% of the mean. Therefore, the average total population is estimated to be about 200 individuals scattered over an area of 2 ha (5 ac) (BIBE and Service 2008, p. 3). The greatest number of plants followed three consecutive years (1990-1992) when annual precipitation exceeded 150% of the long-term average (BIBE and Service 2008, p. 3). The least number of plants was observed after an extremely dry period in 2000 and 2001 (BIBE and Service 2008, p. 3). Since 2002, when all individuals were permanently marked, annual recruitment (mean 14.3 individuals) has exceeded annual mortality (mean 5.0 individuals) each year (BIBE and Service 2008, p. 3). In September 2010, the plots had 115 live individuals, and recruitment (21) exceeded mortality (5) (Sirotnak 2011, p. 1). A historically unprecedented period of exceptional drought and high temperatures prevailed from October 2010 until November 2011. However, we will not know the full impacts of this drought on Guadalupe fescue populations until monitoring is completed during the September 2012 flowering season.

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

Wildfire

The pine-oak-juniper woodlands of the Chisos Mountains experienced relatively frequent, low-intensity wildfires for centuries (Moir and Meents 1981, p. 7; Moir 1982, pp. 90-98; Poole 1989 p. 8; Zimmerman and Moir 1998, p. 12; Camp et al. 2006, pp. 3-6, 14-23, 59-61). Wildfire has been suppressed at BIBE since its establishment in 1944; no wildfires have occurred at the Guadalupe fescue site since that time (Camp et al. 2006, p. 4). Periodic wildfire and leaf litter reduction may be necessary for long-term survival of Guadalupe fescue populations, although this has not been investigated (BIBE and Service 2008, pp. 4-5). The absence of wildfire in the Chisos range has led to an increased density of small-diameter trees and a deep accumulation of leaf litter. This high fuel load increases the risk of a much more intense wildfire that could kill all or most of the vegetation and sterilize the soil. The impact of an intense wildfire, should one burn through the site of the remaining Guadalupe fescue population would potentially be catastrophic.

Grazing

Guadalupe fescue is a palatable forage grass and is potentially threatened by grazing animals (Poole 1989, p. 13). Although BIBE and Maderas del Carmen do not allow livestock grazing, trail crews at BIBE use horses and mules (Poole 1989, p. 14; Gordon and Poole 2009 p. 2). Introduced animals, including feral burros, horses, hogs, and audad (Barbary sheep) have damaged native vegetation and habitats in other areas of BIBE. Due to the small population sizes at BIBE, Maderas del Carmen, and perhaps other sites, the loss of even a few individuals could reduce the genetic diversity below the level necessary for long-term survival.

Recreation

A popular hiking trail from Pinnacles to Boot Spring at BIBE bisects the Guadalupe fescue population and raises some potential threats. These threats include trampling by hikers straying from the trail, trampling or grazing by pack animals used by BIBE personnel, and erosion or debris flow caused by trail runoff. In 2005, debris flows below trail switchbacks buried some of the monitored Guadalupe fescue plants up to 20 cm (8 in.) deep; however, trail runoff may or may not have caused the debris flow (BIBE and Service 2008, p. 5).

Invasive Species

Horehound (Marrubium vulgare), an introduced invasive plant, is present in Boot Canyon at BIBE but has been removed from the vicinity of the Guadalupe fescue site (BIBE and Service 2008, p. 5). Horehound, King Ranch bluestem (Bothriochloa ischaemum), and other invasive plant species potentially threaten the species throughout its range.

Climate Change

According to the Intergovernmental Panel on Climate Change (IPCC) (2007, p. 1) “Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.” Average Northern Hemisphere temperatures during the second half of the 20th century were very likely higher than during any other 50-year period in the last 500 years and likely the highest in at least the past 1,300 years (IPCC 2007, p. 1). It is very likely that, over the past 50 years, cold days, cold nights, and frosts have become less frequent over most land areas, and hot days and hot nights have become more frequent (IPCC 2007, p. 1). It is likely that heat waves have become more frequent over most land areas, and the frequency of heavy precipitation events has increased over most areas (IPCC 2007, p. 1).

The IPCC (2007, p. 6) predicts that changes in the global climate system during the 21st century are very likely to be larger than those observed during the 20th century. For the next two decades a warming of about 0.2°C (0.4°F) per decade is projected (IPCC 2007, p. 6). Afterwards, temperature projections increasingly depend on specific emission scenarios (IPCC 2007, p. 6). Various emissions scenarios suggest that by the end of the 21st century, average global temperatures are expected to increase 0.6°C to 4.0°C (1.1°F to 7.2°F) with the greatest warming expected over land (IPCC 2007, p. 6-8). Localized projections suggest the southwest may experience the greatest temperature increase of any area in the lower 48 States (IPCC 2007, p. 8). The IPCC says it is very likely that hot extremes, heat waves, and heavy precipitation will increase in frequency (IPCC 2007, p. 8). There is also high confidence that many semi-arid areas like the western United States will suffer a decrease in water resources due to climate change (IPCC 2007, p. 8). Milly et al. (2005, p. 347) project a 10–30 percent decrease in precipitation in mid-latitude western North America by the year 2050 based on an ensemble of 12 climate models.

A drier, warmer climate may adversely affect Guadalupe fescue by making the small amount of habitat the

species is known to occupy unsuitable. It may also improve habitat conditions for invasive plant species and/or for plants that currently occupy drier, hotter habitat at lower elevations than Guadalupe fescue. .

Based on our evaluation, we conclude that Guadalupe fescue is threatened by the present and threatened destruction, modification, or curtailment of its habitat and range.

B. Overutilization for commercial, recreational, scientific, or educational purposes:

We are not aware of any overutilization for commercial, recreational, scientific, or educational purposes.

C. Disease or predation:

The collected seeds of Guadalupe fescue sometimes contain an endogenous fungus (a fungus that lives within the host plant cells) (Poole 1989, p. 16). Investigators have not determined whether this fungal infection occurs naturally or is caused by handling and storage in seed banks, nor what effect this has on seed germination, viability, and vigor. However, this fungus may interfere with seed banking and propagation work conducted at Desert Botanical Gardens and elsewhere, and potentially threatens wild populations (Poole 2007). Therefore, we conclude that Guadalupe fescue may be threatened by disease.

D. The inadequacy of existing regulatory mechanisms:

Guadalupe fescue is not legally protected by the State of Texas. The NPS manages all species on their lands in accordance with the National Park Service Organic Act of 1916, but there are no specific regulatory prohibitions protecting Guadalupe fescue.. The BIBE Fire Management Plan contains protections for the species, but does not include management of the Guadalupe fescue site with prescribed burning. Guadalupe fescue is not protected under Mexican Federal law (SEMARNAT 2010, p. 1; Valdes-Reyna 2010). However, on August 26, 2008, the Service, BIBE, and GUMO signed a Candidate Conservation Agreement (BIBE and Service 2008) that provides for conservation of Guadalupe fescue on NPS lands through monitoring, seed banking, fire management, trail and visitor management, and establishment of an advisory team of species experts.

We conclude that existing regulations do not sufficiently limit or alleviate threats to Guadalupe fescue in the United States or Mexico.

E. Other natural or manmade factors affecting its continued existence:

The known populations of Guadalupe fescue are isolated from each other and contain relatively few individuals. It is extremely unlikely that any gene flow, through pollen transfer or seed dispersal, occurs between these populations (all grasses are wind pollinated). The small sizes and isolation of these populations make them more vulnerable to inbreeding depression (Barret and Kohn 1991, p. 4) and to catastrophic losses from wildfires or other chance events. Although the reproductive system of Guadalupe fescue and the genetic composition of its populations have not been determined, some Festuca species are obligate outcrossers (Pedersen and Sleper 1993, p. 187; Fryxell 1957 p. 180). If Guadalupe fescue is an obligate outcrosser, the loss of even a few individuals from a small, isolated population could reduce or prevent sexual reproduction within the population, if the remaining individuals are too closely related. Long-term survival of the species may require outcrossing with other extant populations of this species (Best 2007, p. 1). However, the progeny of a cross between different populations could also suffer from outbreeding depression (Edmands 2007, pp.464, 466), rendering the offspring less fit than the parent populations. Therefore, experimental

reproduction studies should be conducted ex-situ to prevent possible contamination of the remaining populations with unfit genotypes.

We conclude that Guadalupe fescue is threatened by other natural or manmade factors including the small size and isolation of known populations, the potential for catastrophic losses, and the potentially limited genetic diversity within and among populations.

Conservation Measures Planned or Implemented :

In 1998, the Service and BIBE signed a Candidate Conservation Agreement for the conservation of Guadalupe fescue (BIBE and Service 1998), which expired in April 2005. The Service, BIBE, and GUMO signed an updated Candidate Conservation Agreement on August 26, 2008, which will remain in effect for 10 years (BIBE and Service 2008). The 2008 agreement continues many of the provisions initiated under the 1998 agreement, including monitoring, seed banking, fire management, trail and visitor management, and establishment of an advisory team of species experts. The National Seed Storage Laboratory, Fort Collins, Colorado, has established a Guadalupe fescue seed bank to enable the restoration of populations lost to unanticipated catastrophic events. The 2008 agreement adds new actions, including educating staff and visitors, monitoring and controlling invasive species, and cooperation with Mexican agencies and researchers to conserve the known populations and search for new ones. Scientific research objectives include the potential role of fire and other habitat management strategies, genetic structure and reproductive biology, continued surveys at GUMO and in Coahuila, establishment of a germ plasm (live plant) bank, and techniques for reintroduction of the species.

Summary of Threats :

Threats include potential changes in the wildfire cycle and vegetation structure, trampling from humans and pack animals, possible grazing, trail runoff, fungal infection of seeds, small sizes and isolation of populations, climate change, and limited genetic diversity. Threats to the Maderas del Carmen population are presumed to be similar. The status of other Mexican populations is unknown.

We find that Guadalupe fescue is warranted for listing throughout all of its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

Implement all measures contained in the 2008 Candidate Conservation Agreement (see CONSERVATION MEASURES above).

Priority Table

Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/Population	6
Moderate to Low	Imminent	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-imminent	Monotypic genus	10
		Species	**11**
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

Magnitude:

The magnitude of threats to Festuca ligulata is moderate. The two extant populations occur on protected natural areas. The Candidate Conservation Agreement extended in 2008 between the Service and NPS provides for conservation of the species, including population monitoring, appropriate fire management and cooperative efforts by the NPS and its partners in the United States and Mexico. NPS is aware of threats and has confirmed its commitment to conserving this species.

Imminence :

Threats to the overall population are non-imminent, due to the 2008 Candidate Conservation Agreement, monitoring, and other conservation actions that alleviate threats to the species.

__Yes__ Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

__No__ Is Emergency Listing Warranted?

We have no information that would indicate the threats are likely to extirpate this species before a normal listing process could be conducted.

Description of Monitoring:

BIBE conducts annual monitoring of the U.S. population. The monitoring includes numbers of individual plants, age and size profiles, reproductive success, and general information about the vegetation community (Sirotnak 2011, p. 1-2).

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Texas

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

TPWD informed us that they have received no new information on Guadalupe fescue during the last year (Poole 2011).

Literature Cited:

Aiken, S. G. and L. L. Consaul. 1995. Leaf cross sections and phytogeography: a potent combination for identifying members of Festuca subgg. Festuca and Leucopoa (Poaceae) occurring in North America. American Journal of Botany 82: 1287-1299.

Aiken, S.G., Dallwitz, M.J., McJannet, C.L. and Consaul, L.L. 1996 onwards. Festuca of North America: descriptions, illustrations, identification, and information retrieval. Version: 19th October 2005. http://delta-intkey.com/. Accessed March 6, 2009.

Appelhons, D. J. 1973. Grassland vegetation of a relict community in the Franklin Mountains, El Paso County, Texas. Master's Thesis. University of Texas at El Paso, El Paso, Texas. 59 leaves.

Barrett, S.C.H. and J.R. Kohn. 1991. Genetic and evolutionary consequences of small population size in plants: Implications for conservation. Pp. 1-30 in D. Falk and K.E. Holsinger, eds. Genetics and Conservation of Rare Plants. Oxford University Press, New York. 283 pp.

Best, C. 2007. Email from Chris Best, U.S. Fish and Wildlife Service, to Joe Sirotnak, National Park Service. Subject: FW: Festuca ligulata. January 10, 2007. 1pp.

Big Bend National Park and U.S. Fish and Wildlife Service (BIBE and Service). 1998. Conservation Agreement for Castilleja elongata (Tall Paintbrush) and Festuca ligulata (Guadalupe Fescue). 17 pp. + Appendices. U.S. Fish and Wildlife Service, Austin Ecological Services Field Office.

Big Bend National Park and the U.S. Fish and Wildlife Service (BIBE and Service). 2008. Candidate Conservation Agreement for Festuca ligulata (Guadalupe Fescue). 18 pp. + 5 pp. appendices. U.S. Fish and Wildlife Service, Austin Ecological Services Field Office.

Camp, A., H. M. Poulos, R. Gatewood, J. Sirotnak, and J. Karges. 2006. Assessment of top down and bottom up controls on fire regimes and vegetation abundance and distribution patterns in the Chihuahuan Desert borderlands: a hierarchical approach. Final Report to the Joint Fire Science Program # 03-3-3-13. Yale University School of Forestry and Environmental Studies. New Haven, CT. 77 pp.

Comisión Nacional de Areas Naturales Protegidas. 2010. Areas Naturales Protegidas y áreas destinadas voluntariamente a la conservación. Actualización: 15 febrero, 2010. http://www.conanp.gob.mx/sig/información/info.htm. Accessed: March 18, 2010.

Edmands, S. 2007. Between a rock and a hard place: evaluating the relative risks of inbreeding and outbreeding for conservation and management. Molecular Ecology 16: 463-475.

Fryxell, P. A. 1957. Mode of Reproduction in Higher Plants. Bot. Rev. 23: 135 – 233.

Gordon, W. and J. M. Poole. 2009. Texas Parks and Wildlife Department. Letter dated March 5, 2009. 25 pp.

Gould, F. W. 1975. The Grasses of Texas. Ill. V. Kapadia. Texas A&M Press. College Station, Texas. 653 pp.

Integrated Taxonomic Information System. 2011. Festuca ligulata Swallen. http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=40803. Accessed: May 4, 2011. 3 pp.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate change 2007: synthesis report, summary for policymakers. Intergovernmental Panel on Climate Change, Fourth Assessment Report. Released on 17 November 2007. 23 pp. Available from: http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf.

Milly, P.C.D., K.A. Dunne, and A.V. Vecchia. 2005. Global pattern of trends in stream flow and water availability in a changing climate. Nature 438:347-350. Moir, W. 1982. A fire history of the high Chisos, Big Bend National Park, Texas. The Southwestern Naturalist 27:87-98.

Moir, W. and J. Meents. 1981. Fire ecology study of the Chisos Mountains, Big Bend National Park, Texas. Phase II. CDRI Contribution No. 117. Final report of contract no. CX 70298005 for the National Park Service. Chihuahuan Desert Research Institute, Alpine, TX. 25 pp. + appendix.

Natural Resources Conservation Service. 2011. The PLANTS Database. Festuca ligulata Swallen. (http://plants.usda.gov/java/nameSearch?keywordquery=Festuca+ligulata&mode=sciname&submit.x=12&subr Accessed: May 4, 2011. National Plant Data Center, Baton Rouge, LA 70874-4490 USA. 3 pp.

Pedersen, J. F. and D. A. Sleper. 1993. Genetic manipulation of tall fescue. Agriculture, Ecosystems and Environment 44: 187-193.

Poole, J. 1989. Status survey on Festuca ligulata. Texas Natural Heritage Program, Texas Parks and Wildlife Department. Unpublished report. U.S. Fish and Wildlife Service, Austin Ecological Services Field Office. 23 pp. plus maps and figures.

Poole, J. 2007. Telephone conversation with Jackie Poole, Botanist, Texas Parks and Wildlife Department, Texas (2007).

Poole, J.M.. 2011. Telephone conversation between Jackie Poole, Texas Parks and Wildlife Department and Chris Best, U.S. Fish and Wildlife Service. Re: 2011 CNOR. March 31, 2011.

Poole, J. M., W. R. Carr, D. M. Price and J. R. Singhurst. 2007. Rare Plants of Texas. Texas A&M Press, College Station, Texas. 639 pp.

Secretaría del Medio Ambiente y Recursos Naturales (SEMARNAT). 2010. Normas Oficiales Vigentes Ordenadas por Materia. NOM-059-ECOL-2001. http://www.semarnat.gob.mx/leyesynormas/Pages/normasoficialesmexicanasvigentes.aspx. México, D. F. Accessed March 16, 2010.

Sirotnak, J. 2011. 1993-2010 Festuca ligulata monitoring data summary table – working. Microsoft Word file attached to Email from Joe Sirotnak, National Park Service, to Chris Best, Service. Re: Sept 2010 Guadalupe Fescue Survey Data. March 2, 1011. 2 pp.

Swallen, J. R. 1932. Five new grasses from Texas. American Journal of Botany. 19:436-440.
Texas Natural Diversity Database. 2007. Element occurrence printouts for Festuca ligulata. Wildlife Diversity Program of Texas Parks and Wildlife Department. April 19, 2007. 9,079 pp.

Tropicos.org. Missouri Botanical Garden. http://www.tropicos.org/Specimen/1984542 Accessed May 4, 2011. 1 pp.

Valdés-Reyna, J. 2009. Gramíneas raras del desierto Chihuahuense: estatus de Festuca ligulata en Coahuila, México. Reporte Final, Contrato OK44. Submitted to World Wildlife Fund and National Park Service. 23 pp.

Valdes-Reyna, J. 2010. Email from Jesús Valdes-Reyna, Universidad Autónoma Agronómica Antonio Narro, to Chris Best, Service. Re: Preguntas sobre Festuca ligulata. March 16, 2010. 1 pp.

Worthington, R. D. 1991. Letter to the Texas Natural Heritage Program, March 13. Texas Parks and Wildlife Department files, Austin, Texas. 1 p.

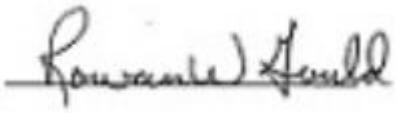
Zimmerman, J. A. C. and W. H. Moir. 1998. Conservation status of Festuca ligulata in the Chisos Mountains, Big Bend National Park. RM-4251. Sustainability of Southwestern Forest and Woodland Ecosystems. USDA Forest Service. X pp.

Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted

12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  05/30/2012
Date

Concur:  11/06/2012
Date

Did not concur: _____ _____
Date

Director's Remarks: