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Candidate Petition Project

PLANTS

PETITIONS TO LIST AS FEDERALLY ENDANGERED SPECIES

The following document contains the individual petitions for the 47 plant species to be listed as federally endangered species under the federal Endangered Species Act.

Aquarius paintbrush	***Castilleja aquariensis***
Big Pine partridge pea	***Chamaecrista lineata var. keyensis***
Pineland sandmat	***Chamaesyce deltoidea ssp.pinetorum***
Wedge spurge	***Chamaesyce deltoidea ssp.serpyllum***
Cape Sable thoroughwort	***Chromolaena frustrata***
Puerto Rico manjack	***Cordia rupicola***
Florida prairie-clover	***Dalea carthagenensis var. floridana***
Florida pineland crabgrass	***Digitaria pauciflora***
Basalt daisy	***Erigeron basalticus***
Lemmon's fleabane	***Erigeron lemmonii***
Umtanum desert-buckwheat	***Eriogonum codium***
Red Mountain buckwheat	***Eriogonum kelloggii***
Guadalupe fescue	***Festuca ligulata***
Wonderland Alice-flower	***Gilia caespitosa***
Island brittleleaf	***Gonocalyx concolor***
Whorled sunflower	***Helianthus verticillatus***
Neches River rose-mallow	***Hibiscus dasycalyx***
Florida Keys indigo	***Indigofera mucronata var. keyensis***
Gladecress	***Leavenworthia crassa***
Texas golden gladecress	***Leavenworthia texana***
Short's bladder-pod	***Lesquerella globosa***
White bluffs bladderpod	***Lesquerella tuplashensis***
Sand flax	***Linum arenicola***
Carter's small-flowered flax	***Linum carteri var. carteri***
Bog asphodel	***Narthecium americanum***
Florida semaphore cactus	***Consolea corallicola***
Hirst's panic grass	***Panicum hirstii***
Bushy whitlow-wort	***Paronychia congesta***
Fickeisen plains cactus	***Pediocactus peeblesianus var. fickeiseniae***
Parachute beardtongue	***Penstemon debilis***
DeBeque phacelia	***Phacelia submutica***
White fringless orchid	***Platanthera integrilabia***
Stonecrop (Red Mountain)	***Sedum eastwoodiae***

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Ramshaw Meadow sand-verbena	***Abronia alpina***
Georgia rockcress	***Arabis georgiana***
Blodgett's silverbrush	***Argythamnia blodgettii***
Georgia aster	***Aster georgianus***
Horseshoe milk-vetch	***Astragalus equisolensis***
Sleeping Ute milk-vetch	***Astragalus tortipes***
Northern wormwood	***Artemisia campestris var. wormskioldii***
Florida brickle-bush	***Brickellia mosieri***
Calliandra locoensis	***Calliandra locoensis***
Calyptranthes estremerae	***Calyptranthes estremerae***
Parish's checkerbloom	***Sidalcea hickmanii ssp. parishii***
Webber's ivesia	***Ivesia webberi***
Soldier Meadows cinquefoil	***Potentilla basaltica***
White River beardtongue	***Penstemon scariosus var. albifluvis***

PETITION TO LIST

Aquarius paintbrush
(*Castilleja aquariensis*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The status of *Castilleja aquariensis* (Scrophulariaceae) as a taxonomically valid species is uncontroversial (e.g., Welsh et al. 1993; Kartesz 1998).

NATURAL HISTORY

Morphology:
Castilleja aquariensis is a perennial herb, 1.5-3 dm tall, and probably somewhat parasitic. It has spikes of flowers with pale yellow bracts in late June-August (bracts are more conspicuous than the flower petals).

Habitat:
Castilleja aquariensis is endemic to the upper elevations of the Aquarius Plateau (including Boulder Mountain) on the boundary between Garfield and Wayne Counties in south central Utah. The species occurs sporadically in an area about 25 miles across in an east-west direction and about 6 miles across in a north-south direction. Its typical habitat is subalpine sagebrush-grass meadows and openings in spruce communities in rocky/gravelly soils from about 2800-

3650 m elevation.

POPULATION STATUS

The entire population of this species is estimated at about 45,000 individuals.

The U.S. Fish and Wildlife Service classifies *Castilleja aquariensis* as a candidate for Endangered Species Act protection with a listing priority number of 8. The Utah Natural Heritage Program lists this species as Imperiled.

LISTING CRITERIA

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

Historical range: Utah.

Current range: Upper elevations of the Aquarius Plateau (including Boulder Mountain) on the boundary between Garfield and Wayne Counties in south central Utah**.**

Land ownership: The species occurs entirely on public lands within the Dixie National Forest.

Some populations of *C. aquariensis* are vulnerable to habitat destruction and degradation as a consequence of road construction to support recreational and timber harvesting activities within the species' range.

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

None known.

C. *Disease or predation.*

This species is extensively impacted by domestic livestock grazing. It has been virtually eliminated in sheep grazing allotments and has been greatly reduced in both numbers and reproductive vigor in areas of moderate to heavy cattle grazing. Current studies have estimated a total population of about 42,000 individuals in areas of light cattle grazing (over 90 percent of the species' total population on about 10 percent of the species' potential habitat).

The entire Aquarius Plateau is considered by many botanists and range conservationists to be severely overgrazed. Efforts by the Forest Service to reduce grazing and implement grazing systems that would promote enhanced vigor of forage species have been opposed by livestock

grazing permittees. Continuation of current grazing patterns and intensities may extirpate the species from much of its remaining occupied habitat leaving the species to persist only in its more inaccessible relictual habitat. These relictual stands themselves continue to be vulnerable to overgrazing as lack of rangeland forage abundance and quality may force utilization of nontraditional grazing areas.

D. ***The inadequacy of existing regulatory mechanisms.***

No Federal or State laws or regulations specifically protect *C. aquariensis*. The Forest Service administratively recognizes this species for special management consideration. Intensive livestock management will be necessary for the recovery of the species. As described above, *C. aquariensis* is a sensitive indicator of grazing intensity on the overall plant community. A reduction in range carrying capacity and other alterations of the current domestic livestock grazing practices are necessary for the conservation of the species ecosystem. Protection of *C. aquariensis* is in keeping with the Forest Service's mission to provide for the sustained yield of range forage, one of its trust resources, to improve the grazing system on the Aquarius Plateau.

While the conservation of *C. aquariensis* may require intensive management, this management will benefit the entire ecosystem and should be implemented if only as a good management practice. Proposed grazing systems would increase intensity of grazing use in these areas with vigorous populations of *C. aquariensis* while reducing intensity of grazing use in areas of current heavy use without vigorous *C. aquariensis* populations. Threat to the species is imminent with the current grazing situation. The Fish and Wildlife Service and Forest Service signed a conservation agreement for this species. However, due to resistance from local ranchers and county governments this conservation agreement is not yet fully implemented (U.S. Fish and Wildlife Service candidate assessment form)..

Current Conservation Efforts: The Forest Service is currently studying the biology and ecology of *C. aquariensis,* emphasizing the impact of livestock grazing on the species' reproductive vigor. In addition, the Forest Service intends to monitor the population to determine whether proposed changes in the grazing system would increase the viability of the population throughout its range on the Aquarius Plateau.

The U.S. Fish and Wildlife Service and Forest Service have entered into a conservation agreement for *C. aquariensi*s. The Forest Service proposed a 40 percent+ reduction in livestock grazing within the range of the *C. aquariensis* to bring forage utilization to the carrying capacity of that range. The grazing permittees challenged the Forest Service both legally and administratively to prevent the Forest Service's planned reduction. Full implementation of the conservation agreement is contingent upon that planned reduction.

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

Low population numbers and population fragmentation resulting from the extirpation of several of the species' smaller historic stands poses a threat to the species' genetic potential to adapt to changing environmental conditions.

REFERENCES:

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Whittekiend, D.C. 1992. Effects of Ungulate Grazing on *Castilleja aquariensis* N. Holmgren (Scrophulariaceae), A Central Utah Endemic and notes on Pollination of Aquarius Paintbrush *Castilleja aquariensis* N. Holmgren (Scrophulariaceae). Unpublished Thesis, Brigham Young University, Provo, Utah. 39 pp.

PETITION TO LIST

Big Pine partridge pea
(*Chamaecrista lineata* var. *keyensis*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The status of *Chamaecrista lineata* var. *keyensis* (Fabceae) as a taxonomically valid variety is uncontroversial; *Cassia keyensis* is a synonym for this taxon (e.g., Kartesz 1998; Wunderlin and Hansen 2000). This species is also known as Key cassia.

NATURAL HISTORY

Chamaecrista lineata var. *keyensis* is an herbaceous perennial plant that occurs only on the edges of rockland hammocks and pinelands in the pine rocklands ecological community. It is shade intolerant and requires periodic burning to reduce competition from woody vegetation (TNC 1999). It was historically known from Big Pine Key and from one site on Cudjoe Key, Monroe County, Florida (Long and Lakela 1971). It is presently known only from Big Pine Key, where Ross and Ruiz (1996) found it in 130 of 145 (89 percent) pine rockland sample plots on the island.

POPULATION STATUS

The total number of individuals has been estimated to be close to 10,000. Most known plants

occur on the National Key Deer Refuge, with approximately 1,000 or fewer plants occurring on unprotected, privately-owned lands elsewhere on Big Pine Key (Bradley and Gann 1999).

Pine rocklands on the National Key Deer Refuge encompass approximately 400 hectares (ha) (1,000 acres) of the refuge's 3,300 ha (8,200 acres (ac)) (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). Given the species' narrow habitat range, and the small number of individuals that occur, *Chamaecrista lineata* var. *keyensis* is vulnerable to extinction.

The U.S. Fish and Wildlife Service classifies *Chamaecrista lineata* var. *keyensis* as a candidate for Endangered Species Act protection with a listing priority number of 6. The State of Florida lists this variety as endangered (Wunderlin and Hansen 2000). The Florida Natural Heritage Program lists this taxon as Imperiled.

LISTING CRITERIA

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

Historical range: Big Pine Key and one site on Cudjoe Key, Florida.

Current range: Big Pine Key, Florida.

Land ownership: *Chamaecrista lineata* var. *keyensis* can be found within the 40.5-ha (1,000-ac) pine rocklands portion of the 3,321-ha (8,200-ac) National Key Deer Refuge. Other known populations occur on private lands within proximity of the National Key Deer Refuge and are not protected.

The acreage of pine rocklands on Big Pine Key was reduced from 1,049 ha (2,592 ac) in 1955 to 701 ha (1,732 ac) in 1989 (Folk 1991). This has resulted in a loss of approximately 33 percent of habitat. A significant amount of pine rockland habitat in the Keys is still threatened by development (personal communication 1998 cited in U.S. Fish and Wildlife Service candidate assessment form). Based on the number of people moving to Florida, pressures from development are not expected to diminish in the years to come, especially throughout the range of *Chamaecrista lineata* var. *keyensis*. Florida had a 15.3 percent increase in the human population from April 1, 1990, to July 1, 1998, and was ranked as the fourth fastest growing state in the nation during 1998 (U.S. Census Bureau 1998).

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

None are known.

C. *Disease or predation.*

None are known.

D. *The inadequacy of existing regulatory mechanisms.*

The Florida Department of Agriculture and Consumer Services has designated this species as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur.

Current Conservation Efforts: The National Key Deer Refuge is conducting studies to determine proper fire regimes for the listed species that occur in pine rocklands; however, there are no specific conservation activities for *Chamaecrista lineata* var. *keyensis*. Although the conservation activities on the National Key Deer Refuge are not targeting *Chamaecrista lineata* var. *keyensis*, the species may benefit since it occupies habitat utilized by other listed species. The U.S. Fish and Wildlife Service has developed a multi-species recovery plan. This plan is ecosystem-based and includes many recommendations for conservation of the pine rockland community (U.S. Fish and Wildlife Service 1998).

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

Fire suppression and exotic plant invasions are the biggest threats to *Chamaecrista lineata* var. *keyensis*. Fire is required to maintain the pine rockland community. Under natural conditions, lightning fires typically occurred at 3- to 7-year intervals. With fire suppression, hardwoods eventually invade pine rocklands and shade out understory species like *Chamaecrista lineata* var. *keyensis*. Fire suppression has reduced the size of the areas that burn and habitat fragmentation has prevented fire from moving across the landscape in a natural way. Thus, many pine rockland communities have moved past their normal "fire subclimax" and are succeeding to tropical hardwood hammock communities.

Currently, experimental fire regimes are being conducted on the National Key Deer Refuge on Big Pine Key. The U.S. Fish and Wildlife Service is working cooperatively with Florida International University in Miami to determine the proper fire frequencies necessary to maintain the pine rockland community on the refuge. The fire management activities are designed to induce two burns per year for 2 years, at 8 ha (20 ac) a year. This management plan is designed for the endangered Key Deer (*Odocoileus virginianus clavium*), the threatened Garber's spurge (*Chamaesyce* (= *Euphorbia*) *garberi*), and the endangered key tree-cactus (*Pilosocereus* (=*Cereus*) *robinii*), all of which utilize the pine rockland ecological community. *Chamaecrista lineata* var. *keyensis* may benefit from the refuge's fire management plan.

Exotic plants have significantly affected pine rocklands. At least 277 taxa of exotic plants are now known to invade pine rocklands in South Florida (U.S. Fish and Wildlife Service 1998). Some of these may compete directly with *Chamaecrista lineata* var. *keyensis* for space and resources, while others have a profound effect on community structure and responses to fire. The

exotic tree, Brazilian pepper (*Schinus terebinthifolius*) is the most widespread and one of the most invasive species. If left uncontrolled in a fire-suppressed pineland, it will form a dense monospecific canopy almost completely eliminating native vegetation. Earleaf acacia (*Acacia auriculiformis*), natal grass (*Rhynchelytrum repens*), shrub verbena (*Lantana camara*), and tongue tree (*Albezia lebbeck*) are some of the other exotic pests in pine rocklands.

All of these species affect the characteristics of a fire when it does occur. Fires that once burned fairly cool with mostly pine needle duff for fuel may now burn much hotter and affect the type of community that develops following fire. For instance, a catastrophic fire moves the herbaceous component to bracken fern thickets rather than grasses. Therefore, with the presence of exotic species, it is uncertain just how a managed fire regime will affect *Chamaecrista lineata* var. *keyensis*.

Based on the small number of individuals and narrow range, catastrophic events such as hurricanes and tropical storms may negatively affect *Chamaecrista lineata* var. *keyensis*. Either type of event could extirpate remaining populations, possibly causing the extinction of the species.

REFERENCES

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PETITION TO LIST

pineland sandmat
(*Chamaesyce deltoidea pinetorum*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The status of *Chamaesyce deltoidea pinetorum* (Euphorbiaceae) as a taxonomically valid subspecies is uncontroversial; *Euphorbia smallii* is a synonym for this taxon (e.g., Kartesz 1998; Wunderlin and Hansen 2000).

NATURAL HISTORY

Morphology:
Chamaesyce deltoidea pinetorum is a small erect or nearly-erect herbaceous perennial forming small tufts. The stems have rather long hairs, as do the leaves, whose blades range in shape from kidney-shaped to triangular to oval. The "flowers" are specialized structures called cyathia, characteristic of the genus *Euphorbia* and its closest relatives (see Small 1933 for a technical description).

Habitat:
Chamaesyce deltoidea pinetorum is known only from the southern portion of the Miami Rock Ridge in southern Miami-Dade County, Florida (Small 1933, Long and Lakela 1971, Wunderlin 1998). The current and historic ranges are similar. This species occurs on the pine rocklands ecological community. It is shade intolerant and requires periodic burning to reduce competition from woody vegetation.

POPULATION STATUS

The total number of plants has been estimated to be fewer than 10,000. Fewer than 9,000 plants

occur at seven preserve sites: Everglades National Park, Florida City Pineland, Navy Wells Park, Palm Drive, Pine Ridge Sanctuary, Rock Pit #39, and Seminole Wayside Park. Fewer than 1,000 plants occur at fewer than 10 private unprotected sites (two 1999 personal communications cited in U.S. Fish and Wildlife Service candidate assessment form).

The U.S. Fish and Wildlife Service classifies *Chamaesyce deltoidea pinetorum* as a candidate for Endangered Species Act protection with a listing priority number of 6. The State of Florida lists this subspecies as endangered (Wunderlin and Hansen 2000). The Florida Natural Heritage Program lists this subspecies as Critically Imperiled.

LISTING CRITERIA

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

Historical range:	Southern portion of the Miami Rock Ridge in southern Miami-Dade County, Florida.
Current range:	Southern portion of the Miami Rock Ridge in southern Miami-Dade County, Florida.
Land ownership:	Over 90 percent of the remaining habitat occurs in Everglades National Park; most of the remaining habitat occurs on preserves managed by Miami-Dade County. The 10 sites on private property make up only a small fraction of the available habitat.

Much of the habitat of *Chamaesyce deltoidea pinetorum* has been negatively altered by human development. Pine rocklands in Miami-Dade County have been reduced to about 11 percent of their former extent (Kernan and Bradley 1996). Of the estimated historical extent of 74,000 hectares (ha) (182,800 acres), only 8,140 ha (20,110 acres) of pine rocklands remained in 1996. Outside the Everglades National Park, only about 1 percent of the Miami Rock Ridge pinelands have escaped clearing, and much of the remaining pinelands is in small remnant blocks isolated from other natural areas (Herndon 1998).

Florida had a 15.3 percent increase in its human population from April 1, 1990, to July 1, 1998, and was ranked as the fourth fastest growing state in the nation during 1998 (U.S. Census Bureau 1998). This trend is expected to continue. Herndon (1998) and Bradley and Gann (1999) suggest that hydrologic manipulations to Taylor Slough and the Shark River Slough could affect the occurrence of *Chamaesyce deltoidea pinetorum* in Everglades National Park, and that excessive flooding in the pine rockland of Long Pine Key may be damaging to this population.

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

None are known.

C. *Disease or predation.*

None are known

D. *The inadequacy of existing regulatory mechanisms.*

The Florida Department of Agriculture and Consumer Services has designated *Chamaesyce deltoidea*, which includes *pinetorum* and two other subspecies, as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which discloses project impacts, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur.

Current Conservation Efforts: In 1979, Miami-Dade County enacted the Environmentally Endangered Lands Covenant Program which gives private land owners of pine rockland habitat a tax break if they agree to not develop the property and instead to manage it for a period of ten years (U.S. Fish and Wildlife Service 1998). The U.S. Fish and Wildlife Service has developed a multi-species recovery for the threatened and endangered species of South Florida. This plan is ecosystem-based and includes many recommendations for conservation of the pine rockland community (U.S. Fish and Wildlife Service 1998).

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

Fire suppression and exotic plant invasions are the greatest threats to *Chamaesyce deltoidea pinetorum*. Fire is required to maintain the pine rockland community. Under natural conditions, lightning fires typically occurred at 3- to 7-year intervals. With fire suppression, hardwoods eventually invade pine rocklands and shade understory species like *Chamaesyce deltoidea pinetorum*. Fire suppression has reduced the areas that do burn, and habitat fragmentation has prevented fire from crossing the landscape in a natural way. Thus, many pine rockland communities have moved past their normal "fire subclimax" toward tropical hardwood hammock communities.

Invasive exotic species have also altered the type of fire that occurs in pine rocklands. Historically, pine rocklands had an open low understory where natural fires remained patchy with low temperature intensity, thus sparing many native plants such as *Chamaesyce deltoidea pinetorum.* The current density of exotic plant overgrowth may no longer allow the species to be conserved through prescribed burning. Dense vegetative growth can create very high fire temperatures and longer burning periods. Pine rockland plants cannot tolerate these extreme conditions. Given the current conditions, exotic plant control may require alternate, more labor intensive methods such as hand chopping followed by spot treatment, which is very costly because of the hand labor. Given the acreage of land, staffing, and budget constraints, this method may not be feasible in Everglades National Park staff or Miami-Dade County preserves. Exotic plant taxa seriously threaten pine rocklands. As a result of human activities, at least 277 taxa of exotic plants are now known to have invaded pine rocklands throughout South Florida (U.S. Fish and Wildlife Service 1999).

The most serious threats to *Chamaesyce deltoidea pinetorum* and other pine rockland endemic plants are from Brazilian pepper (*Schinus terebinthifolius*) and Burmareed (*Neyraudia reynaudiana*). Other invasive species, including melaleuca (*Melaleuca quinquenervia*), are also problems. Based on the small number of individuals within a narrow range, catastrophic events such as hurricanes and tropical storms may negatively affect *Chamaesyce deltoidea pinetorum*. Either type of event could extirpate remaining populations.

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PETITION TO LIST

wedge sandmat
(*Chamaesyce deltoidea serpyllum*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27//85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The status of *Chamaesyce deltoidea serpyllum* (Euphorbiaceae) as a taxonomically valid subspecies is uncontroversial; *Euphorbia deltoidea* var. *serpyllum* is a synonym for this taxon (e.g., Kartesz 1998; Wunderlin and Hansen 2000). This subspecies is also known as wedge spurge.

NATURAL HISTORY

Morphology
Chamaesyce deltoidea serpyllum is a small prostrate perennial herb. The stems are slender and numerous, radiating out from the tap root. The leaves are more or less triangular. The "flowers" are cyathia, the specialized inflorescences characteristic of the genus *Euphorbia* and its close relatives.

Habitat
Wedge sandmat is known only from pine rockland vegetation on Big Pine Key, Monroe County, Florida (Small 1933, Long and Lakela 1971, Wunderlin 1998, Ross and Ruiz 1996). The current and historic ranges are similar. This species occurs on the edges of hammocks and pinelands. *Chamaesyce deltoidea serpyllum* is shade intolerant and requires periodic burning to reduce

competition from woody vegetation.

POPULATION STATUS

The total number of individuals has been estimated to be fewer than 10,000 plants at only six sites. Most known plants occur on the National Key Deer Refuge, with approximately 1,000 or fewer plants occurring on unprotected, privately-owned lands within the vicinity of the refuge (Ross and Ruiz 1996; two 1999 personal communications cited in U.S. Fish and Wildlife Service candidate assessment form).

Pine rocklands on the National Key Deer Refuge at Big Pine Key encompass approximately 400 hectares (ha) (1,000 acres) of the refuge's 3,300 ha (8,200 acres (ac)). Ross and Ruiz (1996) found *Chamaesyce deltoidea serpyllum* only in study transects in the northern and eastern portions of the island. Given the species' narrow habitat range, and small number of individuals that occur, *Chamaesyce deltoidea serpyllum* is vulnerable to extinction.

The U.S. Fish and Wildlife Service classifies *Chamaesyce deltoidea serpyllum* as a candidate for Endangered Species Act protection with a listing priority number of 6. The State of Florida lists this subspecies as endangered (Wunderlin and Hansen 2000). The Florida Natural Heritage Program lists this taxon as Critically Imperiled.

LISTING CRITERIA

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

Historical range: Big Pine Key, Monroe County, Florida.

Current range: Big Pine Key, Monroe County, Florida.

Land ownership: *Chamaesyce deltoidea serpyllum* can be found within the 400.5-ha (1,000-ac) pine rocklands portion of the 3,321-ha (8,200-ac) National Key Deer Refuge. Although it probably occurs on other preserved sites on Big Pine Key, this needs to be documented. Other known populations are on private lands near the National Key Deer Refuge and are not protected

Acreage of pine rocklands on Big Pine Key was reduced from 1,049 ha (2,592 acres) in 1955 to 701 ha (1,732 acres) in 1989 (Folk 1991). This results in a loss of approximately 33 percent of habitat. A significant amount of pine rockland habitat in the Keys is still threatened by development (personal communication 1998 cited in U.S. Fish and Wildlife Service candidate assessment form). Based on the number of humans moving to Florida, pressures from development are not expected to diminish in the years to come, especially throughout the range of *Chamaesyce deltoidea serpyllum*. Florida had experienced a 15.3 percent increase in the

human population from April 1, 1990, to July 1, 1998, and was ranked as the fourth fastest growing state in the nation during 1998 (U.S. Census Bureau 1998).

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

None are known.

C. *Disease or predation.*

None are known.

D. *The inadequacy of existing regulatory mechanisms.*

The Florida Department of Agriculture and Consumer Services has designated *Chamaesyce deltoidea*, which includes *serpyllum* and two other subspecies, as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur.

Current Conservation Efforts: In association with the Florida International University of Miami, the National Key Deer Refuge on Big Pine Key is conducting a 2-year control burn study to determine proper fire regimes for Keydeer, which utilize pine rocklands. Although the conservation activities on the refuge are not targeting *Chamaesyce deltoidea serpyllum,* the species may benefit because it occupies habitat utilized by the Key deer.

The U.S. Fish and Wildlife Service has developed a multi-species recovery plan for the threatened and endangered species of South Florida. This plan is ecosystem-based and includes many recommendations for conservation of the pine rockland community (U.S. Fish and Wildlife Service 1998).

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

Fire suppression and exotic plant invasions are the biggest threats to *Chamaesyce deltoidea serpyllum*. Fire is required to maintain the pine rockland community. Under natural conditions, lightning fires typically occurred at 3- to 7-year intervals. With fire suppression, hardwooods eventually invade pine rocklands and shade out understory species like *Chamaesyce deltoidea serpyllum.* Fire suppression has reduced the size of the areas that do burn and habitat fragmentation has prevented fire from moving across the landscape in a natural way. Thus, many pine rockland communities have moved past their normal "fire subclimax" and are succeeding to tropical hardwood hammock communities.

Currently, experimental fire regimes are being conducted on the National Key Deer Refuge on Big Pine Key. The U.S. Fish and Wildlife Service is working cooperatively with Florida International University in Miami to determine the proper fire frequencies necessary to maintain

the pine rockland community on the refuge. The fire management activities are designed to induce two burns per year for 2 years, at 8 ha (20 ac) a year. This management plan is designed for the endangered Key Deer (*Odocoileus virginianus clavium*), and the threatened garber's spurge (*Chamaesyce* (= *Euphorbia*) *garberi*), which utilize the pine rockland ecological community. *Chamaesyce deltoidea serpyllum* may benefit from the Refuge's fire management plan.

Exotic plants have significantly affected pine rocklands. At least 277 taxa of exotic plants are now known to invade pine rocklands in South Florida (U.S. Fish and Wildlife Service 1998). Some of these may compete directly with *Chamaesyce deltoidea serpyllum* for space and resources, while others have a profound effect on community structure and responses to fire. The exotic tree, Brazilian pepper (*Schinus terebinthifolius*) is the most widespread and one of the most invasive species. If left uncontrolled in a fire-suppressed pineland, it will form a dense monospecific canopy almost completely eliminating native vegetation. Earleaf acacia (*Acacia auriculiformis*), natal grass (*Rhynchelytrum repens*), shrub verbena (*Lantana camara*), and tongue tree (*Albezia lebbeck*) are some of the other exotic pests in pine rocklands.

All of these species affect the characteristics of a fire when it does occur. Fires that once burned fairly cool with mostly pine needle duff for fuel may now burn much hotter and affect the type of community that develops following fire. For instance, a catastrophic fire moves the herbaceous component to bracken fern thickets rather than grasses. Therefore, with the presence of exotic species, it is uncertain just how a managed fire regime will affect *Chamaesyce deltoidea serpyllum*.

Based on the small number of individuals within a narrow range, catastrophic events such as hurricanes and tropical storms may negatively affect *Chamaesyce deltoidea serpyllum*. Either type of event could extirpate remaining populations.

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PETITION TO LIST

Cape Sable thoroughwort
(*Chromolaena frustrata*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Chromolaena frustrata* (Asteraceae) as a valid species is uncontroversial; *Eupatorium frustratum* is a synonym for this taxon (e.g., Kartesz 1998; Wunderlin and Hansen 2000).

NATURAL HISTORY

Morphology:
Chromolaena frustrata is an erect fragrant herb up to about 8 inches tall with 1 to many stems and opposite leaves. Flower heads are in small clusters. Each head has 25 or more small flowers, with blue or violet petals.

Habitat:
This species is found in undisturbed areas, most commonly in open sun to partial shade at the edges of rockland hammock and in coastal rock barren. It is often found growing in the shade of other species. It was historically known from coastal berm along the northern edges of Florida Bay. Coastal rock barrens are composed of exposed Key Largo Limestone with a diverse assemblage of herbaceous plant taxa, many of which are halophytes (Bradley and Gann 1999).

The historical range of *Chromolaena frustrata* is on nine islands of the Florida Keys, from Key Largo to Boca Grande Key (12 miles west of Key West in Key West National Wildlife Refuge). Known localities include Boca Grande Key, Big Pine Key, Knights Key, Key Largo, Long Key, Plantation Key, Lignumvitae Key, Upper Matecumbe Key, and Lower Matecumbe Key. On the mainland, *Chromolaena frustrata* was historically reported from the Turner River (Bradley and Gann 1999, citing Moldenke 1944), the Ten Thousand Islands area, Cape Sable, along the

Buttonwood Canal (east of Coot Bay, north of the Bear Lake Road), just south of West Lake, and in Madeira Hammock.

Chromolaena frustrata now occurs on the Everglades National Park, two State parks (Long Key State Recreation Area and Lignumvitae Key State Botanical Site), and two unprotected sites. It has been searched for on Knights Key but that island has been almost completely developed and it probably no longer exists there (Bradley and Gann 1999). It was not seen in a 1996 survey of Boca Grande Key. It has not been seen recently on Lower Matecumbe Key, Key Largo, or Plantation Key, but thorough searches have not been conducted (Bradley and Gann 1999).

POPULATION STATUS

The total number of plants is estimated at fewer than 1,000 (Bradley and Gann 1999). *Chromolaena frustrata*'s restricted ecological range and its drastic loss of habitat suggest that the number of individuals is declining.

The U.S. Fish and Wildlife Service classifies *Chromolaena frustrata* as a candidate for Endangered Species Act protection with a listing priority number of 5. The State of Florida lists this species as endangered (Wunderlin and Hansen 2000). The Florida Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA

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

Historical range:	Florida (Florida Keys: Boca Grande Key, Big Pine Key, Knights Key, Key Largo, Long Key, Plantation Key, Lignumvitae Key, Upper Matecumbe Key, and Lower Matecumbe Key; Mainland: Turner River, the Ten Thousand Islands area, Cape Sable, along the Buttonwood Canal (east of Coot Bay, north of the Bear Lake Road), just south of West Lake, and in Madeira Hammock).
Current range:	Florida (Everglades National Park, Long Key State Recreation Area, Lignumvitae Key State Botanical Site, and two unprotected sites).
Land ownership:	*Chromolaena frustrata* has been found on the Everglades National Park, two State parks (Long Key State Recreation Area and Lignumvitae Key State Botanical Site), and two unprotected sites.

Habitat loss threatens *Chromolaena frustrata*. While more careful surveys might turn up a few more sites in the Keys, it is clear that *Chromolaena frustrata* has lost much of its habitat there, especially on heavily developed islands like Knights Key. It is now known in the Keys at only

two non-preserve sites and three protected sites. While recent information is lacking from the mainland (Ten Thousand Islands, Turner River, and Cape Sable), the prospects of it occurring there are not good due to past farming in the Cape Sable area and the spread of exotic pest plants (discussed below). Its status in the Turner River area is unknown.

Most *Chromolaena frustrata* habitat has been negatively altered or destroyed by human activity. Based on the number of people moving to Florida, pressures from development are not expected to diminish in the years to come. Florida had a 15.3 percent increase in the human population from April 1, 1990, to July 1, 1998, and was ranked as the fourth fastest growing state in the nation during 1998 (U.S. Census Bureau 1998).

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

None are known.

C. ***Disease or predation.***

None are known.

D. ***The inadequacy of existing regulatory mechanisms.***

The Florida Department of Agriculture and Consumer Services has designated *Chromolaena frustrata* (= *Eupatorium frustratum*) as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur.

Current Conservation Efforts: Although the *Chromolaena frustrata* populations located on public lands are protected from development, they are still under threat from exotic vegetation. There are no specific conservation activities for *Chromolaena frustrata* on public lands. There are no current conservation activities for the two non-preserve *Chromolaena frustrata* populations. The U.S. Fish and Wildlife Service has developed a multi-species recovery plan for the threatened and endangered species of South Florida. This plan is ecosystem-based and includes many recommendations for conservation of the communities where *Chromolaena frustrata* occurs (U.S. Fish and Wildlife Service 1998).

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

Bradley and Gann (1999) state that exotic plant taxa negatively impact *Chromolaena frustrata* wherever it occurs. Brazilian pepper (*Schinus terebinthifolius*) occurs in all habitats where this species occurs and is currently a big problem in coastal rock barrens and rockland hammock ecotones. Latherleaf (*Colubrina asiatica*) is invading large areas of hammocks within Everglades National Park along the edge of Florida Bay. This species can radically change the structure of these hammocks and may be eliminating occurrences of this species (Bradley and Gann 1999).

Management of exotic plant invasion is crucial to the conservation of the species. Without proper control and eradication of these exotic plants, *Chromolaena frustrata* will be extirpated.

Over the long run, sea level rise is also a threat to this species. All known populations are in low lying areas near the coast (Bradley and Gann 1999), where sea level rise in the twentieth century has been shown to cause changes to the native vegetation. Given the species' narrow range and the small number of extant individuals, *Chromolaena frustrata* is extremely vulnerable to natural catastrophic events such as hurricanes and tropical storms. These natural events could extirpate existing populations.

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PETITION TO LIST

Puerto Rico manjack
(*Cordia rupicola*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

Cordia (Boraginaceae) is a genus of about 250 or more species of trees and shrubs of tropical and subtropical regions. Liogier and Martorell (1982) recognize seventeen species for Puerto Rico. Fifteen species are considered to be native to Puerto Rico and the remaining two are introduced. The U.S. Fish and Wildlife Service gives no common name for this species in its candidate species list, but Kartesz (1998) uses the name "Puerto Rico manjack". The status of *Cordia rupicola* as a valid species is uncontroversial (e.g., Kartesz 1998).

NATURAL HISTORY

Morphology:
Cordia rupicola is a small shrub reaching about 1.5 to 5 meters (4.9 to 16.4 feet) in height. Leaves are ovate to elliptic, 2 to 9 centimeters (cm) (0.8 to 3.5 inches) long and chartaceous. The upper leaf surface is rigidly scabrous, beneath puberulous and the strigose petioles are from 2 to 10 millimeters (0.1 to 0.4 inches) long. Flowers are in solitary globular heads about 1 cm (0.4 inches) in diameter and up to 20 flowered. The corolla is white, 7 mm (0.3 inches) long, and the

fruit is a red one-seeded drupe about 4 to 5 mm (0.2 inches) long (Proctor 1991).

Habitat:
Cordia rupicola was previously thought to be endemic to Puerto Rico but has recently (1987) been reported from the island of Anegada. The species was first discovered by the German botanical collector Paul Sintenis in 1886 at Los Indios, located between Barinas and Guayanilla. It was later found in the Guánica area in 1887, and again in 1943 and 1959 (Proctor 1991).

Surveys conducted in 1991 did not find the species at the historical locations in Guánica and Guayanilla (Proctor 1991). At that time, the only known location was that of Anegada. However, surveys conducted in 1995 located the species in the area of Peñuelas, an area to the east of Guayanilla, at a site called El Peñon.

The Peñuelas site is located within the subtropical dry forest life zone overlying a limestone substrate. The hills are wooded with a low dense brush, 2 to 3 meters (6.5 to 9.8 feet) in height, with only a few scattered trees that reach 4 to 5 meters (13.1 to 16.4 feet) tall. The area appears to have been cut over recently. The scattered trees include *Bourreria succulenta* var. *succulenta* (palo de vaca), *Bucida buceras* (ucar), and *Bursera simaruba* (almacito). The shrub layer is dominated by *Croton humilis*, *Eupatorium sinuatum*, *Lantana reticulata* (caria quillo), and *Turnera diffusa*. Average rainfall received in this dry life zone is less than 66 cm (25.7 inches) a year. The site is privately owned and the area is part of a residential development (Breckon and Kolterman 1996).

POPULATION STATUS

Approximately 15 plants of *C. rupicola* have been located at the Peñuelas site. Some plants were observed with fruit in the month of January. Other rare and endangered plants, including *Eugenia woodburyana* (listed as endangered), *Myrtus bellonis*, *Passiflora bilobata*, and *Nashia inaguensis*, are also known from the site (Breckon and Kolterman 1996).

The U.S. Fish and Wildlife Service classifies *Cordia rupicola* as a candidate for Endangered Species Act protection with a listing priority number of 2.

LISTING CRITERIA

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

Historical range: Puerto Rico, British Virgin Islands (Anegada).

Current range: Puerto Rico.

Land ownership: The only known population is located on privately owned land.

The species is currently known from only one area in Puerto Rico. While it has been reported from Anegada, little is known about the species on that island. The known population site in Puerto Rico is located on privately owned land that forms part of a residential development. Although lots are large in size, many of the surrounding lots have been completely cleared for house construction. While high voltage power lines that pass over the property may protect the area somewhat, concern has been expressed over the Puerto Rico Energy Authority's clearing of vegetation under such lines by cutting, burning, or the use of herbicides.

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

The species is not known to be utilized for commercial, recreational, scientific or educational purposes.

C. ***Disease or predation.***

Neither disease nor predation have been documented to be factors affecting this species.

D. ***The inadequacy of existing regulatory mechanisms.***

The Commonwealth of Puerto Rico has adopted a regulation that recognizes and provides a protection for certain Commonwealth listed species. However, *Cordia rupicola* is not on this list. Federal listing would provide protection under the Endangered Species Act, and, by virtue of the existing cooperative agreement under section 6, it would ensure the species' addition to the Commonwealth list.

Current Conservation Efforts: Studies of the species' distribution, abundance and reproductive biology by the University of Puerto Rico, Mayaguez Campus are ongoing.

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

One of the most important factors affecting the continued survival of this species is its limited distribution. It is currently known from only one site in Puerto Rico, on privately owned land. The site is located within the driest life zone on the island, and fires, both spontaneous and caused by man, are a frequent occurrence. In addition, damage from catastrophic events, such as hurricanes, could result in the loss of a significant number of individuals. Hurricane Georges, in 1998, caused severe damage in this part of the island.

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PETITION TO LIST

Florida prairie-clover
(*Dalea carthagenensis* var. *floridana*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Dalea carthagenensis* var. *floridana* (Fabaceae) as a valid variety is uncontroversial (e.g., Kartesz 1998; Wunderlin and Hansen 2000).

NATURAL HISTORY

Morphology:
Dalea carthagenensis var. *floridana* is a shrub up to 2 meters (6 feet) tall with small pealike flowers borne in spikes.

Habitat:
Dalea carthagenensis var. *floridana* is known only from pine rocklands, edges of rockland hammock edges, and coastal uplands. It has been collected in Miami-Dade, Collier, Monroe, and Palm Beach Counties. It was last reported from Palm Beach County in 1918. Currently, it is known from the Big Cypress National Preserve in Collier and Monroe Counties and from the Miami Rock Ridge in Miami-Dade County at the Charles Deering Estate and at the R. Hardy Matheson Preserve. Some of the Miami area sites where *Dalea carthagenensis* var. *floridana* was once collected still exist, so it could be worth searching Key Biscayne (Crandon Park), the Castellow Hammock Environmental Education Center, the Cox Hammock, and the edge of Everglades National Park (Bradley and Gann 1999) to determine whether or not the species is extant at those sites.

This shrub is found in several habitats, including edges of rockland hammock and pine rockland,

coastal upland, and marl prairie (Bradley and Gann 1999). Fire is probably very important to this taxon. Plants probably do not tolerate shading by hardwoods in the absence of periodic fires. Two of the extirpated occurrences were reported from rockland hammocks (Castellow and Cox). Plants probably occurred at the edges of these hammocks. Bradley and Gann (1999) report that plants were known to occur in coastal uplands on Key Biscayne at Crandon Park. Good information on the habitat it occurred in is not available, but it probably grew along the edges of one of several small maritime hammocks there, and possibly in coastal strand (Bradley and Gann 1999).

POPULATION STATUS

The number of plants has been estimated at fewer than 1,000, perhaps about 200 to 300. All are on protected lands (Bradley and Gann 1999).

The U.S. Fish and Wildlife Service classifies *Dalea carthagenensis* var. *floridana* as a candidate for Endangered Species Act protection with a listing priority number of 6. The State of Florida lists this taxon as endangered (Wunderlin and Hansen 2000). The Florida Natural Heritage Program lists this taxon as Critically Imperiled.

LISTING CRITERIA

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

Historical range: Florida.

Current range: Florida.

Land ownership: All known plants of *Dalea carthagenensis* var. *floridana* occur on preserved lands. All known non-preserved sites have been extirpated.

Most of *Dalea carthagenensis* var. *floridana's* habitat has been negatively altered by human activity. Pine rocklands in Miami-Dade County have been reduced to about 11 percent of their former extent (Kernan and Bradley 1996). Of the estimated historical extent of 74,000 hectares (ha) (182,780 acres), only 8,140 ha (20,106 acres) of pine rocklands remained in 1996. Outside of the Everglades National Park, only about 1 percent of the Miami Rock Ridge pinelands have escaped clearing, and much of the remaining pinelands is in small remnant blocks isolated from other natural areas (Herndon 1998). Florida had a 15.3 percent increase in the human population from April 1, 1990, to July 1, 1998, and was ranked as the fourth fastest growing state in the nation during 1998 (U.S. Census Bureau 1998). Given the popularity of South Florida, this trend

is expected to continue.

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

None are known.

C. ***Disease or predation.***

None are known.

D. ***The inadequacy of existing regulatory mechanisms.***

The Florida Department of Agriculture and Consumer Services has designated *Dalea carthagenensis* as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur.

Current Conservation Efforts: No specific conservation activities are being conducted for *Dalea carthagenensis* var. *floridana*. Although there is some exotic plant control at Big Cypress National Preserve, current efforts may be insufficient due to the overwhelming task, and current staffing and budget constraints. The U.S. Fish and Wildlife Service has developed an ecosystem-based, multi-species recovery plan for the threatened and endangered species of South Florida. It includes many recommendations for conservation of the pine rockland community (U.S. Fish and Wildlife Service 1999).

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

Fire suppression and invasive exotic plants are the greatest threats to *Dalea carthagenensis* var. *floridana*. Fire is required to maintain the pine vegetation and keep hardwoods from encroaching. Under natural conditions, lightning fires typically occurred at 3- to 7-year intervals. With fire suppression, hardwoods eventually invade pine rocklands and shade out understory species like *Dalea carthagenensis* var. *floridana*. Fire suppression has reduced the size of the areas that burn and habitat fragmentation has prevented fire from moving across the landscape in a natural way. Thus, many pine rockland communities have moved past their normal "fire subclimax" toward tropical hardwood hammock communities. More to the point, the sites where this plant persists in the Miami metro area are surrounded by urban development, making prescribed burning difficult but not impossible.

Exotic species have also altered the type of fire that occurs in pine rocklands. Historically, pine

rocklands had an open low understory where natural fires remained patchy with low temperature intensity, thus sparing many native grasses and understory plants such as *Dalea carthagenensis* var. *floridana*. The current density of exotic plant overgrowth throughout the range of *Dalea carthagenensis* var. *floridana* has created a situation that may no longer allow the species to be conserved through fire. Dense vegetative growth can create immense fire temperatures and longer burning periods.

Pine rockland plants cannot tolerate these extreme conditions. Given the current conditions, exotic plant control may require an alternate, more labor intensive method. One such method, hand chopping followed by spot treatment, requires extensive man-hours and is very costly. This method is feasible, if costly, at a small, intensively managed site like the Charles Deering Estate, but not for the large Big Cypress National Preserve.

Exotic plant taxa have significantly affected pine rocklands. As a result of human activities, at least 277 taxa of exotic plants are now known to have invaded pine rocklands throughout South Florida (U.S. Fish and Wildlife Service 1998). In much of south Florida, the worst of these plants are Brazilian peppertree (*Schinus terebinthifolius*) and Burmareed (*Neyraudia reynaudiana*). Melaleuca (*Melaleuca quinquenervia*) is a severe problem in the Big Cypress National Preserve. All exotic, nuisance plant species threaten the native vegetation with extirpation or extinction.

Given the species' narrow range and the small number of individuals that exist, *Dalea carthagenensis* var. *floridana* is extremely vulnerable to natural catastrophic events such as hurricanes and tropical storms. Either one of these events could extirpate existing populations.

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PETITION TO LIST

Florida pineland crabgrass
(*Digitaria pauciflora*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Digitaria pauciflora* (Poaceae) as a valid species is uncontroversial (e.g., Kartesz 1998; Wunderlin and Hansen 2000). This species is also known as twospike crabgrass. It was first collected in 1903, was described in 1928, and was subsequently apparently not collected from 1936 until Charles E. Hilsenbeck rediscovered it in Everglades National Park in 1973 (Bradley and Gann 1999).

NATURAL HISTORY

Morphology:
Digitaria pauciflora is an herbaceous perennial grass 0.5-1 meter (1.5-3 feet) tall (Small 1933) that can be recognized in the field by its dense covering of erect hairs, giving the plant a very fuzzy and glaucous look (Bradley and Gann 1999).

Habitat:
The historic distribution of *Digitaria pauciflora* was from about South Miami to Long Pine Key, and "island" of pineland in Everglades National Park about 42 miles from South Miami.

Plants occur most commonly along the ecotone between pine rockland and marl prairie, but extend somewhat into both of these ecosystems (Bradley and Gann 1999). The soil where it occurred at the Richmond Pine Rocklands has been classified as Biscayne marl, drained (USDA 1996). These habitats, particularly marl prairie, flood for one to several months every year in the wet season (Bradley and Gann 1999). Pine rocklands and their associated prairies are fire-maintained, with a natural fire frequency of 3 to 7 years for pine rocklands and perhaps slightly more frequently for marl prairies (Bradley and Gann 1999); in the absence of fire, tropical hardwoods quickly encroach. Bradley and Gann (1999) estimate the Long Pine Key occurrence of this species to have between 1000 and 10,000 individuals. The range of *Digitaria pauciflora* on Long Pine Key covers about 8,000 hectares (ha) (31 square miles) (Avery 1983).

POPULATION STATUS

Currently, *Digitaria pauciflora* is only known from Long Pine Key, but in 1995 a single plant was discovered in a marl prairie in the Richmond Pine Rocklands in Miami-Dade County. This plant, on the grounds of the Luis Martinez U.S. Army Reserve Center in the Richmond Pineland Complex, has since disappeared. (Herndon 1998; The Nature Conservancy 1999; two 1999 personal communications cited in U.S. Fish and Wildlife Service candidate assessment form).

The U.S. Fish and Wildlife Service classifies *Digitaria pauciflora* as a candidate for Endangered Species Act protection with a listing priority number of 5. The State of Florida lists this species as endangered (Wunderlin and Hansen 2000). The Florida Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA

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

Historical range: southern Florida.

Current range: Long Pine Key, Florida.

Land ownership: All but one plant of *Digitaria pauciflora* occurs within Everglades National Park. A single individual was found in 1995 at the Captain Luis Martinez U.S. Army Reserve Center in the Richmond Pineland Complex, but this plant has disappeared..

Most of the historic habitat of *Digitaria pauciflora* has been destroyed. Pine rocklands in Miami-Dade County (including patches of marl prairie) have been reduced to about 11 percent of their

former extent (Kernan and Bradley 1996). Of the estimated historical extent of 74,000 ha (182,780 acres), only 8,140 ha (20,106 acres) of pine rocklands remained in 1996. Outside of the Everglades National Park, only about 1 percent of the Miami Rock Ridge pinelands have escaped clearing, and much of the remaining pinelands are in small remnant blocks isolated from other natural areas (Herndon 1998). The regional water control efforts in the Everglades system may alter the hydrology of the Long Pine Key portion of the Everglades National Park, negatively affecting *Digitaria pauciflora* (Herndon 1998).

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

None are known.

C. ***Disease or predation.***

None are known.

D. ***The inadequacy of existing regulatory mechanisms.***

The Florida Department of Agriculture and Consumer Services has designated *Digitaria pauciflora* as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur.

Current Conservation Efforts: No specific conservation activities for *Digitaria pauciflora* occur at the Everglades National Park. Although there is some exotic plant control, current efforts may be insufficient due to the overwhelming task and current staffing and budget constraints. No conservation efforts are being conducted at the U.S. Army Reserve Center. The U.S. Fish and Wildlife Service has developed a multi-species recovery plan for the threatened and endangered species of South Florida. This plan is ecosystem-based and includes many recommendations for conservation of the communities where *Digitaria pauciflora* occurs (U.S. Fish and Wildlife Service 1999).

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

Apart from the potential destruction of suitable habitats outside Everglades National Park, fire suppression and exotic plant invasions are the greatest threats to *Digitaria pauciflora*. Fire is required to maintain the pine rockland community. Under natural conditions, lightning fires typically occurred at 3- to 7- year intervals, or more frequently in marl prairies. With fire suppression, hardwoods eventually invade pine rocklands and shade out understory species such

as *Digitaria pauciflora*. Fire suppression has reduced the size of the areas that burn and habitat fragmentation has prevented fire from moving across the landscape in a natural way. Thus, many pine rockland communities have moved past their normal “fire subclimax” and are becoming tropical hardwood hammocks.

Exotic species have also altered the type of fire that occurs in pine rocklands. Historically, pine rocklands had an open low understory where natural fires remained patchy, with relatively low temperatures, thus sparing many native grasses such as *Digitaria pauciflora*. Dense exotic plant growth in *Digitaria pauciflora*’s range can create much higher temperatures and longer burning periods. Pine rockland plants cannot tolerate these extreme conditions. As a result, the native plants may have to be conserved by removing exotics through methods other than burning. One such method, hand chopping followed by spot treatment, is labor intensive and very costly. This method may not be feasible for the Everglades National Park, given the acreage of land, and current staffing and budget constraints.

Invasive exotic plants have significantly affected pine rocklands. At least 277 exotic plants are now known to have invaded pine rocklands throughout South Florida (U.S. Fish and Wildlife Service 1999). The most serious threats to pine rocklands are Brazilian pepper (*Schinus terebinthifolius*) and Burmareed (*Neyraudia reynaudiana*). Brazilian pepper is a threat to marl prairies (Bradley and Gann 1999).

Given the species’ narrow range and the small number of individuals that exist, *Digitaria pauciflora* is vulnerable to natural catastrophic events such as hurricanes and tropical storms. Either one of these events could extirpate existing populations.

REFERENCES

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PETITION TO LIST

Acuna cactus
(*Echinomastus erectrocentrus* var. *acunensis*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 07/01/75:
CNOR 12/15/80:
CNOR 09/27/85:
CNOR 02/21/90:
CNOR 09/30/93:
CNOR 02/28/96: C
CNOR 09/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 06/13/02: C

TAXONOMY

Echinomastus erectrocentrus (Cactaceae) is listed as a synonym of *Sclerocactus erectocentrus* by Kartesz (1998).

NATURAL HISTORY

This cactus is known only from well-drained gravel ridges and knolls on granite soils in Sonoran Desert scrub association at 1,300-2,000 feet elevation. Populations are known from Pinal and Pima Counties in Arizona and Sonora, Mexico (U.S. Fish and Wildlife Service 1992).
Six sites are currently known; one historical site has not been located recently. A new site was found in the Sand Tank mountains in 2000.

POPULATION STATUS

The Arizona Game and Fish Department (1992) notes 5 occurrences including historical ones. Population sizes are unknown at this time.

The U.S. Fish and Wildlife Service classifies *Echinomastus erectrocentrus* var. *acunensis* as a candidate for Endangered Species Act protection with a listing priority number of 6. The Arizona Natural Heritage Program lists this taxon as Critically Imperiled.

LISTING CRITERIA

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

Historical range: Arizona; Sonora, Mexico.

Current range: Pinal and Pima Counties, Arizona; Sonora, Mexico.

Land ownership: This cactus is found on lands managed by the BLM, National Park Service at Organ Pipe Cactus National Monument, Arizona State Land Department, Department of Defense lands, and private lands.

Habitat destruction through development has been and will continue to be a threat to this cactus. Urban development, in the Ajo, Arizona, area as well as Sonoyta, Mexico, will continue to be significant threat to this species. Mining is also a threat to this plant. Past mining activities in the Ajo area have removed a significant portion of the population from the area and the remaining plant populations are fragmented.

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

Illegal collection is a primary threat to this cactus variety. In 1997, the National Park Service (Organ Pipe National Monument) reported illegal collection of these plants from their lands.

C. *Disease or predation.*

Dead plants have been found; however, the cause is unknown. Additionally, plants have been found uprooted, possibly by javelina or other animals. Starting in 1997, cacti monitored in Organ Pipe NM showed 50% mortality, attributed to being uprooted and mortality associated with dry winters. A very large percent of the adult cacti died. This will have a marked effect on the total reproductive output for these populations in Organ Pipe (which are the largest populations that exist). Although the plants were not specifically monitored on BLM lands, observations showed a similar fate for those populations. (personal communication 2001 cited in U.S. Fish and Wildlife Service candidate assessment form).

D. ***The inadequacy of existing regulatory mechanisms.***

This cactus is protected by Arizona Plant Law. Arizona Native Plant Law prohibits collection without obtaining a permit and plants may not be moved off of private property without contacting the State. It is also protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). However, CITES does not regulate take (collection) or domestic trade, only international trade.

Current Conservation Efforts: The U.S. Fish and Wildlife Service is funding a section 6 study to analyze demographic and monitoring data to determine population dynamics of this cactus.

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

Natural death of individuals by unknown causes may exacerbate human-caused threats to this plant's continued existence.

REFERENCES

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U.S. Fish and Wildlife Service. 1992. Handbook of Arizona's Endangered, Threatened, and Candidate Plants. Arizona Ecological Services Field Office, Phoenix, AZ.

PETITION TO LIST

basalt daisy
(*Erigeron basalticus*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Erigeron basalticus* (Asteraceae) as a valid species is uncontroversial (e.g., Hitchcock and Cronquist 1976; Kartesz 1998).

NATURAL HISTORY

Very little is known about the life history of *Erigeron basalticu*s. This species is a perennial that grows in crevices in basalt cliffs on canyon walls, at elevations between 380 to 460 meters (1,250 to 1,500 feet). The seeds are adapted for wind dispersal, which is probably augmented by rainfall washing the seeds downslope. The species is presumably dependent upon insects for pollination. There is no evidence of reproduction other than by seed. *Erigeron basalticus* grows in crevices with virtually no soil and its roots may contribute to fracturing of the basalt around the crevices. The species likely contributes to soil formation at these sites.

Erigeron basalticus is found within microsites that are largely devoid of other vegetation, and which are undergoing primary succession. In addition, there are few other species using nearby cliffs and outcrops. Total vegetative cover in these areas is about one percent. As the most abundant vascular plant present, this species may be important for insects and other fauna inhabiting the area, potentially serving as both cover and forage.

POPULATION STATUS

This species is limited to a single population in the Yakima River Canyon and the canyon of a tributary, Selah Creek, an area of approximately 52 square kilometers (20 square miles) in northern Yakima and southern Kittitas counties, Washington.

The population is distributed among eight, potentially interbreeding occurrences or subpopulations within the two canyons. Extensive searches in similar habitat nearby have failed to reveal additional occurrences of the species. However, the upper reaches of some of the cliffs in the canyons have not been thoroughly inventoried, and there could be additional occurrences of the species in these relatively inaccessible locations.

Erigeron basalticus was first collected in 1942 and described in 1944. The size of the population in the 1940s is unknown. Approximately 7,000 plants currently exist, with 8 occurrences occupying about 67 hectares (165 acres), within an area of about 16 x 3 kilometers (10 x 2 miles). The overall population size, both in number of individuals and total area occupied, has changed little between the status survey of 1988 and the 1998 review. However, individual numbers in four of the eight occurrences, the smallest subpopulations, have decreased substantially and two areas now support fewer than 20 plants each (Table 1). The size of the subpopulations prior to 1988 is also not known.

Table 1. Occurrences of *Erigeron basalticus* and change in subpopulation status between 1988 and 1998, and land ownership. Numbers and hectares (acres) are estimated. These data are from the U.S. Fish and Wildlife Service candidate assessment form for *Erigeron basalticus*.

SITE	AREA OCCUPIED	NUMBER PRESENT, 1988	NUMBER PRESENT, 1998	PERCENT DECREASE	LAND OWNERSHIP
Burbank Creek	0.4 ha (1 ac)	100	0	88	Private
Baldy	0.4 ha (1 ac)	62[a]	0.125	76	WDFW
Roza Dam	8 ha (20 ac)	250	<100	60	1)BLM 2)Private

Yakima Canyon ACEC[b]	4 ha (10 ac)	175-200	100	40-50	1)BLM 2)BNSF RR
Selah Cliffs	20-24 ha (50-60 ac)	5000	5000	None	1)WDNR 2)Private 3)YTC 4)WDOT
Mouth of Yakima Canyon	24 ha (60 ac)	Hundreds	Hundreds	Some, erosion in one area	1)BLM 2)Private 3)WDOT
Wymer	2 ha (6 ac)	150-600	Thousands? or 120-600[d]	None	Private
L.T. Murray	<2 ha (5 ac)	100-500	100-500	None	1)WDFW 2)BNSF RR

a/ counted
b/ ACEC: Area of Critical Environmental Concern
c/ BLM: U.S. Bureau of Land Management
BNSF RR: Burlington Northern Santa Fe Railroad
WDFW: Washington Department of Fish and Wildlife
WDNR: Washington Department of Natural Resources
YTC: U.S. Army, Yakima Training Center
d/ Contradictory estimates given in status review: "Thousands," but a density of 20-100 plants per acre, in 2 ha (6 ac).

Whether these declines are a recent development or represent a continuous downward trend since before the 1988 status review is not known, nor are the causes of the declines apparent. There is no visible alteration of the physical habitat. Of the declining subpopulations, only the Roza Dam area contains young and immature plants, as do the larger, apparently more stable subpopulations, indicating that successful reproduction is occurring in these areas. The declines may result from lack of successful recruitment, possibly resulting from insufficient pollination. Pesticides used in nearby agricultural fields may impact the species necessary for pollination. Other possible causes for the declines may involve direct impacts from herbicide drift originating on nearby agricultural fields and/or maintenance activities on nearby highway/railroad rights-of-way.

The U.S. Fish and Wildlife Service classifies *Erigeron basalticus* as a candidate for Endangered Species Act protection with a listing priority number of 11. The Washington Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA:

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

Historical range: Washington.

Current range: A single population in the Yakima River Canyon and the canyon of a tributary, Selah Creek in northern Yakima and southern Kittitas counties, Washington.

Land ownership: Most of the subpopulations occur in areas with mixed ownership, a combination of Federal, State, and/or private. Two subpopulations occur entirely on private lands and one occurs entirely on State land. Specific land ownership of each of the sites is displayed in Table 1.

State Highway 821, Interstate 82/US Highway 97, and a Burlington Northern/Santa Fe railway have been constructed through habitat occupied by this species. State Highway 821 and the railroad right-of-way parallel the Yakima Canyon and are adjacent to, or cross through, four of the subpopulations. Interstate 82/US 97 crosses Selah Canyon, which contains one of the subpopulations. Maintenance, major improvement, or expansion of these transportation corridors may damage or destroy individual plants or their habitat. Most through-traffic uses Interstate 82 rather than SR 821, which is now a secondary scenic route with little potential for expansion or major improvement (personal communication cited in U.S. Fish and Wildlife Service candidate assessment form).

Maintenance of the railroad right-of-way (herbicide spraying for vegetation control, rock exclusion fences, etc.) may damage or destroy individual plants and/or their habitat. Basalt has been quarried at two locations where the species occurs, and at various other locations along Yakima Canyon. Additional quarrying or expansion of existing quarries in the vicinity of the subpopulations could threaten the species. Stone from local quarries may be used to stabilize and repair slides along SR 821. Currently, the county road department typically gets its gravel from mining operations along the Selah River (personal communication cited in U.S. Fish and Wildlife Service candidate assessment form). There is little development now occurring along Yakima Canyon, however, future development along the Yakima River could result in additional quarrying and lead to general degradation of the species' habitat (increase in exotic weeds, habitat conversions, etc.).

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

There is no evidence that overutilization for commercial, scientific, or educational purposes exists. However, incidental destruction of the plant may be associated with recreational use of

the Yakima Canyon by boaters who stop to picnic and camp along the river. Recreational boat use of the Yakima River has increased dramatically in recent years, with up to 500,000 visitors annually (Camp 1997). *Erigeron basalticus* is attractive while in bloom and may be picked by recreational users or collected by rock gardeners. One subpopulation is easily accessible from Interstate 82, immediately south of the confluence of Selah Creek and the Yakima River. Damage by rock climbers is also a potential threat in Selah Creek Canyon, where there are formations that may attract recreational climbing.

C. *Disease or predation.*

No known threats. Because of the relatively steep habitats occupied by *Erigeron basalticus*, grazing is unlikely to become a threat.

D. *The inadequacy of existing regulatory mechanisms.*

There is minimal regulatory protection for *Erigeron basalticus* on any of the ownership parcels. Five sub-populations occur on lands administered by the Bureau of Land Management (BLM). By policy, BLM must ensure that actions authorized, funded, or carried out do not contribute to the need to list a candidate species. The five BLM parcels supporting *Erigeron basalticus* are designated Areas of Critical Environmental Concern (ACEC). The ACEC designation indicates to the public that the BLM recognizes that an area has significant values and has established special management measures to protect these values. Despite these policies, protections to plants occurring on ACEC's are not guaranteed.

Protection is especially questionable where the plant occurs within the highway right-of-way and is managed by Washington Department of Transportation. This species also occurs on the Yakima Training Center (YTC), administered by the U.S. Department of the Army, but is given no special protection. One sub-population and a portion of another is found on lands administered by the Washington Department of Fish and Wildlife (WDFW). A significant portion of the Selah Cliffs subpopulation occurs in an area managed by the Washington Department of Natural Resources (WDNR) as a Natural Area Preserve, with the basalt daisy as the primary resource of concern in the Preserve. The species is listed as Threatened by WDNR (personal communication 1997 cited in U.S. Fish and Wildlife Service candidate assessment form). Despite the Threatened designation, Washington State does not have an Endangered Species Act for plants and provides no regulatory protection for this taxon.

Current Conservation Efforts: Preliminary discussions concerning development of a Conservation Agreement with the BLM for *Erigeron basalticus* occurred from 1994 to 1996, but were discontinued.

Much of the species' habitat is in public ownership where protective measures may prove more

effective. The conservation measures the U.S. Fish and Wildlife Service deems necessary to protect the species are appropriate for inclusion within Conservation Agreements with other Federal and State agencies, and/or with private landowners, however there has been no recent progress on Conservation Agreements.

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

The limited range, extremely limited habitat, and the small number and size of the subpopulations make *Erigeron basalticus* vulnerable to environmental and demographic stochasticity. A localized heavy rainfall event in 1998 resulted in significant landslides in the Yakima River Canyon. None of the species' occurrences were affected, but future slides may impact the species (Gamon 1998). There have been substantial declines in the number of individuals in four of the eight subpopulations over the last 10 years. The reasons for the declines are unclear. Spraying of pesticides on agricultural fields adjacent to the canyons is a potential threat to the plant and its insect pollinators, possibly reducing or preventing recruitment in some locations. Herbicide drift from nearby agricultural fields and/or maintenance of highway/railroad rights-of-way may cause direct impacts to individual plants, potentially causing declines in certain subpopulations.

REFERENCES:

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PETITION TO LIST

Lemmon's fleabane
(*Erigeron lemmonii*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 12/09/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Erigeron lemmonii* (Asteraceae) as a valid species is uncontroversial (e.g., Kartesz 1998).

NATURAL HISTORY

Morphology:
A slender, lax perennial herb that grows in clumps, about 3 dm tall. Flowers (May-September) have white to pale purple ray flowers surrounding the yellow disk.

Habitat:
This prostrate perennial fleabane occurs in crevices and ledges of west-, south- and north-facing limestone cliffs and on faces of large boulders in canyon bottoms within the pine-oak woodland

association at elevations from 6300 to 7300 feet (U.S. Fish and Wildlife Service 1992).

POPULATION STATUS

The species is now known from just a single site on the Fort Huachuca Military Reservation of southeastern Arizona. Approximately 70 individuals are present at this site. The Arizona Game and Fish Department (1992) noted 7 historical and current occurrences for this species.

The U.S. Fish and Wildlife Service classifies *Erigeron lemmonii* as a candidate for Endangered Species Act protection with a listing priority number of 5. The Arizona Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA

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

Historical range: Arizona.

Current range: Fort Huachuca Military Reservation, Arizona.

Land ownership: All known locations of the plant are on the Fort Huachuca Military Reservation and possibly on the Coronado National Forest.

Virtually any habitat change is a serious threat to the species because all known individuals are in a single very small population. Due to its vertical cliff face habitat, many of the more usual impacts (e.g., grazing, development) are unlikely. The single largest threat to the species is from catastrophic wildfire in the canyon where the plant occurs. An intense wildfire in the narrow canyon would almost certainly desiccate plants on the cliff face, possibly directly killing individuals or stressing out plants that could lead to lower reproductive output. According to the U.S. Fish and Wildlife Service, the landowner (DOD, Ft. Huachuca) is willing to develop a conservation agreement for this species. Measures have been taken to reduce the threat of wildfire (the entire range of this species is within a Mexican Spotted Owl Protected Activity Center) and also the threats from recreational rappeling, which is not allowed on the cliff faces occupied by the plant.

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

None known
.

C. ***Disease or predation.***

None known.

D. ***The inadequacy of existing regulatory mechanisms.***

This species is protected (restrictions on collection) by the Arizona Native Plant Law and is designated by the Forest Service as a sensitive species. Arizona Native Plant Law prohibits collection without obtaining a permit and plants may not be moved off of private property without contacting the State.

Current Conservation Efforts: No pre-listing activities are underway at this time, although Ft. Huachuca has indicated a willingness to start work on a conservation agreement (personal communication February 2001 cited in U.S. Fish and Wildlife Service candidate assessment form).

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

Because it occurs as a single very small population, this species is vulnerable to extinction by a natural or human-caused catastrophic event.

REFERENCES

Arizona Game and Fish Department. 1992. Heritage Data Management System: Plants-Status and Occurrences. Phoenix, Arizona.

Kartesz, J. 1998. A Synonymized Checklist of the Vascular Flora of the United States, Puerto Rico and the Virgin Islands. http://www.csdl.tamu.edu/FLORA/b98/check98.htm.

NatureServe Explorer: An online encyclopedia of life [web application]. 2001. Version 1.6 . Arlington, Virginia, USA: NatureServe. Available: http://www.natureserve.org/explorer. (Accessed: July 15, 2002).

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PETITION TO LIST

Umtanum desert-buckwheat
(*Eriogonum codium*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Eriogonum codium* (Polygonaceae) as a valid species is uncontroversial (e.g., Reveal et al. 1996; Kartesz 1998)

NATURAL HISTORY

Eriogonum codium was discovered in 1995 during a botanical survey of the Hanford Nuclear Reservation. The species grows exclusively on exposed basalt flow material of the Lolo Flow of the Wanapum Basalt Formation. Soils are classified as lithosols and are composed of fine reddish to blackish basalt overlain with pumice. It is unknown whether the association of *Eriogonum codium* with the Lolo Flown is related to the chemical composition or physical characteristics of the particular bedrock on which it is found, or some other unknown factor.

The elevation of the population ranges from 335 to 390 meters (1,100 to 1,280 feet). Potential locations for additional populations within the lower Columbia Basin were intensively searched during 1996 and 1997 but no other plants were found. *Eriogonum codium* is a long-lived woody perennial forming low mats. Individual plants may exceed 100 years old, based on counts of annual growth rings on cross sections of recently dead *Eriogonum codium* plants (personal communication 2000 cited in U.S. Fish and Wildlife Service candidate assessment form). Growth rates also are extremely slow, with stem diameters increasing an average of only 0.17mm/yr.

POPULATION STATUS

The entire range of the species consists of a single population of approximately 5,200 plants on Umtanum Ridge, immediately south of the Columbia River in Benton County. The population is restricted to a narrow, discontinuous (scattered distribution) one-mile portion of the steep north-facing crest of Umtanum Ridge.

The U.S. Fish and Wildlife Service classifies *Eriogonum codium* as a candidate for Endangered Species Act protection with a listing priority number of 2. The Washington Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA:

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

Historical range: Washington.

Current range: A single patchily distributed population along a one mile stretch of the steep north-facing crest of Umtanum Ridge, immediately south of the Columbia River in Benton County, Washington.

Land ownership: Land ownership of the species is entirely on the Hanford Nuclear Reservation. The Department of Energy is seeking to surplus and release much of the land that is considered safe and free from contamination by nuclear radiation. Umtanum Ridge and the portions of the Hanford site that support *Eriogonum codium* have recently been considered for inclusion in the Hanford Reach National Monument/Saddle Mountain National Wildlife Refuge, but the final decision on these lands is still unclear.

Wildfire is a major threat to *Eriogonum codium.* During the summer of 1996, a fire escaped from the Yakima Training Center (U.S. Department of Army) and traveled eastward for the entire length of Umtanum Ridge, running out of fuel on the rocky face at the east end of Umtanum Ridge. The fire was most severe where there was a high density of shrubs. Shrub and grass fuels on the crest of Umtanum Ridge are sparse and the fire was patchy in its distribution within the *Eriogonum codium* population. It was estimated that the fire killed at least 800 *Eriogonum codium,* between 10 to 20 percent of the entire population (personal communication 2000 cited in U.S. Fish and Wildlife Service candidate assessment form). Plants appear to be quite sensitive to heat and fire and were easily killed. Even plants that were singed but were not visibly charred appeared to be declining or have died during the following year.

The fire did not stimulate vigorous new growth on established *E. codium* plants, nor sprouting from the root crown. There was no apparent flush of seedlings regenerated during the following spring. The fact that the plants did not exhibit re-sprouting from the root crown indicates that the species is not a fire adapted perennial species. The long-term impact of the fire to the population is unknown, but is likely to be significant given low recruitment rates documented in this species. Fire may become an even greater threat if the frequency of fires increases. Frequent fires enhance the invasion of non-native species, particularly cheatgrass (*Bromus tectorum*), which in recent surveys appears to grow best in the area directly shaded by the *Eriogonum* plants. The establishment and growth of cheatgrass directly beneath *Erigonum codium* increases the species flammability, thereby influencing the pattern of burning within this ecosystem.

There has been an increasing incidence of trespassing by ORVs, hikers, and dirt bikes in the vicinity of the *Eriogonum codium* population and within the population itself. The open, cliff edge where the plants grow is a logical place for human traffic because of the compact substrate, sparse vegetation cover and the view overlooking the Columbia River. *Eriogonum codium* plants are extremely sensitive to disturbance and are easily damaged by trampling or crushing by ORVs. Within 2 days of being run over by trespassing dirt bikes, entire portions of plants showed signs of decline. Some plants have died while the fate of several other disturbed plants is being monitored.

The collection of petrified wood also threatens the species. Collection of petrified wood is apparent throughout the area where the *Eriogonum codium* population is found--holes dug with a pick axe and shovel are up to 1.5 meters (5 feet) in diameter and four feet deep. It is not known whether these collections were made before the Department of Energy acquired the land in 1943 or by illegal collectors entering the property since that time. If Hanford allows public access onto this property or if it is transferred to private ownership, the collection of petrified wood may likely increase. Present day petrified wood collectors often utilize heavy equipment for excavation which would pose greater adverse impacts to the species than collections made with a pick axe and shovel. The potential impact to the species from petrified wood collection is likely to severely threaten this single population.

Sheep occasionally have been allowed to graze in the vicinity of this population (personal communication 2000 cited in U.S. Fish and Wildlife Service candidate assessment form). While impacts on *Eriogonum codium* plants from grazing have not yet been observed, trampling, browsing, or other direct or indirect effects are possible if livestock grazing is permitted to continue.

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

There is no evidence of collection, recreational, scientific, and educational use of this species.

C. *Disease or predation.*

Within the *Eriogonum codium* population, western harvester ants (*Pogonomyrmex occidentali*s) were observed gathering mature *E. codium* achenes and transporting them to their below-ground colonies for consumption. Ants would then bring up and discard the inedible remains of the achene above ground near the colony. It is unknown what percentage of achenes are consumed by ants and other insects, and thus how much of an impact insects are having on the available seed bank within the population. Ant predation of seeds has proved to be a significant factor in the viability of at least one other rare Eriogonum taxon (*E. umbellatum* var. *torreyanu*m). Other disease and predation interactions are unknown, as the species has been known for only five growing seasons.

D. *The inadequacy of existing regulatory mechanisms.*

Eriogonum codium is currently listed as Endangered by the Washington Department of Natural Resources (WDNR) Natural Heritage Program (WNHP 1997). There is no State Endangered Species Act for plants in Washington, and therefore, there is no legal protection based on this state designation.

Current Conservation Efforts: During 1997, a National Fish and Wildlife Foundation grant was awarded to the U.S. Fish and Wildlife Service, in partnership with the Nature Conservancy of Washington. Initial inventory work was accomplished in 1997. The population was mapped, and 24 permanent sample plots were established. Growth rate studies of this long-lived species were begun. Individual plants were tagged for demographic studies to observe the expansion of adult plants and the regeneration and establishment of seedlings. During 1998, more sampling was accomplished. From one year of study it was found that no adult plants died, although several were impacted by off-road vehicle damage. No new seedlings were recruited in the sample plots, and the population is dominated by larger, mature plants. Monitoring of the permanent plots has been conducted by the Nature Conservancy through 2000.

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

The plant community and the habitat in which *Eriogonum codium* is found was altered by fire during 1996. One consequence of fire or any disturbance which removes native plants from the shrub-steppe communities of eastern Washington is the displacement of native vegetation by non-native, weedy species, particularly *Bromus tectorum* (cheat grass). Because of the 1996 fire, there is now a higher cover of weedy plant species, including *Bromus tectoru*m, growing within and around the *E. codium* population.

Eriogonum codium has proportionally fewer plants in smaller size classes than in larger size classes. A typical size class distribution for a perennial plant has a higher proportion of plants in

the smaller size classes; however, this species is dominated by mature plants with little recent successful establishment of seedlings. During the period from 1997-1999, only one seedling was observed to survive for 1 year, and it did not survive the second year (personal communication 2000 cited in U.S. Fish and Wildlife Service candidate assessment form). This indicates a problem associated with the reproduction and establishment of *E. codium*, and its subsequent development from small seedlings into larger, mature plants. One factor, or combination of factors, is likely to be responsible for lower than expected numbers of plants in the smaller size classes. Possible factors include: low seed production, low seed or pollen viability, low seedling survival, and/or insect predation of seeds. Long term monitoring and research may determine the cause of this skewed size class distribution.

Private lands immediately to the west of Umtanum Ridge and surrounding much of the rest of the Hanford Site have been converted from shrub steppe into irrigated agricultural lands. The potential for expansion of the species is therefore restricted. The area where *Eriogonum codium* occurs, the Hanford Nuclear Reservation, is Federal Department of Energy land at the moment. This area may become part of the Hanford Reach National Monument/Saddle Mountain National Wildlife Refuge, but the timing or details of this transition are still unclear.

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PETITION TO LIST

Red Mountain buckwheat
(*Eriogonum kelloggii*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

Asa Gray described this taxon in 1870 from specimens that were collected from the type locality by Dr. A. Kellogg at Red Mountain, Mendocino County, California in 1869 (Gray 1870). Marcus Jones renamed this plant *Eriogonum caespitosum* var. *kelloggii* (Jones 1903). Walter Knight returned the species to *Eriogonum kelloggii* (Knight 1971).The taxonomic status of *Eriogonum kelloggii* (Polygonaceae) as a distinct species is now uncontroversial (e.g., Hickman 1993; Kartesz 1998).

NATURAL HISTORY

This serpentine endemic is found in rocky barren openings in lower montane coniferous forests between 1,094 and 1,216 meters (3,600 and 4,000 feet) in elevation (California Department of Fish and Game (CDFG) 1997). It is a perennial herb that blooms May-August.

POPULATION STATUS

This species has always been rare and is known from five occurrences at Red Mountain and Little Red Mountain, Mendocino County, California. Dr. Michael Baad has annually monitored permanent plots since 1987 (13 plots in 1987 and 1989-1998; 11 plots in 1988). This study has found considerable variation in plant density and reproductive success, but no discernible long-term trends (Baad 1998).

The U.S. Fish and Wildlife Service classifies *Eriogonum kelloggii* as a candidate for Endangered Species Act protection with a listing priority number of 5. The California Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA

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

Historical range: California.

Current range: Five occurrences are known at Red Mountain and Little Red Mountain, Mendocino County, California

Land ownership: One occurrence is in private ownership, one occurrence on a mixture of private and public lands (Bureau of Land Management) and three occurrences on public lands (Bureau of Land Management) at Red Mountain, Mendocino, California. There maybe an additional occurrence on the California Department of Fish and Game reserve at Red Mountain (personal communication 2001 cited in U.S. Fish and Wildlife Service candidate assessment form).

Although mining does not now occur in the species' habitat, potential future surface nickel and chromium mining threaten this species (Baad 1994, CDFG 1997, Finan 1994). Most likely, any mining operation on Red Mountain or Little Red Mountain would be an open-face bench type that would involve removal and processing of the mineral-bearing ore which contains the nickel, chromium, and cobalt (BLM 1988). All vegetation and habitat for *Eriogonum kelloggii* would be removed. Ore would be processed on public or adjacent private lands. Overburden and processed soil disposal areas would be needed, along with a transportation system, perhaps involving cable trams across Cedar Creek Canyon (BLM 1988). Although no scientific evidence is available to suggest such secondary effects, additional biological values of the habitat may be lost through habitat fragmentation, alteration of hydrology, and increases in airborne particulates that may depress pollinator success (Saunders et al. 1991, Meffe and Carroll 1997).

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

None known at this time.

C. ***Disease or predation.***

None known at this time.

D. ***The inadequacy of existing regulatory mechanisms.***

The State of California listed this species as endangered in 1982, but state laws are inadequate to protect this species (personal communication 1994 cited in U.S. Fish and Wildlife Service candidate assessment form)

Current Conservation Efforts: The primary threat to this species is the potential for future mining activities. Whether or not mining occurs depends on the future economic feasibility and demand for minerals. The holders of mining claims could engage in a validation process of their mining claims and thereby be granted patent to the lands on Red Mountain. If the lands were to be patented into private ownership and mining commenced, neither the Service or the BLM could offer any protection of the land beyond elevating the profile and plight of the plant species in a proposed or final rule. The BLM Arcata Field Office staff and manager support the U.S. Fish and Wildlife Service listing the taxon (U.S. Fish and Wildlife Service candidate assessment form).

From 1987 through 1998, the Red Mountain endemic plants experienced little human impact (Baad 1998). It is not believed that the development of a conservation agreement would provide any protection against the future patenting of exiting mining claims.

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

The small number of populations and individual plants make this species highly vulnerable to random environmental events.

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PETITION TO LIST

Guadalupe fescue
(*Festuca ligulata*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 12/9/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The status of *Festuca ligulata* (Poaceae) as a taxonomically valid species is uncontroversial (e.g., Kartesz 1998; Hatch et al. 2001).

NATURAL HISTORY

Festuca ligulata is a perennial grass, 5-8 dm tall, with a few-branched inflorescence with drooping spikelets. It flowers from August-September. The typical habitat of *Festuca ligulata* is moist woodland slopes and creek bottoms above 1830 m elevation.

POPULATION STATUS

The only known population (which has varied from 51 to several hundred individuals) is in Big Bend National Park. Historically this fescue was reported in the Guadalupe Mountains as well, but has not been relocated there. There are no historical population estimates. Plants are found

scattered in patches in the dense understory of pine-oak-juniper woodlands.

The U.S. Fish and Wildlife Service classifies *Festuca ligulata* as a candidate for Endangered Species Act protection with a listing priority number of 11. The Texas Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA

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

Historical range: Texas (possibly New Mexico and Mexico).

Current range: Big Bend National Park, Texas.

Land ownership: The only known existing site is in Big Bend National Park. In addition, a historical population that has not been relocated occurred in Guadalupe Mountains National Park, New Mexico.

The single known population is bisected by a trail and subject to occasional trampling by horses and hikers. Prior trail construction may have reduced the population area by up to 25 percent. New trails are planned that may affect this species, but plans have not been finalized. There is some concern that this species may be successional following fire or other disturbance, and that the suppression or reduced incidence of this disturbance has resulted in the reduction of areas of suitable habitat for the species. This fescue may be dependent on periodic light fire and may require active management to persist.

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

None known.

C. *Disease or predation.*

The seeds are known to occasionally have a fungus but it has not been observed to reach levels that appear to pose a serious threat to the known population.

D. *The inadequacy of existing regulatory mechanisms.*

This species is not State-listed. Theoretically, the National Park Service should manage all species for their lands, in accordance with the Park Service's Organic Act, but no regulatory prohibitions against impacts are in place.

Current Conservation Efforts: Big Bend National Park and the U.S. Fish and Wildlife Service signed a conservation agreement in l998. However, the National Park Service has not had an

opportunity to implement any of the measures outlined in the agreement, although implementing this agreement is supposedly a high priority for the Park (personal communication 2001 cited in U.S. Fish and Wildlife Service candidate assessment form).

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

Very low population numbers and restriction to a single known population make this species highly vulnerable to extinction from catastrophic local events or because of reduced genetic viability that may render the species less adaptive to adverse change in its environment.

REFERENCES

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PETITION TO LIST

Wonderland alice-flower
(*Aliciella caespitosa*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

This species was formerly known as *Gilia caespitosa* (Polemoniaceae). As a result of molecular and morphological studies demonstrating that *Gilia* was a polyphyletic genus, Porter (1998) resurrected the genus *Aliciella* to include a monophyletic assemblage of species formerly included in *Gilia*, including *Gilia caespitosa*. The new name for this species is *Aliciella caespitosa* (Porter spelled the specific epithet of this new combination as "*cespitosa*" but provided no explanation for the slightly altered spelling, which we thus assume was an error). This genus is incorrectly spelled "*Alicelia*" in the U.S. Fish and Wildlife Service candidate species list.

NATURAL HISTORY

Aliciella caespitosa is a perennial herb with sparsely leafy flowering stems, 3-8.5 cm tall, arising from a densely leafy base. Flowers (June-July) are scarlet red, occasionally fading to maroon or purple.

This species is found on Navajo and Wingate sandstone in crevices, Carmel Limestone formations, detrital slopes, and (infrequently) in sandy wash bottoms. It is found within open

pinyon-juniper communities, often mixed with mountain brush, sagebrush, or ponderosa pine, from about 1550 to 2750 m elevation.

This plant was first collected in 1875 and was not seen again for almost 90 years.

POPULATION STATUS

Aliciella caespitosa is known from 15 populations scattered over a distance of about 30 kilometers (20 miles) near the Fremont River from the northern portion of the Water Pocket Fold westward to Rabbit Valley in Wayne County, Utah, an area locally known as Wayne Wonderland. The species is most commonly found on fine to course textured, easily eroded, light colored, sandy geological formations. The species populations can be grouped into two metapopulations. The western six populations in the vicinity of Teasdale, Utah, comprise the Rabbit Valley metapopulation, numbering about 5,000 individuals. The eastern nine populations near Fruita, Utah, comprise the Capitol Reef metapopulation, numbering about 1,000 individuals.

The U.S. Fish and Wildlife Service classifies *Aliciella caespitosa* as a candidate for Endangered Species Act protection with a listing priority number of 11. The Utah Natural Heritage Program lists this species as Imperiled.

LISTING CRITERIA:

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

Historical range:	Utah.
Current range:	Scattered over a distance of about 30 kilometers (20 miles) near the Fremont River from the northern portion of the Water Pocket Fold westward to Rabbit Valley in Wayne County, Utah, an area locally known as Wayne Wonderland.
Land ownership:	More than 80 percent of the species population is found on lands managed by BLM. About 15 percent is found within Capitol Reef National Park. Less than 5 percent is found on Forest Service and private lands.

Some populations are near frequently traveled roads and trails and are subject to human and off-road vehicle trampling. All populations are associated with sandstone outcrops with the potential for sand and sandstone quarrying. Some sites are near road, trail and utility corridors and are vulnerable to habitat disturbance associated with the use and maintenance of these facilities. Mining and mining claim assessment work for gypsum threatens the species' largest population near Teasdale.

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

Collection of plants and seeds is a significant threat due to the desire of rock-garden enthusiasts to obtain this very attractive cushion plant. The seeds of *A. caespitosa* are advertised for sale in rock-gardening catalogs for the price of $1 per seed. Few seeds are produced by wild plants (see factor *E*. below). Should their locations become commonly known their populations could be devastated by excessive collection.

C. *Disease or predation.*

Some populations occur within active grazing allotments and along stock driveways. The species may be subjected to trampling. It is not generally grazed.

D. *The inadequacy of existing regulatory mechanisms.*

No Federal or State laws or regulations specifically protect *A. caespitos*a. The Forest Service and the Bureau of Land Management administratively recognize this species for special management consideration, but do not have the legal authority to require Federal mineral lease holders to modify their mineral recovery plans and on-the-ground actions solely to protect this species. The National Park Service provides protection of all natural resources within National Parks and has the authority to protect the species from all of its human-caused threats. However, the National Park populations in Capitol Reef comprise only about one-sixth of the species' total population. The Rabbit Valley populations on BLM-managed public are more robust but have less protection from threats to the species' habitat and to the species directly. The Forest Service has minimal populations, about100 individuals, on its public lands. The FWS, NPS, BLM, and Forest Service have signed a conservation agreement.

Current Conservation Efforts: According to the U.S. Fish and Wildlife Service, the Federal land managing Agencies are developing a conservation agreement with FWS for the species.

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

Aliciella caespitosa is reproductively depressed. The entire population has very low natural recruitment. Low seed production, germination rate, and high seedling mortality threatens to decrease the species' overall range and abundance (two 1995 personal communications cited in U.S. Fish and Wildlife Service candidate assessment form). Pesticide use in fields near Torrey, Teasdale, and Bicknell, and in pioneer era orchards within Capitol Reef National Park may impact pollination by adversely affecting the species pollinator(s), which remains unknown.

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PETITION TO LIST

island brittleleaf
(*Gonocalyx concolor*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The status of *Gonocalyx concolor* (Ericaceae) as a taxonomically valid species is uncontroversial (e.g., Liogier and Martorell 1982; Kartesz 1998). No common name is listed for this species in the U.S. Fish and Wildlife Service candidate species list, but Kartesz (1998) lists it as “island brittleleaf”.

NATURAL HISTORY

Morphology:
Gonocalyx concolor is a small evergreen epiphytic shrub. The leaves are simple, alternate, coriaceous, ovate, and 1.5 to 3 centimeters (cm) (0.5 to 1.2 inches) long and 1.5 to 2.25 cm (0.5 to 0.9 inches) broad. Venation is 5-pli from the base with the mid-vein immersed above and immersed beneath. Young leaves and branches are brilliantly rose colored but become green with age. Flowers are bisexual, 5-merous, regular, and uniformly vivid red. They are borne singly on axillary brachyblasts and are semipendent. The corolla tube is campanulate and about 13 to 15 millimeters (mm) (0.5 to 0.6 inches) in length and 6 to 7 mm (0.2 to 0.3 inches) in diameter and carnose. The flowers may be hummingbird pollinated (Proctor 1992).

Habitat:
Gonocalyx portoricensis is found in the Caribbean National forest in the Luquillo Mountains and

in the Toro Negro Commonwealth Forest in Jayuya. Richard A. Howard, of the Arnold Arboretum,, discovered *Gonocalyx concolor* in January 1968 on Cerro La Santa in the Carite Commonwealth Forest. Cerro La Santa lies on the border of the municipalities of Cayey and San Lorenzo at an elevation of approximately 903 meters (984 feet) (Proctor 1992). The plant was also reported from the Caribbean National Forest in the Luquillo Mountains of northeastern Puerto Rico (personal communication 1996 cited in U.S. Fish and Wildlife Service candidate assessment form).

The Carite Commonwealth Forest is located in the Sierra de Cayey in the municipalities of Guayama, Cayey, Caguas, San Lorenzo, and Patillas in southeastern Puerto Rico. The highest peak is Cerro La Santa at 903 meters (2,962 feet). The forest is steep, with slopes ranging from 20 to 60 percent. Underlain by volcanic rock, andesitic in composition, the forest's soils are primarily of clay texture with moderate or slow permeability. Mean annual rainfall is 2,150 mm (86 inches), with February through April being the drier months. Mean monthly temperature varies from 20˚C in February to 23˚C in September. The forest lies within the subtropical wet forest and subtropical lower montane forest life zones. Five vegetation types have been identified: upper montane and palm, lower montane, dwarf or elfin, early successional, and plantations. *Gonocalyx concolor* occurs in the dwarf, or elfin, forest type.

POPULATION STATUS

Currently, *G. concolor* is known only from the type locality in the Carite Commonwealth Forest. The population previously reported from the Luquillo Mountains is apparently no longer extant. Approximately 172 plants have been located at the Carite site. Initial efforts at propagation have been successful. Preliminary studies of the species' reproductive biology indicate that the plant is predominantly outcrossed and outcrossed flowers produced twice the number of seeds than did selfed flowers (personal communication 1996 cited in U.S. Fish and Wildlife Service candidate assessment form).

The U.S. Fish and Wildlife Service classifies *Gonocalyx concolor* as a candidate for Endangered Species Act protection with a listing priority number of 5.

LISTING CRITERIA

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

Historical range:	Puerto Rico.
Current range:	Carite Commonwealth Forest on Cerro La Santa , which is on the border of the municipalities of Cayey and San Lorenzo Puerto Rico.
Land ownership:	The sole known population occurs on land managed by the Puerto Rico

Department of Natural and Environmental Resources.

Gonocalyx concolor has been affected in the past by the construction of roads and telecommunication towers on these mountain peaks. It has also been affected by landslides. Currently, the only known population is located on Cerro La Santa in the Carite Commonwealth Forest. The dwarf or elfin forest in Carite has been reduced in size by nearly 20 percent as a result of the construction of communication towers. The species is found growing on trees located close to the communication towers, the road, plantations, and trails. Any expansion of these facilities might result in a loss of individual plants. The population falls within the Carite Commonwealth Forest and is managed by the Puerto Rico Department of Natural and Environmental Resources, but the forest has no management plan.

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

While *G. concolor* is an attractive plant, it is not known to be utilized for commercial, recreational, scientific or educational purposes.

C. ***Disease or predation.***

Neither disease nor predation are known to be factors affecting this species.

D. ***The inadequacy of existing regulatory mechanisms.***

The Commonwealth of Puerto Rico has adopted a regulation that recognizes and provides protection for certain Commonwealth listed species. However, *Gonocalyx concolor* is not on this list. Federal listing would provide protection under the Endangered Species Act, and, by virtue of the existing cooperative agreement under section 6, it would ensure the species' addition to the Commonwealth list.

Current Conservation Efforts: Aspects of the reproductive biology of the species have been studied and propagation efforts have been initiated.

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

One of the most important factors affecting the continued survival of this species is its limited distribution. The species is epiphytic, growing on the trunks of trees. Damage caused by hurricanes, including tree fall, defoliation, and landslides, could result in the loss of individual plants. Hurricane Georges caused severe damage in the Carite Commonwealth Forest. The species is possibly pollinated by hummingbirds and any modification in habitat that results in shifts in faunal composition may result in the reduction of pollinators.

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PETITION TO LIST

whorled sunflower
(*Helianthus verticillatus*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

Helianthus verticillatus (Asteraceae) was described in 1898 by J.K. Small based on a collection made by S.M. Bain from Chester County, Tennessee, in 1892 (Nordman 1998; Matthews et al. 2002).

No additional collections of this species had been made when Beatley (1963) speculated that the specimens from this single collection site (which lacked basal parts and mature achenes) perhaps represented a single aberrant individual formed from hybridization of an opposite- and an alternate-leaved *Helianthus* species. With no new material to examine, Heiser (1969) and Cronquist (1980) accepted Beatley's suggestion that *Helianthus verticillatus* was a hybrid.

Between 1994 and 1997 several small populations of this species were found in northwestern Georgia and northeastern Alabama, and in 1998 a population was discovered in Tennessee near the site where the type material was collected more than a century previously (Matthews et al. 2002). Morphological and karyotype studies of this material clearly demonstrate that *Helianthus verticillatus* is not a hybrid, but rather a distinct diploid species (Matthews et al. 2002).

NATURAL HISTORY

Morphology:
Small (1898) distinguished *Helianthus verticillatus* from the related *Helianthus gigianteus* by its mostly whorled leaves, glabrous stems, narrow, entire leaf blades, and narrowly linear-lanceolate involucre bracts.

Habitat:

This species is found in moist, prairie-like openings in woodlands and along adjacent creeks. Soils are sandy clays which are alkaline, high in organic matter, and seasonally wet. These communities have strong affinities to the Tall Grass Prairie (including as dominant species, e.g., *Andropogon scoparius* (little bluestem) and *Sorghastrum nutans* (Indian grass)) and are habitat for a number of rare species including *Marshallia mohrii* (Mohr's Barbara's buttons), which is federally listed as threatened.

POPULATION STATUS

Helianthus verticillatus was rediscovered in 1994 in a wet prairie area in Floyd County, Georgia, the first collection in more than 100 years (Allison 1997, Ranger 1995). At this site, plants are concentrated in two areas less than 0.3 kilometer (km) (0.2 mile (mi)) apart. It is difficult to determine the exact number of plants at these sites since this species is rhizomatous; however, 1,000 stems were counted at one site covering approximately 0.4 hectare (1 acre) in area, and one large clump of 20 stems (perhaps representing a single individual) was observed along a nearby creek.

An additional population was discovered in Cherokee County, Alabama, in 1996, in a remnant strip of prairie approximately 3.2 km (2 mi) from the Georgia site (Allison 1997). Several hundred stems were counted at this site at the time of its discovery; however, a subsequent visit revealed that the site had been clear-cut and that the number of plants had decreased (*in litt*. 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). Surveys in 1999 resulted in the discovery of a second Cherokee County site approximately 3 miles from the known population. Approximately 50 plants, some of which extend along a roadside, were counted at this site. Recent survey efforts in Tennessee (Nordman 1998) resulted in the discovery of a fourth population (Madison County). Here, an estimated 700 to 1,200 stems were found growing along a railroad right-of-way, in an adjacent hayfield, along a roadside right-of-way, and along a nearby creek (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). No additional populations were located during surveys in 2000 in Alabama, Georgia, and Tennessee.

In summary, only four populations are known for this species, with two in Alabama, and one each in Georgia, and Tennessee.

The U.S. Fish and Wildlife Service classifies *Helianthus verticillatus* as a candidate for Endangered Species Act protection with a listing priority number of 5. The Alabama, Georgia and Tennessee Natural Heritage Programs list this species as Critically Imperiled.

LISTING CRITERIA

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

Historical range: Alabama, Georgia, and Tennessee.

Current range: Alabama (two sites), Georgia (one site), and Tennessee (one site).

Land ownership: All known populations occur on private land. Temple-Inland Container Corporation, an industrial forestry company, owns the sites in Alabama and Georgia.

This species appears to be a narrow habitat specialist occurring in natural wet meadows/prairies and calcareous barrens. Such habitats are not very extensive and they are often degraded or destroyed for a number of reasons (i.e., agriculture, timbering, residential development). Most of the remaining wet prairies exist as remnants along roadside rights-of-way where mid-successional stages are artificially maintained (*in litt*. 1999 cited in U.S. Fish and Wildlife Service candidate assessment form).

The greatest threat to this species appears to be from industrial forestry practices (*in litt*. 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). Much of this species' prairie habitat has been converted to pine monoculture (*in litt*. 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). One of the Alabama sites was clear-cut in 1998 and numbers at this site have remain low since then (*in litt*. 1999 and personal communication 2000 cited in U.S. Fish and Wildlife Service candidate assessment form). This population will not survive if this site is converted to pine monoculture, as is the current trend. The single Georgia population is owned by a timber company; thus, modification or destruction of its habitat in association with timbering could pose a threat. However, thus far, the timber company has been working with the State of Georgia and The Nature Conservancy to manage the site for this species (U.S. Fish and Wildlife Service candidate assessment form)..

Helianthus verticillatus has not been relocated at the type locality in Tennessee despite intensive surveys of that area (Nordman 1998). However, this record is over 100 years old and locality information is vague, so it is not possible to ascertain the reason for the loss of that site. In Tennessee, much of this species' suitable habitat has been converted for agricultural usage (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). The extant Tennessee population is surrounded by cultivated fields and pastures. The largest concentration of plants at the Tennessee population is located in a natural hayfield (Nordman 1998).

Improvement of the hayfield with fertilization and the introduction of non-native grasses would be detrimental to the population. Plants extending onto the roadside and railroad rights-of- way at this location, and at one of the Alabama sites, are vulnerable to accidental disturbances. These plants could be destroyed if herbicides are used in association with right-of-way maintenance. Any future road construction poses a potential threat to plants located near these road.

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

Helianthus verticillatus is currently not known to be a component of the commercial wildflower

trade; however, it is attractive and has horticultural potential. Taking and vandalism pose threats because of the species' visibility when flowering and the accessibility of the sites.

C. ***Disease or predation.***

This species is not known to be threatened by disease or predation.

D. ***The inadequacy of existing regulatory mechanisms.***

Helianthus verticillatus is a species of special concern in Tennessee and considered endangered in Alabama and Georgia (three 1999 personal communications cited in U.S. Fish and Wildlife Service candidate assessment form); however, it does not receive any formal protection in those States.

Current Conservation Efforts: The Georgia Department of Natural Resources and The Nature Conservancy have been working with staff of Temple-Inland to develop a conservation strategy for the population in Floyd County, Georgia. Temple-Inland implemented a prescribed burn and thinning in 2000 to improve habitat conditions for this species. No permanent protection or formal agreement has been obtained as of yet. Status survey efforts were funded by the U.S. Fish and Wildlife Service in Tennessee in 1998 and 1999. Surveys in Alabama were completed in 2000.

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

The whorled sunflower is extremely vulnerable because of the small number of known populations. A single natural or unnatural disaster could lead to its extinction. *Helianthus verticillatus* appears to have restricted ecological requirements and is dependent upon the maintenance of prairie-like openings for its survival. Soil conditions, in combination with occasional, naturally occurring fires, are thought to have played a role in maintaining suitable habitat. Much of this species' habitat has been degraded due to fire suppression and the subsequent invasion of woody competitors (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). Extant sites will require active management to keep competition and shading under control.

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PETITION TO LIST

Neches River rose-mallow
(*Hibiscus dasycalyx*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The status of *Hibiscus dasycalyx* (Malvaceae) as a taxonomically valid species is uncontroversial (e.g., Kartesz 1998; Hatch et al. 2001).

NATURAL HISTORY

Morphology:
The Neches River rose-mallow is a perennial woody herb growing 3-7 feet tall with one or more stems. It bears large and showy white flowers about 3-6 inches wide, each with five 2- 4 inch-long petals. Its leaves are deeply 3-lobed and arrowhead-shaped, with each lobe linear and slenderly tapering. Leaf margins are irregular or saw-toothed. It blooms in the summer, generally June to September, and the mature seeds are densely pubescent (hairy) and buoyant in water for several hours.

Habitat:
The Neches River rose-mallow is found only in east Texas grassland wetlands. It appears to be restricted to wetland areas that are exposed to open sun. It is generally found growing in open,

marshy areas (ponds, sloughs, oxbows) within the immediate floodplain of a permanent stream or river. Areas supporting the plant normally hold standing water early in the growing season, with water levels dropping, but never drying completely until very late in the growing season. This species appears to have community dominance within the narrow band between high and low water levels in wetlands exposed to the open sun.

POPULATION STATUS

A 1995 status survey covering 10 counties resulted in confirmation or discovery of the species at only three sites, but in three separate counties. Two more sites were discovered in 1996 and 1997. Although currently low in number, the distant locations of these sites suggest a relatively wide historical range. As of 1999, the various populations included:

1) Lovelady site (near Tantabogue Creek in Highway 230 ROW southwest of Lovelady in Houston County): supported an average of 3 plants during years 1993- 1997, 13 for 1998-1999, and 8 in 2000; number of stems averaged 33 and number of fruits/flowers averaged 132 for years 1993-1999.
2) Maxwell site (on private land adjacent to Lovelady ROW population in Houston County): supports about 200 plants along a wide drainage-way.
3) Champion site (on private land near White Rock Creek in west Trinity County): supports more than 300 individuals.
4) Highway 94 roadside park (on highway ROW near Neches River in east Trinity County): supported an average of 35 plants for years 1993-1995, 15 in 1996-1998, 49 in 1999, and 17 in 2000; number of stems averaged 103 and number of flowers/fruits averaged 176 for years 1993-1999. The species has begun colonizing an area left un-mowed by maintenance personnel at the request of the State.
5) Temple-Inland site (on private land near Highway 94 park site in east Trinity County): supports more than 300 plants within a large, managed wetland.
6) Ponta site (on Mud Creek in Highway 204 ROW in Cherokee County): only one plant within ROW monitored regularly 1993-2000; number of stems averaged 6 and number of flowers/fruits averaged 113 for 1993-1999. However, some 75-100 plants lying beneath the Mud Creek bridge are inaccessible due to high water and remain un-identified.

The year 1998 was a year of extreme drought in east Texas. Although plants were present, they were stunted and most did not produce flowers. Year 1999 indicated some recovery from the drought, but 2000 was another drought year, and flowering was erratic. While some sites were just beginning to form buds and flower (Mud Creek), other sites were already in fruit (Lovelady). Most sites that supported flowering held some water in the beginning of the season, but soon dried, probably resulting in poor fruiting success.

In spring 2000, the recovery team received permission to introduce propagated plants onto two areas of Davy Crockett National Forest. A total of nearly 700 plants were placed within Compartments 16 and 20 on the edges of wetlands that remained wet and intact during this

year's drought. The U.S. Fish and Wildlife Service has monitored these plants, and has noted excellent survival and even flowering during this summer (U.S. Fish and Wildlife Service candidate assessment form).

The U.S. Fish and Wildlife Service classifies *Hibiscus dasycalyx* as a candidate for Endangered Species Act protection with a listing priority number of 5. The Texas Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA

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

Historical range: Texas.

Current range: Five widely separated sites in East Texas.

Land ownership: Approximately 30% of known sites lie within Texas Department of Transportation rights-of-way. Approximately 70% occur on private lands, to which FWS currently has limited access. Two new populations have been established on National Forest land, and their survival is being monitored.

The historical habitat of *Hibiscus dasycalyx* has been affected by drainage or filling of floodplain depressions and oxbows, stream channelization, road construction, timber harvesting, agricultural activities (primarily mowing and grazing), and herbicide use. Threats to current potential habitat include wetland alteration, herbicide use on private lands and along powerline rights-of-way, grazing, and mowing. Although three of the known rose-mallow sites are protected by highway right-of-way agreements, which establish herbicide and mowing restrictions, two of these (Lovelady and Ponta sites) remain vulnerable to agricultural activities (herbiciding and mowing) on adjacent private land, and appear to be declining in number as a result. The species is also vulnerable to hybridization with more common and weedy *Hibiscus* species.

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

Members of the genus *Hibiscus* are of high horticultural interest, but no overutilization threats to this species are currently known.

C. *Disease or predation.*

Although the first foliage of the year is often consumed by insects before mid-summer, the plants regularly produce a second crop of leaves which are not eaten, so predation is not a major threat.

D. ***The inadequacy of existing regulatory mechanisms.***

With the exception of two recent introductions onto National Forest land, all known populations are on private land or within State (Texas Department of Transportation) highway right-of-way. Management agreements have been developed for right-of-way sites, but plants on private lands receive little protection unless the landowner is willing to establish such restrictions. Protection measures for all plants are limited to some degree in Texas because of the large proportion (97 percent) of private land. Currently, there are no restrictions on use of herbicides near populations on private land, and only limited review of federally-funded wetland projects that could affect the species.

Current Conservation Efforts: A recovery team is in place that includes The U.S. Fish and Wildlife Service, Texas Parks and Wildlife Department, U.S. Forest Service, Texas Nature Conservancy, Stephen F. Austin State University, and private industry. According to the U.S. Fish and Wildlife Service candidate assessment form, the following conservation efforts are underway:

o Texas Parks and Wildlife Department has management agreements in place with Texas Department of Transportation to protect the three right-of-way populations (Lovelady, Ponta, Highway 94).
o A candidate conservation agreement has been secured with Champion International, a large timber company, to protect the population on their land in west Trinity County. A similar agreement for the population found on property owned by the Temple-Inland Forest Products Corporation (east Trinity County), is being pursued but may not be successful.
o FWS has contacted the owner of the Maxwell site (William Earl Maxwell) and he has been receptive to the possibility of a conservation agreement for his land.
o With partial funding from National Fish and Wildlife Foundation, Stephen F. Austin State University (SFASU) is conducting a genetic analysis of the Neches River rose-mallow and related species, based on plant tissue collected from known sites in summer 1998. They are also determining the species' habitat needs based on experimental plantings at a site on Mill Creek in Nacogdoches County. Finally, they have propagated more than 2000 plants suitable for introduction efforts.
o Davy Crockett National Forest (DCNF) represents the only public land within the range of the rose-mallow. Aerial photos and site visits identified two wetland sites that supported favorable rose-mallow habitat. DCNF Ranger Raoul Gagne and Forest Supervisor Ronnie Raum gave the team permission to re-introduce the species at these two sites. About 700 plants were planted in April 2000, with the help of DCNF, SFASU, and Texas Nature Conservancy. According to the U.S. Fish and Wildlife Service, these plants will be monitored and, if they become self-sustaining, FWS will seek their protection through a conservation agreement with USFS (U.S. Fish and Wildlife Service candidate assessment form). David Wrobleski (DCNF biologist) reported good survival and reproduction during the summer (personal communication cited in U.S. Fish and Wildlife Service candidate assessment form).

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

All populations of this plant are currently at high risk due to genetic swamping by an invading related *Hibiscus* species, *H. laevis*. It is believed that this invasion is due to human alteration of *H. dasycalyx* habitat.

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PETITION TO LIST

Florida Keys indigo
(*Indigofera mucronata* var. *keyensis*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 09/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 06/13/02: C

TAXONOMY

The name *Indigofera mucronata* var. *keyensis* (Fabaceae) is listed as a synonym for *Indigofera trita scabra* by Wunderlin and Hansen (2000). Kartesz (1998) uses the name *Indigofera trita* var. *keyensis* for this taxon. Bradley and Gann (1999) note that the nomenclature for this taxon needs further study.

NATURAL HISTORY

Contrary to some reports in the literature, this plant is not a vine. The reports are probably based on misidentified specimens of *Indigofera miniata* (Bradley and Gann 1999). Such misidentifications are probably also the source of reports in the literature (Austin 1980, Isely 1990) to the effect that this is a common, weedy species (Bradley and Gann 1999).

Morphology:
Indigofera mucronata var. *keyensis* is a scrambling to erect annual or probably perennial herb up to 1 meter (3 feet) tall. The leafstalk is usually 1.5 to 2.5 centimeters long. Leaves usually have 5 leaflets in pairs. The flowers are typical of peas, with the corolla 6 to 7 millimeters long. The pod is 3 to 4.5 centimeters long.

Habitat:
Indigofera mucronata var. *keyensis* is found at edges of rockland hammock (Small 1933), coastal berm, and rock barren communities in the upper Florida Keys (Bradley and Gann 1999). Coastal rock barren is an open community with no tree canopy and a sparse subcanopy of understory hardwoods. Most of the area is composed of exposed Key Largo Limestone with diverse

assemblage of herbaceous plant taxa, many of which are halophytes (Bradley and Gann 1999). The origin of this community is not understood. It seems possible that periodic storm events are responsible for maintaining coastal rock barrens (Bradley and Gann 1999).

POPULATION STATUS

Indigofera mucronata var. *keyensis* was historically found in the upper and middle Florida Keys from Key Largo to Knight Key. It has been collected or reported on 11 islands, including Crawl Key, Key Largo, Knight Key, Lignumvitae Key, Long Key, Long Point Key, Lower Matecumbe Key, Plantation Key, Upper Matecumbe Key, Vaca Key, and Windley Key. It is currently known only from Crawl Key, Key Largo, Long Key, Long Point Key, Plantation Key, and Windley Key. *Indigofera mucronata* var. *keyensis* has been found in three State parks: John Pennecamp Coral Reef State Park, Long Key State Park, and Windley Key Fossil Reef State Geological Site. A tiny fourth population of 3 to 4 plants is on private, unprotected land at Long Point Key. This species was not found at one of these sites during a study conducted by Ross and Ruiz (1996), possibly due to lack of specific location information in the collection notes. The total number of plants is estimated at between about 100 and 1,000 (Ross and Ruiz 1996; Bradley and Gann 1999).

The U.S. Fish and Wildlife Service classifies *Indigofera mucronata* var. *keyensis* as a candidate for Endangered Species Act protection with a listing priority number of 6. The State of Florida lists this species as endangered (Wunderlin and Hansen 2000).

LISTING CRITERIA

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

Historical range:	Upper and middle Florida Keys from Key Largo to Knight Key, Florida.
Current range:	Crawl Key, Key Largo, Long Key, Long Point Key, Plantation Key, and Windley Key, Florida.
Land ownership:	Three of six occurrences of *Indigofera mucronata* var. *keyensis* are in State Park properties: John Pennecamp Coral Reef State Park, Long Key State Recreation Area, and Windley Key Fossil Reef State Geological Site. A fourth population is on private land at Long Point Key.

This species has been extirpated from the Lower and Upper Matecumbe Keys. Only six occurrences of *Indigofera mucronata* var. *keyensis* are currently known and probably no more than 1,000 individuals exist. The coastal rock barrens where populations occur at Long Key State Recreation Area and Windley Key Fossil Reef State Geological Site are being invaded by native and exotic hardwoods(Bradley and Gann 1999). At least the exotic hardwoods on these sites

should be controlled.

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

None are known.

C. ***Disease or predation.***

None are known.

D. ***The inadequacy of existing regulatory mechanisms.***

The Florida Department of Agriculture and Consumer Services has designated this plant as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur.

Current Conservation Efforts: Although the *Indigofera mucronata* var. *keyensis* populations located on public lands are protected from development, they are still under threat from exotic vegetation. There are no specific conservation activities for *Indigofera mucronata* var. *keyensis* on public lands. There are no current conservation activities for the single *Indigofera mucronata* var. *keyensis* population on private land.

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

Exotic plant taxa negatively affect *Indigofera mucronata* var. *keyensis* throughout its range. At least 162 taxa of exotic plants are now known to invade *Indigofera mucronata* var. *keyensis* habitat (U.S. Fish and Wildlife Service 1998). On Long Point Key, encroaching Brazilian pepper (*Schinus terebinthifolius*) threatens to close over the opening where a small population of *Indigofera mucronata* var. *keyensis* occurs. It is unlikely this population will survive another decade under current conditions (Ross and Ruiz 1996). Latherleaf (*Colubrina asiatica*) could also severely affect this species (Bradley and Gann 1999).

Management of exotic plant invasion is crucial to the conservation of the species. Without proper control and eradication of these exotic plants, they become tall and dense creating a poor environment for *Indigofera mucronata* var. *keyensis*. Given the species' narrow range and the small number of individuals, *Indigofera mucronata* var. *keyensis* is vulnerable to natural events such as hurricanes and tropical storms. Either one of these events could extirpate existing populations–or rehabilitate coastal barrens habitat.

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PETITION TO LIST

gladecress
(*Leavenworthia crassa*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 07/01/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 09/27/85:
CNOR 02/21/90:
CNOR 09/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 06/13/02: C

TAXONOMY

Leavenworthia crassa, a winter annual in the mustard family (Brassicaceae), was described by Rollins in 1963 from material collected in 1959 from Morgan County, Alabama. The taxonomic status of *L. crassa* as a valid species is uncontroversial (e.g., Kartesz 1998).

NATURAL HISTORY

This species is a component of glade flora and occurs in association with limestone outcroppings. The terms “glade” and “cedar glade” refer to shallow-soiled, open areas that are dominated by herbaceous plants and characterized by exposed sheets of limestone or gravel. Eastern redcedar (*Juniperus virginiana*) trees are frequent in the deeper soils along the edges of the glades (Baskin and Baskin 1985, Baskin et al. 1986, Hilton 1997). Historically, glades in northern Alabama occurred as glade complexes where open areas of exposed or nearly exposed limestone were separated by segments of woody vegetation to form an intricate pattern of habitats grading into one another (Hilton 1997). Few undisturbed examples of this community type remain (Rollins 1963, Baskin and Baskin 1985, McDaniel and Lyons 1987, Hilton 1997).

Populations of *Leavenworthia crassa* are now located in glade-like areas exhibiting various degrees of disturbance, including pastures, roadside rights-of-way, and cultivated or plowed

fields (Hilton1997). As with most of the cedar glade endemics, *Leavenworthia* exhibit weedy tendencies and it is not uncommon to find them growing in these altered habitats; however, the geographical range of this species is probably very similar to what it was in pre-settlement times since none of the cedar glade endemics appear to spread far from their original glade habitat (Baskin et al. 1986).

Leavenworthia crassa is endemic to a 13-mile radius area in north central Alabama in Lawrence and Morgan counties (Rollins 1963). A 1961 record from Lauderdale County has never been confirmed (McDaniel and Lyons 1987). Surveys (*in litt.* 1981 cited in U.S. Fish and Wildlife Service candidate assessment form; McDaniel and Lyons 1987; Hilton 1997) were unsuccessful at locating a number of historical sites for *L. crassa*. McDaniel and Lyons (1987) failed to locate eight sites previously reported by Rollins (1963) and Lloyd (1965); Hilton (1997) was unsuccessful at relocating seven sites listed in McDaniel and Lyons' 1987 status report.

POPULATION STATUS

Currently, only six populations of this species are thought to survive with three populations each in Morgan and Lawrence counties, Alabama. Only one of the six populations is rated a high quality site (A-rank), having 500 or more plants in a relatively undisturbed glade. Of the remaining populations, two are given a B-rank (50 or more plants on a glade with some disturbance); two have a C-rank (20 or more plants in disturbed glade community); and one was given a D-rank (few plants in unrestorable habitat) (Hilton 1997). (The Nature Conservancy ranks sites and populations using A through D, but criteria may vary depending upon the species and habitat type. Hilton developed these ranks specifically for *Leavenworthia crassa* and its habitat type.).

The U.S. Fish and Wildlife Service classifies *Leavenworthia crassa* as a candidate for Endangered Species Act protection with a listing priority number of 5. The Alabama Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA

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

Historical range:	Northern Alabama.
Current range:	13-mile radius area in north central Alabama in Lawrence and Morgan counties.
Land ownership:	One population occurs on U.S. Forest Service land. The remaining sites are located on private land with plants in some populations extending onto county-maintained roadside rights-of-way.

This species is endemic to cedar glade areas in north central Alabama that have been significantly altered from their original condition. More than a 50 percent loss in glade habitat has occurred since European settlement (Hilton 1997). Glade habitats today have been reduced to remnants fragmented by agriculture and development.

Hilton (1997) conducted a thorough survey of cedar glade communities in north Alabama using historical records, soil maps, topographic maps, geology and aerial photography. Her efforts resulted in the identification of 22 high priority glades. However, field surveys found only five of these to be in good condition and restorable; only two of these were considered high quality sites (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form).

At four of the *Leavenworthia crassa* sites, plants occur in pasture areas, on roadside rights-of-way, and/or in planted fields surrounded by agriculture or residential developments (Hilton 1997). Periodic disturbance, such as plowing in row crop farming, arrests succession and maintains populations in this type of habitat; however, plowing or herbicide treatment in the spring prior to seed set and dispersal could be detrimental to populations. Plants extend into pastures at two sites. Populations are enhanced by the disturbance created from light grazing; however, heavy grazing of pastures creates unfavorable conditions (i.e. soil compaction, soil eutrophication) for *Leavenworthia crassa*.

Improvement of pastures with fertilizer treatments and/or the introduction of forage grasses would eventually decimate populations due to competition. Lyons (*in litt.* 1981 cited in U.S. Fish and Wildlife Service candidate assessment form) considered that her failure to relocate many of the historical *Leavenworthia crassa* sites from the 1960's was due to the change in agricultural practices from growing corn to using those sites for cattle pastures. McDaniel and Lyons (1987) considered the trend toward converting agricultural sites for use as pasture as a primary threat to the species. Populations extend onto roadsides or are near roads at five of the six sites. Mowing and herbicide application prior to seed set pose threats to those populations located on roadside rights-of-way. Three historical sites near roads have not been relocated and a portion of one of the existing populations was destroyed by road widening and grading in the 1980's (McDaniel and Lyons 1987). The largest population of this species has a dirt road traversing through a portion of the site and this has made the site vulnerable to off-road vehicles and dumping (Hilton 1997).

Hilton (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form) considers residential and industrial development to be the primary threat to cedar glade communities today and the primary reason for the loss of cedar glade habitat in the last decade. One of the six populations is located in the front yard of a residence.

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

Overutilization is not considered a threat to this species.

C. *Disease or predation.*

One population was lost due to infection by a mustard rust in the early 1980's (McDaniel and Lyons 1987; Lyons and Antonovics 1991). It is not known whether this disease poses a significant long-term threat to the species.

D. ***The inadequacy of existing regulatory mechanisms.***

This species is considered endangered in Alabama by the Alabama Natural Heritage Program; however, there are no State or Federal laws that give this species any legal protection. The population within the Bankhead National Forest is within a Native American cultural site and, as such, is taken out of active timber management. No other protective measures are afforded to this species and its habitat at this site.

Current Conservation Efforts: The Nature Conservancy, Alabama Natural Heritage Program, has approached the Forest Service concerning protection/management needs for the population on their property. No management plan has been drafted as of yet. The U.S. Fish and Wildlife Service funded a survey of cedar glade habitats in the Moulton Valley physiographic region of northwestern Alabama, the major area for this habitat type.

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

Winter annuals, such as *Leavenworthia*, are excluded from many habitats because they are poor competitors (Baskin and Baskin 1985). The most vigorous populations of *Leavenworthia crassa* are located in areas which receive full, or near full, sunlight at the canopy level and have limited herbaceous competition (Hilton 1997). Rollins (1963) documented the loss of plants of *Leavenworthia* by invading grasses in an unweeded portion of an experimental plot, while those plants of *Leavenworthia* in the hand-weeded part of the plot thrived. Lloyd (1965) also noted that *Leavenworthia* species competed poorly with invading weedy species in fallow agricultural fields in north Alabama.

Hilton (1997) was unable to relocate five populations in abandoned fields and pastures, which McDaniel and Lyons (1987) had noted as appearing depressed due to competition from invading weedy species. Shading and competition are potential threats at the two largest populations of *Leavenworthia crassa* (Hilton 1997). One site, reported to be widely open in 1963, is now partially shaded due to a partial closing of the canopy (Hilton 1997). Exotics are a major problem in many glades due to the ever present disturbances that allow for their colonization (Hilton 1997). Exotics pose a threat to one population of *Leavenworthia crassa* where they have established near an unimproved road traversing the site (Hilton 1997).

Under natural conditions, cedar glades are maintained edaphically through drought and erosion. The shallow soil, exposed rock, and frequent hot, dry summers create xeric conditions that keep competition and/or shading effects of encroaching vegetation in check (Hilton 1997, McDaniel and Lyons 1987, Baskin et al. 1986, Rollins 1963). The soils that develop on the glades are easily eroded, moving downslope or into fractures in the substrate. Periodic fires also likely played a role in maintaining these communities (Hilton 1997). Due to the continuing loss and modification of cedar glade habitats, presently available habitat for *Leavenworthia crassa* is

primarily in areas modified by human activity, where less than optimum conditions exist to perpetuate appropriate habitat. Periodic disturbance is needed to arrest succession and perpetuate suitable habitat.

As with all annuals, this species' long-term survival is dependent upon its ability to reproduce and reseed an area every year. Thus, populations decline and move toward extinction if conditions remain unsuitable for reproduction for many years.

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PETITION TO LIST

Texas golden gladecress
(*Leavenworthia texana*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 02/21/90:
CNOR 09/30/93:
CNOR 09/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 06/13/02: C

TAXONOMY

Leavenworthia texana (Brassicaceae) was recognized as clearly distinct from *L. aurea*, based on chromosome number and morphology, and described as a new species by Mahler in 1987. Kartesz (1998) recognized this taxon as *Leavenworthia aurea* var. *texana*, but it is recognized as a full species, *Leavenworthia texana*, by Hatch et al. (2001).

NATURAL HISTORY

The Texas golden gladecress is a small annual member of the mustard family. Its deep-yellow flowers bloom relatively early (January-February) and for a short period, restricting the time available for surveys at known sites and potential sites of occurrence.

The Texas golden gladecress, along with the endangered white bladderpod (*Lesquerella pallida*), occurs only on the Weches outcrops of east Texas. At present, the bladderpod and gladecress are known to exist only in San Augustine County.

The Weches geologic formation consists of a layer of calcareous sediment lying above a layer of glauconite clay up to 20 inches below the surface. The formation was produced by ancient Eocene seas 30 to 50 million years ago and is one of the most richly fossiliferous of the Coastal Plain, containing the remains of nearly 100 species of corals and crustaceans. It averages five miles in width as it parallels Highway 21 through north San Augustine County. Erosion of the complex has produced a rugged topography of steep, flat-topped hills and escarpments dissected

by deep valleys. It has also created the unique ecology of Texas golden gladecress habitats: islands of thin, loamy, alkaline soils (pH 7-8), within the normally deep, sandy, acidic soils (pH 4-5) of the Pineywoods region. The glauconite layer of the Weches is impermeable to water, making the thin upper soils seepy and wet much of the year, but often hard and dry during the summer. This, and the alkalinity of the soils, produce conditions unique to Weches outcrops, generally supporting open-sun, herbaceous, and specialized plant communities. Weches glades have some similarity to limestone glades in parts of Oklahoma and Alabama; caliche glades on the Texas Edwards Plateau; and the Catahoula barren communities of north Jasper and Newton counties of Texas.

The environmental factors shared by these communities are shallow, calcareous soils; primarily open-sun conditions; herbaceous-dominated vegetation; and fluctuation from spring soil saturation to summer drought. The open, seepy Weches glades support highly diverse plant communities. More than 100 species, representing at least 39 plant families, have been documented on Weches glades. Most are small and herbaceous, and either annuals or biennials. Besides the endemic bladderpod and gladecress, some species are found nowhere else in eastern Texas, or are uncommon in the Pineywoods. Populations of blazing star, whitlow-wort, and yellow evening-primrose lie more than 200 miles disjunct from their range on the Edwards Plateau, and purple prairie-clover lies more than 135 miles from its central Texas range. Other species, such as blue waxweed and spike-rush, reach the western extreme of their range here and are found nowhere else in Texas. More wide-spread species include Arkansas savory, baby's-breath, brown-eyed susan, canary grass, coneflower, corn-salad, false aloe, green-thread, Indian plantain, sandwort, stonecrop, twist-flower, white heliotrope, wind-flower, wild geranium, and wild onion. Grasses include dropseed, bluestem, grama, and fescue. Trees and shrubs found at glade edges include red cedar, buckeye, dogwood, sugar hackberry, sweetgum, and white ash.

POPULATION STATUS

The Texas golden gladecress was historically recorded at 8 sites in east Texas. It was later restricted to 5 locations, all in San Augustine County. (A population introduced into Nacogdoches County has not been monitored..) Two of these locations have since been lost to glauconite mining. One historic site (Geneva) in Sabine County (adjacent to San Augustine County on the east) was re-discovered in 1998 and found to support over 300 plants. However, this site has since been destroyed by the landowner. No gladecress have been seen in recent years at other white bladderpod sites (Goetz, Blount #2, Miley, Watts, Williams #1 and #2). Texas golden gladecress appear to be restricted in occurrence to the outcrops themselves, as opposed to the bladderpod, which can colonize a substantial area surrounding an outcrop. This factor may render the gladecress even more imperiled than the bladderpod, which is currently listed as endangered. Known sites are now restricted to two. [A third site (Haley) is currently closed to visitors, and its status is unknown.]

1) The Tiger Creek (Chapel Hill) site supported 91 plants in spring 1998 and 67 in spring 2000. The reduction is probably due to extreme drought in the area.

2) The Kardell site on Sunrise Road supported 490 in spring 1998, but only 96 in spring 2000, probably due to drought.

Unless new populations can be discovered, the Texas golden gladecress is in imminent danger of extinction. Only two sites of known status exist, making the species highly vulnerable to rapid and sudden loss. The Texas golden gladecress is in desperate need of immediate and effective conservation measures, yet no funds for such activities have been made available in recent years. This situation needs to be reversed as quickly as possible.

The U.S. Fish and Wildlife Service classifies *Leavenworthia texana* as a candidate for Endangered Species Act protection with a listing priority number of 2. The Texas Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA

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

Historical range: East Texas.

Current range: San Augustine County, Texas.

Land ownership: All historic and current sites occur on private land owned by different individuals.

Texas golden gladecress habitat has been impacted by highway construction, residential development, conversion to pasture and cropland, widespread use of herbicides, and over-grazing. Two sites have been lost to glauconite mining. However, the primary current threat to gladecress habitat is the continued and expanding invasion of non-native and weedy shrubs and vines into Weches glades, converting them to dense shrub-thickets. The most serious invaders are Macartney rose and Japanese honeysuckle, but also include Japanese brome and bush-clover, privet, bermuda-grass, broomsedge, spurge, viburnum, and treebine. Control measures (brush-clearing) carried out in 1995 resulted in reappearance of the gladecress after a 10-year absence at one historic site. and its discovery at a second site. Future control measures could have a similar effect at other historic locations. Some of these sites may also be newly vulnerable to the establishment of concentrated chicken production operations. Many of these operations have been recently established in San Augustine and adjacent counties but, to date, none of them immediately near gladecress sites. However, this could change.

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

None known.

C. *Disease or predation.*

One current site and four more historic sites are currently used for cattle grazing, placing the populations at risk of predation and trampling.

D. ***The inadequacy of existing regulatory mechanisms.***

All populations are on private land and receive little protection. The U.S. Fish and Wildlife Service is currently denied access to one site, resulting in unknown status. Another site is currently grazed, with unknown impact. Protection measures for all plants are limited to some degree in Texas because of the large proportion (97 percent) of private land and the lack of State regulation of rare species.

Current Conservation Efforts: 1) This plant occurs within the same habitat system as the white bladderpod (*Lesquerella pallida*), which is federally listed as endangered. Management activities (brush-clearing) carried out three years ago for the bladderpod resulted in a return of the gladecress to one site after a 10-year absence, and its discovery at a second location. However, non-native shrubs have again invaded these sites, limiting gladecress and bladderpod numbers.

2) U.S. Fish and Wildlife Service funds have recently been allocated to the Texas Nature Conservancy to conduct a status survey of the gladecress and implement protection measures where possible, but complete information and success may be restricted by lack of landowner access. GPS coordinates for existing sites has been determined and each site has been monitored for 3 years. In addition, potential sites of occurrence in surrounding areas have been identified with the use of GIS data, including aerial, geologic, and hydrologic data sources. (No soil survey has been published for San Augustine County.) A total of 48 sites with medium to high potential for glade habitat have been located. The owners of these tracts will be determined, and contact will be made to receive permission to conduct spring surveys on their lands. TNC will be working with all landowners to secure protection measures for known sites.

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

Known gladecress sites are being heavily impacted by invasion of non-native shrubby species. All sites remain vulnerable to conversion to cropland or range, over-grazing, glauconite mining, and concentrated animal feeding operations (CAFO's). Unless new populations can be discovered, the Texas golden gladecress is in danger of extinction. With only two sites of known status, the possibility of succumbing to some man-made or natural event is high. Recent droughts have had a pronounced effect on reproduction (between 1998 and 2000 Tiger Creek site declined from 91 to 67, and Kardell from 490 to just 96).

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PETITION TO LIST

Short's bladderpod
(*Lesquerella globosa*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 07/01/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 09/27/85:
CNOR 02/21/90:
CNOR 09/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 06/13/02: C

TAXONOMY

Short's bladderpod is a perennial member of the mustard family (Brassicaceae) that occurs in Indiana, Kentucky, and Tennessee. This species was first described as *Vesicaria globosa* by Desvaux in 1814 (Payson 1922). In 1888 Watson proposed that, because of several distinctive characters, the American species of the genus *Vesicaria* be separated into their own genus, *Lesquerella*. The taxonomic status of *Lesquerella globosa* as a valid species is uncontroversial (e.g., Kartesz 1998).

NATURAL HISTORY

Morphology:
Short's bladderpod is 3 to 5 decimeters tall and has yellow flowers that appear March through May. The leaves are 1.5 to 3 centimeters (cm) long, 0.2 to 0.6 cm wide, gray-green in color, and densely hairy. The fruits develop soon after flowering and are round, small (0.2 to 0.27 cm in diameter) and become slightly hairy as they mature.

Habitat:
Lesquerella globosa grows on steep, rocky wooded slopes and talus areas. It also occurs along cliff tops and bases and cliff ledges. The species usually is found adjacent to rivers or streams

and on south to west facing slopes. Most populations are closely associated with outcrops of calcareous rock (Shea 1993). The Indiana population is found within the Shawnee Hills section of the Interior Low Plateau Physiographic Province. The Kentucky populations are found within the Bluegrass section of this Province. The Tennessee populations occur within the Highland Rim and Central Basin sections of the Interior Low Plateau Province (Fenneman 1938, Quarterman and Powell 1978).

POPULATION STATUS

Populations vary in size from 2 to about 1,500 individuals; most contain fewer than 50 plants. In a 1992 Status Survey for Short's bladderpod, Shea (1993) reported that there were records of 50 sites that supported or historically supported this species. Of these 50 occurrences, only 26 were found to be extant during the survey. The remaining 24 records were of sites from which the species had been extirpated or lacked sufficient location information to be relocated during the survey. In 1993, Indiana supported one known population of the species, Kentucky 14 populations, and Tennessee 11 populations.

In 1998, the Tennessee Department of Conservation (TNDEC) conducted extensive searches for additional populations of Short's bladderpod and revisited most of the previously known sites. These searches revealed the presence of 7 additional sites for the species in Tennessee (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). These new sites varied in size from 3 to 60 plants.

The Kentucky State Nature Preserves Commission (KSNPC) has, within the past few years, revisited all known Kentucky locations for Short's bladderpod. They have not discovered any additional populations of the species and in 1998 they completed site conservation plans for the highest quality Kentucky Short's bladderpod sites (personal communication cited in U.S. Fish and Wildlife Service candidate assessment form). In Indiana, despite searches for additional populations of Short's bladderpod, only one site is known to support the species in Indiana (personal communication cited in U.S. Fish and Wildlife Service candidate assessment form 1999) . The Indiana population grows on a clay bank adjacent to a dirt road that is periodically flooded. This flooding necessitates regular road grading in order to remove debris deposited during flood events.

At the present time, there are 18 known locations for Short's bladderpod in Tennessee. Cheatham County has six sites. The two largest known populations occur in Cheatham County; one of these large sites contains 1,000 plants and the other contains 1,500 plants. The remaining four populations have 6, 6, 7, and 50 plants respectively. Davidson County has four sites that currently support the species. These vary in size from 13 to 50 plants. Jackson County has three locations supporting Short's bladderpod and these contain 3, 5, and 50 plants, respectively. Montgomery County has two populations, one of these including 10 plants and the other 21 plants. Smith County also has two populations, one of which has 10 plants and the other has 30 plants. Trousdale County only supports one population which contained 100 to 150 plants in

1998. Estimates of the 1998 population levels for all of the known Tennessee sites were provided by Andrea Shea (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form).

Kentucky supports 14 Short's bladderpod sites (Shea 1993 and personal communication cited in U.S. Fish and Wildlife Service candidate assessment form 1999) . In 1992 these sites varied in size from 2 to 118 individual plants, and in 1998 they varied from 2 to 237 plants. Bourbon County, Kentucky, contains one population of the species that had 118 plants in 1992 and 98 plants in 1998. Clark and Scott counties each have one site for the species and both of these sites supported just 2 plants in 1992. Franklin County contains 11 Short's bladderpod populations that vary in size from 237 plants to 4 plants.

Most (7 of 11) of the Franklin County sites contain fewer than 50 plants. In 1998, the KSNPC developed site conservation plans for five of the Kentucky populations. These sites were chosen for conservation plan development because they were believed to highest quality sites remaining in Kentucky (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). Overall, Kentucky sites are generally poor in quality (personal communication cited in U.S. Fish and Wildlife Service candidate assessment form). Only one of the Kentucky populations is protected to any degree; that population is in Clark County. Although this population is within a Registered Natural Area, it is of generally poor quality and contained only 2 plants in 1992.

Historically, there were at least 57 sites supporting Short's bladderpod. Of these 57 sites, only 33 are currently extant. All remaining populations are small and vulnerable to extirpation.

The U.S. Fish and Wildlife Service classifies *Lesquerella globosa* as a candidate for Endangered Species Act protection with a listing priority number of 5. The Indiana Natural Heritage Program lists this species as Critically Imperiled. The Kentucky and Tennessee Natural Heritage Programs list this species as Imperiled.

LISTING CRITERIA

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

Historical range: Indiana, Kentucky, Tennessee.

Current range: Indiana, Kentucky, Tennessee.

Land ownership: Most of the sites (91 percent) for this species are under private ownership or within the rights-of way of State and county roads. Two of the Tennessee sites are on lands managed by the U.S. Army Corps of Engineers, Nashville District (6 percent). One Tennessee site is on State-owned lands (3 percent). The Indiana site is on land owned by The Nature

Conservancy.

Road construction and road maintenance have played a significant role in the decline of *Lesquerella globosa*. These activities continue to pose threats to the continued existence of most populations. During Shea's 1992 status survey for this species (Shea 1993), she observed at least three sites that had been lost or drastically reduced by road construction or maintenance.

She also noted that road maintenance remains a threat at most of the sites. In the introduction to the site conservation plans developed by the KSNPC for the highest quality sites remaining in Kentucky, White (not dated) states that, with only one exception, all of the sites are roadside occurrences that are no longer part of naturally functioning ecosystems. She also states that most occur as small roadside remnants of natural cliffline or rock outcrops; consequently, her management recommendations for these sites concentrate on implementing roadside maintenance activities in a manner compatible with the protection of Short's bladderpod. Specific activities that have impacted the species in the past and continue to threaten it include bank stabilization, herbicide use, mowing during the growing season, grading of road shoulders, and road widening or repaving. Sediment deposition during road maintenance or from land disturbing activities adjacent to the sites supporting the species also potentially threatens many populations.

Shea (1993) noted that impoundments and artificial water level manipulation threatened and, in a case along the Cumberland River, have destroyed sites supporting the species. Many of the Short's bladderpod locations are adjacent to rivers and streams, and impoundment and water level manipulation still threaten the species. Invasive non-native vegetation is a significant threat at most sites. White (not dated) listed invasive plants as a major threat at all five of the sites for which she prepared management plans.

This exotic vegetation was also noted as a threat by Shea (1993) in her assessment of the species status. Invasive plants that have been identified as potential threats to Short's bladderpod include *Lonicera japonica* (Japanese honeysuckle), *Alliaria petiolata* (garlic mustard), *Trifolium hybridum* (alsike clover), *Melilotis alba* (sweet clover), *Festuca pratensis* (fescue), *Rosa multiflora* (multiflora rose) and *Camassis scilloides* (wild hyacinth). These plants have often been planted as ornamentals, as cultivated plants, or for erosion control. Unfortunately, after they are established, they often become quite aggressive and displace native vegetation. In many cases these plants will, if left uncontrolled, completely dominate the vegetation of some areas. Short's bladderpod will be lost from many of these sites if active intervention is not undertaken to reestablish the native flora and eliminate the non-native vegetation.

Activities such as commercial and residential construction potentially threaten the species at several sites. These threats can be direct in the form of actual loss due to construction, or indirect in the form of severe habitat alteration from sediment runoff from areas disturbed during construction. Other threats listed by Shea (1993) and White (not dated) include trash dumping, cattle and goat grazing, and shading from overstory trees.

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

There is little or no commercial trade in *Lesquerella globosa* at this time. Most populations are very small and cannot support collection of plants for scientific or other purposes. Inappropriate collecting for scientific purposes or as a novelty is a threat to the species.

C. *Disease or predation.*

Disease and predation are not known to be factors affecting the continued existence of the species at this time.

D. *The inadequacy of existing regulatory mechanisms.*

Lesquerella globosa is listed as an endangered plant in Tennessee under that State's Rare Plant Protection and Conservation Act. This law regulates the sale of endangered plants and prohibits anyone from knowingly taking an endangered plant without the permission of the landowner or land manager. The species does not receive any protection at the State level in either Kentucky or Indiana.

Current Conservation Efforts: The KNSPC has developed site conservation plans for the five highest quality sites remaining in Kentucky. Tennessee has conducted extensive searches for additional populations of Short's bladderpod, but has not taken any actions to protect any of the known sites for the species.

The IDNP, the KNSPC , and the TNDEC all support the Federal listing of Short's bladderpod as endangered or threatened (three 1999 personal communications cited in U.S. Fish and Wildlife Service candidate assessment form). The Nashville District Corps of Engineers is aware of the proposed elevation of Short's bladderpod to candidate status, and they anticipate that they will be able to provide any management that is needed to protect the species on lands under their control. Region 3 has reviewed this proposal and supports the elevation of Short's bladderpod to Federal candidate status (U.S. Fish and Wildlife Service candidate assessment form).

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

None are known at this time.

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PETITION TO LIST

White Bluffs bladderpod (*Lesquerella tuplashensis*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Lesquerella tuplashensis* (Brassicaceae) as a valid species is uncontroversial (e.g., Kartesz 1998).

NATURAL HISTORY

Lesquerella tuplashensis is a short-lived perennial which grows on the upper edge of the White Bluffs of the Columbia River, Franklin County, Washington.

There is one known population of the species. The population is found on the upper zone and the top of a near vertical exposure of cemented, highly alkaline calcium carbonate paleosol (a "caliche" soil). This hard calcium carbonate paleosol caps several hundred feet of alkaline, easily eroded lacustrine sediments of the Ringold Formation. The species may be an obligate calciphile, as are many of the endemic *Lesquerell*a.

The species occurs intermittently in a narrow band (usually less than 10 meters (33 feet) wide) along an approximately 17 kilometers (km) (10.6 mile (mi)) stretch of the bluff (personal communication 2000 cited in U.S. Fish and Wildlife Service candidate assessment form).

POPULATION STATUS

The population varies considerably between years, but censuses of adult (flowering) plants suggest there may be greater than 50,000 plants in the population during some years. Although plants were originally collected from the population in 1883, the material was in poor condition

and no definitive identification could be made. The plant was not recognized as a species until 1996. The population was rediscovered in 1994, and was described and published as a species by Rollins et al. (1996). Despite searches during 1995 and 1996 in all areas of similar substrate in central Washington, no additional plants have been found.

The U.S. Fish and Wildlife Service classifies *Lesquerella tuplashensis* as a candidate for Endangered Species Act protection with a listing priority number of 5. The Washington Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA:

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

Historical range: Washington.

Current range: A single population along the upper edge of the White Bluffs of the Columbia River, Franklin County, Washington.

Land ownership: Most (approximately 85 percent) of the *Lesquerella tuplashensis* is within the new Hanford Reach National Monument/Saddle Mountain National Wildlife Refuge. However, 23 percent of the total *Lesquerella tuplashensis* population lies near or adjacent to private, irrigated land. Approximately 15 percent of the population occurs entirely on private land.

Groundwater movement from adjacent, up-slope agricultural activities have caused mass-failure landslides throughout the length of the White Bluffs. The southernmost 6 km (3.7 mi) of the population (35 percent of the population) lie near or adjacent to irrigated land and have been moderately to severely altered by seepage and landslides. *Lesquerella tuplashensis* plants have not been found in areas which have been disturbed by landslides, regardless of whether the landslide disturbance is moderate or severe.

Recently, the area of the species distribution has been incorporated into the Hanford Reach National Monument/Saddle Mountain National Wildlife Refuge. This may have somewhat decreased the threats from agriculture and irrigation. However, agriculture and irrigation occurs above the White Bluffs, and any increase in irrigation on the lands in the vicinity of the White Bluffs will increase the probability of mass-failures, hydrologic changes, and invasion of non-native, state-listed noxious weeds into the population. At several locations along the White Bluffs, agricultural activities (farming) occur directly adjacent and up to the edge of the bluff; farming has occurred on these lands since at least the early 1970s and is active presently (Lindsay 1997).

All mass-failures occurring along the White Bluffs, with one exception, are found in association

with water seepage. Water, particularly water from irrigation, is the primary factor triggering mass-slope failures (Lindsay 1997). Yellow star thistle (*Centaurea solstitiali*s) has been documented in the vicinity of the *Lesquerella* population and is known as a rapid invader of arid environments, even in the absence of disturbance. Other threats include recreational mountain bike riding which occurs along the rim of the bluffs for most of the length of the population, with at least one well-established trail.

Off-road vehicles (three-wheel and four-wheel) and dirt bike activity also threaten the species. This occurs intermittently within the Federal portion of the population (a prohibited activity) and commonly within the private portion of the population where it is legal. Off-road vehicle activity has increased disturbance and erosion, destroying individual *Lesquerella* plants.

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

There is no evidence of collection, recreational, scientific, or educational use of this species, although the species is extremely showy and may be subject to collection if access is opened to the public.

C. *Disease or predation.*

Some predation by larval insects on developing fruits was observed yearly since 1996 (personal communication 2000 cited in U.S. Fish and Wildlife Service candidate assessment form). More thorough investigations are necessary to determine whether this results in significant impacts on seed production.

D. *The inadequacy of existing regulatory mechanisms.*

Lesquerella tuplashensis was designated as endangered and added to the list of Endangered, Threatened and Sensitive Vascular Plants of Washington in 1997. However, there is no State Endangered Species Act for plants in Washington, and therefore there is no legal protection based on the state designation. The U.S. Department of Energy (DOE) has no rare plant policy which provides protection, nor does the Washington Department of Fish and Wildlife, which manages portions of DOE lands where the *Lesquerella tuplashensis* is found. The Federal land on which the population occurs is not within any kind of conservation designation.

Current Conservation Efforts: During 1997, a National Fish and Wildlife Foundation grant was awarded to the U.S. Fish and Wildlife Service, in partnership with the Nature Conservancy of Washington. Because the population extends for approximately 17 km (10.6 mi), a subsample approach was implemented to sample the population. The Nature Conservancy has continued to monitor permanent quadrats to investigate life history characteristics of the species. Permanent transects to track changes in population size have not been monitored every year due to lack of resources (personal communication 2000 cited in U.S. Fish and Wildlife Service candidate assessment form).

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

A gravel road parallels the *Lesquerella tuplashensis* population and climbs up the face of the bluffs at the north end of the population. The presence of this road increases the landslide potential (portions of the road have been closed for this very reason--high landslide potential). Portions of the bluff-edge which were dynamited for the road have not been re-colonized by *Lesquerella tuplashensi*s. Part of the population lies adjacent to a scenic overview, which makes plants more vulnerable to collecting and increases the risk of invasion by non-native species. Although a large portion of the population is on Federal Land, the boundary between landowners on top of the bluff is generally not marked or fenced, allowing access by prohibited off-road vehicles and illegal agricultural activities on to Department of Energy lands. In general, pollinators may be negatively affected by pesticide use on orchards and irrigated fields in the vicinity of the population. The population is also naturally limited by the scarcity of its highly specific substrate.

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PETITION TO LIST

sand flax
(*Linum arenicola*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Linum arenicola* (Linaceae) as a valid species is uncontroversial (e.g., Kartesz 1998; Wunderlin and Hansen 2000).

NATURAL HISTORY

Morphology:
Linum arenicola is a wiry, yellow-flowered perennial herb with one to several stems from its base, linear leaves 7 to 10 millimeters long, and flowers with yellow petals about 4.5-5.5 millimeters long (Bradley and Gann 1999, adapted from Rogers 1963).

Habitat:
Linum arenicola historically was distributed in Monroe County in the lower Florida Keys, and in central and southern Miami-Dade County. In Miami-Dade, the plant was widespread from Coconut Grove to what is now the main entrance to Everglades National Park and Turkey Point. In Monroe County, the plant was recorded from Big Pine Key, Ramrod Key, Sugarloaf Key, Park Key, Boca Chica Key, and Middle Torch Key.

This species can be found around solution pits and shallow soils of semi-shaded ephemeral pools

on limerock in open pine rocklands, pineland clearings, and adjacent roadsides (Long and Lakela 1976). Several other species of *Linum* occur within the range of *Linum arenicola* (Kernan and Bradley 1996). *Linum medium, L. carteri* var. *carteri,* and *L. carteri* var. *smallii* also grow on the southeast Florida mainland (Kernan and Bradley 1996).

POPULATION STATUS

Linum arenicola is currently known from only four sites in Miami-Dade County: Camp Owaissa Bauer (owned by Miami-Dade County) and nearby private land, Homestead Air Reserve Base, Homestead Bayfront Park (on a limestone canal levee), and two other private sites. In Monroe County, it is on Big Pine Key (in part on the National Key Deer Refuge). It is also on Sugarloaf Key, on land owned by the Florida Department of Transportation.

Kernan and Bradley (1996) determined that seven mainland (Miami-Dade County) populations of *Linum arenicola* exist in six areas. They estimated that approximately 1,000 plants of *Linum arenicola* occur in Miami-Dade County. All populations but one were estimated by walking transects across populations and counting individuals. The Homestead Air Force base population number 1 was estimated by counting a 1 x 1 meter (3.3 x 3.3 feet) sampling quadrant, and extrapolating the mean to the area of the population (Kernan and Bradley 1996). The Homestead Air Reserve Base population number 1 contains 60 percent of the known individuals in Miami-Dade County (Kernan and Bradley 1996).

A population known as the Old Cutler contained 26 percent of the known individuals in Miami-Dade County, prior to being cleared. There are fewer than 200 plants in the remaining populations on the mainland (Kernan and Bradley 1996). Ross and Ruiz (1996) found *Linum arenicola* in 16 plots in five pine rockland vegetation sampling transects at the National Key Deer Refuge on Big Pine Key. They provided no estimates of numerical abundance. No plants were found at other pine rockland vegetation sampling sites elsewhere in the Florida Keys. Bradley and Gann (1999) estimate this population at fewer than 10,000 plants.

The U.S. Fish and Wildlife Service classifies *Linum arenicola* as a candidate for Endangered Species Act protection with a listing priority number of 2. The State of Florida lists this species as endangered (Wunderlin and Hansen 2000). The Florida Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA

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

Historical range: Monroe and Miami-Dade Counties, Florida.

Current range: Monroe and Miami-Dade Counties, Florida.

Land ownership: Some plants occur on the National Key Deer Refuge, but the exact number is unknown. The largest population on the mainland is on Homestead Air Force Base, which is being closed and the property sold for private development. One site, Camp Owaissa Bauer is a park owned and managed by Miami-Dade County, but the plants there are located along the roadside and, consequently, are exposed to various types of inadvertent abuse, including illegal dumping. One site in private ownership is protected under the Environmentally Endangered Lands Covenant Program. All other sites are in private ownership with no special management or protection; most are on valuable development properties.

Residential and commercial development has drastically reduced the habitat for *Linum arenicola* throughout pine rockland habitats in south Florida and the Florida Keys. Pine rockland habitat in Miami-Dade County has been reduced to about 11 percent of its natural extent (Kernan and Bradley 1996). Of the original 74,000 hectares (ha) (182,780 acres) of pine rockland habitat, 8,140 ha (20,106 acres) remained in 1996. Less than 2 percent of the 65,000 ha (160,550 acres) of pine rockland habitat that existed outside Everglades National Park in 1900 remains today (Kernan and Bradley 1996). Given the number of people moving to Florida, pressures from development are not expected to diminish in the years to come, especially throughout South Florida. Florida has experienced a 15.3 percent increase in the human population from April 1, 1990, to July 1, 1998, and was ranked the fourth fastest growing State in the nation during 1998 (U.S. Census Bureau 1998).

Acreage of pine rocklands on Big Pine Key was reduced from 1,049 ha (2,592 acres) in 1955, to 701 ha (1,732 acres) in 1989 (Folk 1991). This has resulted in a loss of approximately 33 percent of habitat. A significant amount of pine rockland habitat in the Keys is still threatened by development (personal communication 1998 cited in U.S. Fish and Wildlife Service candidate assessment form).

Homestead Air Reserve Base is in the process of being transferred to private ownership, and the populations of *Linum arenicola* in this area (more than 60 percent of the known plants) will likely be impacted by various types of development. The second largest population in Miami-Dade County (256 plants) was destroyed by clearing for commercial development (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form).

Only two *Linum arenicola* populations are on preserves and protected from urban development, Camp Owaissa Bauer and National Key Deer Refuge. Camp Owaissa Bauer is a park owned and managed by Miami-Dade County. The species' restricted ecological range, the drastic loss of its habitat, and the infrequency of collections suggests that *Linum arenicola* may be facing extirpation on the Florida mainland (Kernan and Bradley 1996).

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

None are known.

C. *Disease or predation.*

None are known.

D. *The inadequacy of existing regulatory mechanisms.*

The Florida Department of Agriculture and Consumer Services has designated *Linum arenicola* as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur.

Current Conservation Efforts: In 1979, Miami-Dade County enacted the Environmentally Endangered Lands Covenant Program which gives private land owners of pine rockland habitat a tax break if they agree to not develop the property and manage it for a period of 10 years (U.S. Fish and Wildlife Service 1998). This program is ongoing and has protected many pine rockland sites. One *Linum arenicola* site is on land managed under this program. Although *Linum arenicola* is not specifically managed within the National Key Deer Refuge, the species' may benefit from the conservation efforts made for the Key deer (*Odocoileus virginianus clavium*).

The U.S. Fish and Wildlife Service has developed a multi-species recovery plan for the threatened and endangered species of South Florida. This plan is ecosystem-based and includes many recommendations for conservation of the communities where *Linum arenicola* occurs (U.S. Fish and Wildlife Service 1999).

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

Fire is required to maintain the pine rockland community. Under natural conditions, lightning fires typically occurred at 3- to 7-year intervals. With fire suppression, hardwooods eventually invade pine rocklands and shade out understory species like *Linum arenicola*. Natural fires are unlikely to occur or will be suppressed in the remaining highly fragmented pine rockland habitat in Miami-Dade County.

Exotic plants have significantly affected pine rocklands. At least 277 taxa of exotic plants are now known to invade pine rocklands in South Florida (U.S. Fish and Wildlife Service 1998). Some of these may compete directly with *Linum arenicola* for space and resources, while others have a profound effect on community structure and responses to fire. The exotic tree Brazilian pepper (*Schinus terebinthifolius*) is the most widespread and one of the most invasive species. If left uncontrolled in a fire-suppressed pineland, it will form a dense monospecific canopy almost completely eliminating native vegetation. Earleaf acacia (*Acacia auriculiformis*), natal grass (*Rhynchelytrum repens*), shrub verbena (*Lantana camara*), and tongue tree (*Albizia lebbeck*) are some of the other exotic pests in pine rocklands.

All of these species affect the characteristics of a fire when it does occur. Fires that once burned fairly cool with mostly pine needle duff for fuel may now burn much hotter and affect the type of community that develops following fire. For instance, a catastrophic fire moves the herbaceous component to bracken fern thickets rather than grasses. Therefore, with the presence of exotic species, it is uncertain just how fire, even under a managed situation, will affect *Linum arenicola*. Based on the low number of individuals within the species' narrow range, catastrophic events such as hurricanes and tropical storms may negatively affect the species by altering the vegetation composition or water levels.

Illegal dumping could destroy some *Linum arenicola*. After Hurricane Andrew in 1992, the Bauer Drive site was disturbed by the placement and collection of a pile of clean-up debris that was illegally dumped on a portion of the population (Kernan and Bradley 1996).

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PETITION TO LIST

Carter's small-flowered flax
(*Linum carteri* var. *carteri*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 07/01/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 09/27/85:
CNOR 02/21/90:
CNOR 09/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 06/13/02: C

TAXONOMY

The taxonomic status of *Linum carteri* and *Linum carteri* var. *carteri* as a valid species and variety, respectively, is uncontroversial (e.g., Kartesz 1998; Wunderlin and Hansen 2000). The State of Florida lists *Linum carteri* (Linaceae), which includes both *Linum carteri* var. *carteri* and *Linum carteri* var. *smallii*, as endangered (Wunderlin and Hansen 2000), but the U.S. Fish and Wildlife Service specifically lists the variety *carteri* on its candidate list.

NATURAL HISTORY

***Morphology**:*
Linum carteri var. *carteri* is an erect, annual or short-lived perennial herb, often with several stems 23 to 36 centimeters tall. The stems are puberulent (with fine, short hairs). The leaves are slender, 1.8 to 2.6 centimeters long. Flower petals are orange-yellow and 9 to 17 millimeters long. In habit and flower the plant closely resembles pitted stripeseed (*Piriqueta caroliniana*) (Bradley and Gann 1999).

Habitat:
The historic range of *Linum carteri* var. *carteri* was from Coconut Grove southward in Miami-Dade County in pine rocklands. The very similar *L. carteri* var. *smallii*, which has glabrous

(hairless) stems, has a slightly larger range as an endemic, fire dependent, herbaceous annual plant that historically occurred throughout the pine rocklands of the Miami Rock Ridge on the southeast Florida mainland.

POPULATION STATUS

Linum carteri var. *carteri* can be found only on the Miami Rock Ridge in Miami-Dade County. K. Bradley and G. Gann (1999) estimate that fewer than 1,000 individuals exist at 9 occurrences, of which only 3 are on conservation lands. Recently, a known population of the species was extirpated from the Charles Deering Estate (two 1999 personal communications cited in U.S. Fish and Wildlife Service candidate assessment form).

Linum carteri var. *carteri* is unusual in that none of the known populations is from a completely undisturbed pine rockland. All known occurrences are within scarified pine rocklands, in disturbed areas adjacent to or within rocklands, or in completely disturbed areas. *Linum carteri* var. *carteri* may not be able to tolerate shading or litter accumulation, and therefore may have been excluded from much of its former habitat. Fire was suppressed in Miami pine rocklands for decades, and many native species may have been forced out of these pinelands by excessive shade. Scarified pine rocklands often support diverse assemblage of native pineland herbs and grasses (Bradley and Gann 1999).

The U.S. Fish and Wildlife Service classifies *Linum carteri* var. *carteri* as a candidate for Endangered Species Act protection with a listing priority number of 3. The State of Florida lists *Linum carteri* as endangered (Wunderlin and Hansen 2000). The Florida Natural Heritage Program lists this taxon as Critically Imperiled.

LISTING CRITERIA

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

Historical range:	From Coconut Grove southward in Miami-Dade County, Florida.
Current range:	Miami Rock Ridge in Miami-Dade County, Florida.
Land ownership:	Two *Linum carteri* var. *carteri* populations with fewer than 100 total individuals are located at two county preserves, Camp Owaissa Baer and R. Hardy Matheson, managed by Miami-Dade County. The other five known sites are located on private, non-protected lands and are subject to development.

Residential and commercial development and agriculture have drastically reduced the habitat for *Linum carteri* var. *carteri* throughout pine rockland habitats in south Florida. Pine rockland

habitat in Miami-Dade County has been reduced to about 11 percent of its natural extent (Kernan and Bradley 1996). Of the original 74,000 hectares (ha) (182,780 acres), 8,140 ha (20,106 acres) of pine rockland habitat remained in 1996. Less than 2 percent of the 65,000 ha (160,550 acres) of pine rockland habitat that existed outside Everglades National Park in 1900 remains today (Kernan and Bradley 1996). Given the number of people moving to Florida, pressures from development are not expected to diminish in the years to come, especially throughout South Florida. Florida has experienced a 15.3 percent increase in the human population from April 1, 1990, to July 1, 1998, and was ranked the fourth fastest growing State in the nation during 1998 (U.S. Census Bureau). Habitat loss by itself may drive *Linum carteri* var. *carteri* to extinction.

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

None are known.

C. ***Disease or predation.***

None are known.

D. ***The inadequacy of existing regulatory mechanisms.***

The Florida Department of Agriculture and Consumer Services has designated *Linum carteri*, which includes varieties *carteri* and *smallii*, as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur.

Current Conservation Efforts: In 1979, Miami-Dade County enacted the Environmentally Endangered Lands Covenant Program which gives private land owners of pine rockland habitat a tax break if they agree to not develop the property and manage it for a period of ten years (U.S. Fish and Wildlife Service 1999). Although there are no current conservation activities being conducted for *Linum carteri* var. *carteri* at the two Miami-Dade County preserves, a management plan has been proposed to manage it.

The U.S. Fish and Wildlife Service has developed a multi-species recovery plan for the threatened and endangered species of South Florida. This plan is ecosystem-based and includes many recommendations for conservation of the communities where *Linum carteri* var. *carteri* occurs (U.S. Fish and Wildlife Service 1999).

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

Fire is required to maintain the pine rockland community. Under natural conditions, lightning fires typically occurred at 3- to 7-year intervals. With fire suppression, hardwoods eventually invade pine rocklands and shade out understory plants such as *Linum carteri* var. *carteri*. Natural fires are unlikely to occur or will be suppressed in the remaining highly fragmented pine

rockland habitat in Miami-Dade County.

Invasive exotic plants, especially Burmareed (*Neyraudia reynaudiana*) and Brazilian pepper (*Schinus terebinthifolius*) threaten pine rockland plants, including *Linum carteri*. The control of exotic species in pine rockland is a very important part of habitat maintenance, but can be very difficult and expensive once exotics are established in an area (Bradley and Gann 1999). Brazilian pepper is the most widespread and one of the most invasive species. If left uncontrolled in a fire-suppressed pineland, it will form a dense single-species canopy almost completely eliminating native vegetation. Earleaf acacia (*Acacia auriculiformis*), natal grass (*Rhynchelytrum repens*), shrub verbena (*Lantana camara*), and tongue tree (*Albizia lebbeck*) are some of the other exotic pests in pine rocklands. All of these species affect the characteristics of a fire when it does occur, providing fuel for fires much hotter than when the main fuel was pine needle duff. For instance, a catastrophic fire may favor bracken fern at the expense of grasses.

Based on the small numbers of individuals within the species' narrow range, catastrophic events such as hurricanes or tropical storms may negatively impact the species by altering the vegetation composition or water levels, or simply by creating masses of urban debris that may be disposed in remnant pinelands (as happened in 1992).

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PETITION TO LIST

bog asphodel
(*Narthecium americanum*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Narthecium americanum* (Liliaceae) as a valid species is uncontroversial (e.g., Gleason and Cronquist 1991; Kartesz 1998).

NATURAL HISTORY

The bog asphodel is found in savannah areas, usually with water moving through the substrate, as well as sandy bogs along streams and rivers (Stone, 1911; Fernald, 1950; Radford et al., 1968; Schuyler, 1990; Gleason and Cronquist, 1991). In the New Jersey Pinelands, savannahs are found adjacent to rivers and creeks, often separated by a wooded levee and bordered by an Atlantic white-cedar (*Chamaecyparis thyoide*s) swamp.

Microhabitats include open bogs surrounded by Atlantic white-cedar, lowlands near sharp river bends and oxbow meanders, *Sphagnum* bogs, iron ore streamlet seeps, small mat hummocks, quaking bogs, mud flats, sunny borders with Atlantic white-cedar swamps, and transitional areas (ecotones) (Radis, 1993; Dodds, 1996; Dodds and Goodwin, 1997). This species is intolerant of full shade, and is vulnerable to alterations or succession of its habitat. The growth of woody vegetation in savannah communities occupied by bog asphodel is most likely suppressed by

substrates of iron ore deposits and by intermittent flooding from adjacent rivers and creeks (Cartica, 1999).

POPULATION STATUS

Now extant only within the Pine Barrens region of New Jersey, the historic range of bog asphodel included New York, New Jersey, Delaware, North Carolina, and South Carolina. The New Jersey Natural Heritage Database currently contains records for 66 occurrences (43 extant, 23 historical) of bog asphodel.

The U.S. Fish and Wildlife Service classifies *Narthecium americanum* as a candidate for Endangered Species Act protection with a listing priority number of 8. The New Jersey Natural Heritage Program lists this species as Imperiled.

LISTING CRITERIA

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

Historical range:	New Jersey, New York, Delaware, North Carolina, South Carolina.
Current range:	New Jersey.
Land ownership:	Of the 43 known extant populations of bog asphodel, 29 occur on State-owned lands, 2 occur on federally owned lands, and 12 occur on private lands.

As an obligate wetland species, *N. americanum* is threatened by changes in hydrology, loss of habitat due to filling or draining of wetlands, flooding as a result of reservoir construction, and conversion of natural wetlands to commercial cranberry bogs.

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

Several easily accessible *N. americanum* sites known to be popular with botanists have experienced severe declines from over-collection. Additionally, recreationists picking wildflowers are drawn to the attractive flowers and seedpods of *N. americanu*m, leading to declines in areas visible from trails, roadways, and streams.

C. *Disease or predation.*

Deer and geese are known to occasionally crop some of the flowering culms. These instances cannot be considered major threats to bog asphodel, although they have been reported occasionally. Deer use bog asphodel habitat quite extensively. Seed predation by long-horned grasshoppers has been documented, although little is known about the frequency and intensity of

this predation on bog asphodel capsules. No other diseases or predators are known to adversely affect bog asphodel populations.

D. *The inadequacy of existing regulatory mechanisms.*

Existing regulations provide limited protection from habitat loss and degradation. New Jersey's Endangered Plant Species List Act (NJAC 7:5C) lists *N. americanum* as endangered, but does not provide regulatory protection from collection or habitat loss. The Pinelands Protection Act (NJSA 13:18-1 et. seq.) exempts some cranberry agricultural practices that present a major threat to *N. americanum* habitat.

Current Conservation Efforts: A Candidate Conservation Agreement is under preparation for 24 bog asphodel sites occurring within Wharton State Forest, New Jersey. This conservation agreement will provide guidance to New Jersey Department of Parks and Forestry land managers to ensure the conservation, protection, and survival of bog asphodel within Wharton State Forest.

With the U.S. Fish and Wildlife Service's support, New Jersey Department of Parks and Forestry produced a comprehensive series of publications on population surveys for *N. americanum*, namely Windish (1993) for West Branch Wading River and Oswego River corridors; Hill (1993) for Wharton and Lebanon State Forests; Radis (1993) for the Batsto River corridor, Wharton State Forest; and Gordon (1996) for Atlantic and Burlington Counties. Schuyler (1995) surveyed historical and known *N. americanum* populations on private lands. In these publications, population numbers are estimated as number of vegetative and flowering plants (actual individuals are virtually impossible to count for plant species that are rhizomatous but, for the purpose of this agreement, discrete above ground portions of the bog asphodel will be called individuals). Moreover, New Jersey Department of Parks and Forestry produced the confidential *Handbook of* Narthecium americanum *Populations on State Owned and Managed Land*s, summarizing site-specific survey results, potential threats, and preliminary management recommendations (Cartica, 1995).

Also with the U.S. Fish and Wildlife Service's support, New Jersey Department of Parks and Forestry published the results of an investigation on hydrology and succession at ten sites populated with *N. americanum* (Dodds, 1996) and revised the boundary of Batsto Natural Area within Wharton State Forest, incorporating 35 percent of the global occurrences of *N. americanum* into the new boundary and providing *N. americanum* with the most protective designation available for State-owned conservation lands (Cartica, 1996). Plans for active management of *N. americanum*, as well as conservation plans and enhancement measures for *N. americanum* populations on State-owned lands were prepared by Dodds (1997a; 1997b), Dodds and Cartica (1997), and Dodds and Goodwin (1997). More recently, *de novo* surveys were initiated implementing GIS technology to locate potential habitat for *N. americanum* in areas that had not been surveyed in the past (Breden et al., 1998). These surveys resulted in the discovery of a new *N. americanum* population comprising a few thousand individuals.

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

Succession and beaver-induced flooding of *N. americanum* habitat are natural threats to the species. Conversely, beaver have been providing hydrological support for *N. americanum* habitat at one site on the Batsto River and one site on the Oswego River. Suppression of natural wildfires that retard succession or create open wetland savannahs may be a factor in the decline of the species. Other factors adversely affecting *N. americanum* include trampling and erosion caused by recreationists on foot or using off-road vehicles.

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PETITION TO LIST

Florida semaphore cactus
(*Opuntia corallicola*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

J.K. Small (1930) discovered this cactus and named it *Consolea corallicola* (Cactaceae), the name currently used for this species by the U.S. Fish and Wildlife Service in its candidate species list. In 1971, Long and Lakela (1971) reassigned the Florida Keys plants to *Opuntia spinosissima*, a species from Jamaica, and this is the name that was used by Kartesz (1998) . Recent research shows that the Florida semaphore cactus is both morphologically and genetically distinct and should be recognized as a distinct species (Austin et al. 1998, Gordon and Kobisiak 1998). This species and its close relatives in the Caribbean should possibly be separated from the genus *Opuntia* into their own genus, *Consolea*, as suggested by Small and his colleagues at the New York Botanical Garden 70 years ago. However, at the present time the name *Opuntia corallicola* is in wide use and is unambiguous (e.g., Wunderlin and Hansen 2000).

NATURAL HISTORY

Morphology:
Opuntia corallicola is a large prickly pear cactus with a distinct trunk and a cluster of pads at the top. The flowers are relatively small. Fallen flowers are capable of sprouting into new plants, and between the fall of flowers and breakage of pads, mature plants tend to be surrounded by smaller developing plants.

Habitat:
This cactus grows on bare rock with a minimum humus-soil cover in hammocks near sea level

(Small 1930, Benson 1982), close to salt water. According to Small (1930), it formerly occurred on Big Pine Key and Key Largo; neither the number of individuals nor the size of those populations were described.

POPULATION STATUS

Cactus hobbyists were thought to have eliminated the species from Florida in the late 1970s, but it was rediscovered at one site on Little Torch Key in the mid 1980s (Austin et al. 1998). It is presently known from a single remaining wild population of about 7 mature plants at The Nature Conservancy's Torchwood Hammock Preserve on Little Torch Key (1999 and 2000 personal communications cited in U.S. Fish and Wildlife Service candidate assessment form).

The U.S. Fish and Wildlife Service classifies *Opuntia corallicola* as a candidate for Endangered Species Act protection with a listing priority number of 2. The State of Florida lists this species as endangered (Wunderlin and Hansen 2000). The Florida Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA

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

Historical range: Florida.

Current range: Little Torch Key, Florida.

Land ownership: The Nature Conservancy owns and maintains the Torchwood Hammock Preserve where the last remaining wild population of *Opuntia corallicola* occurs.

Destruction or modification of habitat as a result of development is a threat throughout the range of *Opuntia corallicola*. Although the species is located at the protected Torchwood Hammock Preserve (owned by The Nature Conservancy), habitat throughout its former range is under intense development pressure. Residential and commercial development, and roadway construction are occurring throughout Monroe County, specifically the Keys.

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

Collecting by cactus hobbyists may have eliminated the species from Big Pine Key and Key Largo in the late 1970s. Although the remaining wild population on Little Torch Key is protected

by the Torchwood Hammock Preserve, the plants are still subject to collection and vandalism. The present number of adult plants is too small to support any unauthorized collecting.

C. *Disease or predation.*

Opuntia corallicola is threatened by an exotic insect native to South America. The moth *Cactoblastis cactorum* was introduced with spectacular success into Australia from Argentina in 1925, to control several North and South American species of *Opuntia* (Habeck and Bennett 1990). It was introduced into several Caribbean islands from 1957 to 1970 and subsequently spread naturally throughout the Caribbean and the Florida Keys to as far north as Key Biscayne (Habeck and Bennett 1990). It has since spread up the Florida coast, and may eventually threaten prickly pears in the southwestern United States and Mexico. This moth, whose larvae burrow into the cactus pad and feed on the tissue, has substantially reduced the abundance of *Opuntia* in the Keys (Austin et al. 1998). As a result of the moth, all remaining adult plants at the Torchwood Hammock Preserve were placed in screen cages in 1990.

D. *The inadequacy of existing regulatory mechanisms.*

The Florida Department of Agriculture and Consumer Services has designated the Florida semaphore cactus (listed as *Opuntia spinosissima*) as endangered under Chapter 5B-40, Florida Administrative Code. This listing regulates commercial trade but provides little or no habitat protection beyond the State's Development of Regional Impact process. This process serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur.

Current Conservation Efforts: The Florida Department of Agriculture and Consumer Services has been conducting studies on research and restoration since 1993 (section 6 funding). The Nature Conservancy has formulated and implemented an informal recovery plan for this species. Fairchild Tropical Garden maintains this species in its Center for Plant Conservation living collection of endangered plants. It has also propagated plants collected from the Little Torch Key population in an effort to transplant them to Big Pine Key and Key Largo. Results of these activities have yet to be determined.

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

Hurricanes and other natural disasters can be devastating to small remnant populations, such as the few wild *Opuntia corallicola* plants on Little Torch Key. Hurricane Georges in September 1998 had a dramatic effect on the population. Eleven plants were broken in half and lost most of their pads (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). However, some parts of plants that landed on the soil did root, producing new

plants. It is unknown whether these new individuals will survive to become adults. While the full impact of the hurricane on the plants is still being evaluated, it was definitely negative.

Opuntia corallicola is an obligate outcrossing species, as are many cacti. Apparently all of the plants in the population carry the same self-incompatibility allele and crosses between plants in this population produce no seeds (Negrón-Ortiz 1998). This is likely the result of genetic drift in this small population. The cactus will reproduce itself vegetatively and the best remaining means of reproduction may be human-assisted propagation.

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PETITION TO LIST

Hirsts' panic grass
(*Panicum hirstii*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The plants first named as *Panicum hirstii* (Poaceae) were recently placed into the genus *Dichanthelium* as *D. hirstii* (Kartesz, Synthesis of the North American Flora, 1999) in an ephemeral publication (printed paper insert accompanying a CD-ROM) that is nevertheless effectively published under the International Code of Botanical Nomenclature (this *D. hirstii* instance being the example cited (Art. 30, Recc. 30A, Ex. 1) in the St. Louis edition of the Code (Greuter et al., 2000, p. 52) accompanying the recommendation that authors avoid publication in ephemeral matter). According to the U.S. Fish and Wildlife Service candidate assessment form, panicoid grass specialist Richard LeBlond is currently examining the taxonomic distinctness of this species. Initial impression is that it is distinct and is clearly a *Dichanthelium*. Schuyler (1996) reviewed the species' distinctiveness from similar species in *Panicum*, concluding that *P. hirstii* (or *D. hirstii*) should continue to be recognized as a distinct species. This taxon is recognized as *Dichanthelium hirstii* by Kartesz (1998). The scientific name honors Frank Hirst, who collected the type specimen in New Jersey; the common name (Hirsts' Panic Grass, note plural possessive) honors both Frank and his brother Robert Hirst, the co-discoverers.

NATURAL HISTORY

Panicum hirstii occurs in Coastal Plain intermittent ponds, usually in wet savanna or pine barren habitats. The species requires habitats that are at least intermittently wet, receiving full sun to light shade, and with substrates that are organic but firm. The plant occurs in flat-bottomed depressions with substantial water-level fluctuations dependent on rainfall. The species relies on periods of standing water to keep competing species at a minimum. Individual populations can vary dramatically in size from year to year. In some years, plants may not appear (Kral, 1982; Schuyler, 1996).

POPULATION STATUS

Currently, *Panicum hirstii* occurs at only one site in Delaware and two sites in North Carolina. The species' historic range included seven sites within New Jersey, Delaware, North Carolina, and Georgia. *Panicum hirstii* has not been observed at the known sites in Sumter and Calhoun Counties, Georgia, for over 30 years and may now be extirpated at the two known Atlantic County, New Jersey, sites. Of the two sites in New Jersey (Barkwoods Pond and Labounsky Pond, collectively known as Hirst Ponds), the species has not been seen at Barkwoods Pond since 1992; the last report from Labounsky Pond was in 1985 (Schuyler, 1998).

Populations at the remaining known sites are small. During a 1999 survey of the Delaware site (Assawoman Pond), 164 individual plants were identified (McAvoy and Bennett, 2000). The two sites in North Carolina occur on the Camp Lejeune Marine Corps Base. One site, referred to as Lyman Road Cypress Savanna, consists of plants scattered over an area of approximately 25 x 20 meters. The other site, referred to as Starretts Meadow, occurs over an area of about 20 x 15 meters (Schuyler, 1998).

The U.S. Fish and Wildlife Service classifies *Panicum hirstii* as a candidate for Endangered Species Act protection with a listing priority number of 5. *Panicum hirstii* is listed as endangered by the State of New Jersey. *Panicum hirstii* is proposed as endangered by the State of North Carolina. The New Jersey, Delaware, and North Carolina Natural Heritage Programs list this species as Critically Imperiled.

LISTING CRITERIA:

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

Historical range: New Jersey, Delaware, North Carolina, Georgia.

Current range: Delaware, North Carolina.

Land ownership: Both North Carolina populations occur on Federal lands. The Delaware population occurs on a State-owned wildlife refuge. Former New Jersey populations occur on lands owned by The Nature Conservancy.

In New Jersey, *Panicum hirstii* habitat at Labounsky Pond has been impacted by an illegally constructed ditch. This ditch drains surface water from a construction parking / heavy equipment storage yard into Labounsky Pond. Runoff of oil, fuel, and lubricants from this storage yard poses a threat to water quality within the pond (1998 and 2000 personal communications cited in U.S. Fish and Wildlife Service candidate assessment form). At both ponds in New Jersey, there is a growing population of resident Canada geese (*Branta canadensi*s). Grazing by these geese is impacting vegetation in the ponds and fecal matter may be contributing to formation of dense algal mats (1998 and 2000 personal communications cited in U.S. Fish and Wildlife Service candidate assessment form).

In Delaware, an adjacent sandpit and agricultural ditching in the area may be lowering water levels at the sites, threatening the hydrology of the site. Encroachment of woody vegetation is an ongoing problem. This woody vegetation includes primarily red maple (*Acer rubrum*) and , secondarily, sweet gum (*Liquidambar styraciflua*). Straw-colored sedge (*Carex striata*) is also encroaching (several 1998 personal communications). Although there are no immediate threats to the two North Carolina populations, both sites are within areas zoned for military training exercises (personal communication 1998 cited in U.S. Fish and Wildlife Service candidate assessment form). There is no permanent habitat protection at any of these sites.

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

Not a major threat to the species. There is potential for ORV disturbance.

C. *Disease or predation:*

Not a known threat.

D. *The inadequacy of existing regulatory mechanisms:*

The State of Delaware does not have a state endangered species act. The State maintains a list of rare plants and a rare plant conservation program. However, no legal protection is given to plants; any protection is strictly voluntary. *Panicum hirstii* is included on Delaware's rare plant list.

The State of New Jersey maintains a list of rare and endangered plant species; however, the State provides no regulatory protection for species on the list. It is against State law to collect plant species occurring on state land, but private landowners with endangered plants on their property have no restrictions. *Panicum hirstii* is listed as endangered by the State of New Jersey.

The State of North Carolina's Plant Conservation Program maintains a list of threatened and endangered plant species. Any person wishing to collect a listed plant species must have written permission from the property owner as well as a permit from the North Carolina Department of Agriculture's Plant Conservation Program. If species are illegally collected, the penalty is a fine of up to $2,000 per plant collected. *Panicum hirstii* is proposed as endangered by the State of North Carolina.

Current Conservation Efforts: The Delaware Division of Fish and Wildlife has conducted periodic removal of encroaching *Carex striata* and woody vegetation at the Assawoman Pond site. The Delaware Natural Heritage Program has effectively managed the *Carex striata* threats to *Panicum hirstii* at Assawoman Pond through 2000. It is presumed that the Delaware Natural Heritage Program will continue to deal with existing and future threats to the species. However, concerns from encroachment by *Acer rubrum* and *Liquidambar styraciflua* and changes to hydrology of the site remain (McAvoy and Bennett, 2000).

The Marine Corps has cooperated in *Panicum hirstii* protection efforts in recent years by avoiding activities that would adversely affect the species at the Camp Lejeune, North Carolina, sites. One site at Camp Lejeune is within a protected zone maintained for red cockaded woodpecker (personal communication 1998 cited in U.S. Fish and Wildlife Service candidate assessment form).

A status survey for the species in New Jersey and Delaware was prepared for the U.S. Fish and Wildlife Service in 1998 by Alfred Schuyler of the Academy of Natural Sciences (Schuyler, 1998). In New Jersey, The U.S. Fish and Wildlife Service and TNC are working with the construction company near Labounsky Pond to eliminate impacts from the illegally constructed ditch. Experimental treatments of the pond bottoms at Labounsky and Barkwoods Ponds were initiated in 1999 in an attempt to stimulate any naturally occurring seed bank of *Panicum hirstii* at these sites (personal communication 2000 cited in U.S. Fish and Wildlife Service candidate assessment form).

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

Competition from rhizomatous perennials that dominate the turf covering the pond bottoms, particularly *Eleocharis robbinsi*i, is a threat in Hirst Ponds, New Jersey. Dense growth of *Utricularia fibrosa* and algae may be retarding growth of *Panicum hirstii* plants at Barkwoods Pond when water is present (personal communication 1998 cited in U.S. Fish and Wildlife

Service candidate assessment form). At Assawoman, *Panicum hirstii* does not occur in areas dominated by *Sclerolepis uniflora*, a rhizomatous perennial, although both species are in proximity there. Similar observations were made at the Camp Lejeune sites in North Carolina. At one site in North Carolina, where *Utricularia inflata* and algae in the water were present, plants of *Panicum hirstii* were much smaller than at the other site in North Carolina, which had deeper and clearer water (Schuyler, 1998).

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PETITION TO LIST

bushy whitlow-wort
(*Paronychia congesta*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Paronychia congesta* (Caryophyllaceae) as a valid species is uncontroversial (e.g., Kartesz 1998; Hatch et al. 2001). This species is also known as Rio Grande nailwort.

NATURAL HISTORY

Paronychia congesta occurs in full sun in openings in blackbrush shrublands, growing in shallow soils on xeric caliche or calcareous outcrops on the Bordas Escarpment. This species is endemic to Jim Hogg County, Texas (Damude and Poole 1990). *Paronychia congesta* is known from two sites classified as having Zapata soils and characterized as well-drained, calcareous, shallow soils with a low available water capacity forming over caliche (Sanders et al. 1974).

POPULATION STATUS

In the late 1980's other suitable sites were surveyed but only the two small populations were located on two separate ranches (Damude and Poole 1990).

The U.S. Fish and Wildlife Service classifies *Paronychia congesta* as a candidate for Endangered Species Act protection with a listing priority number of 11. The Texas Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA:

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

Historical range: Texas.

Current range: Jim Hogg County, Texas.

Land ownership: The two known populations occur on private land.

Threats to the habitat of this species include destruction, modification, and fragmentation. Habitat destruction results from activities such as conversion of native plant communities to improved pasture; increased petroleum and gas exploration, production, and transportation; and highway and infrastructure improvements. Modification of habitat is due to chemical and mechanical brush clearing and the introduction of non-native grasses, such as buffel grass (*Pennisetum ciliaris*). Habitat fragmentation results from blading, discing and reseeding with exotic erosion-control seed mixtures.

Herbicides on highway, utility, and pipeline rights-of-way are another impact contributing to the destruction of the species and its habitat. A potential impact could be “mining” or removal of caliche for use in road building activities. Sanders et al. (1974) stated that the soils where this species lives are suitable as a source of caliche, although rangeland is currently the primary land use on these Zapata soils. Highway improvement and new construction have intensified across South Texas in response to trade opportunities associated with the North American Free Trade Agreement and these activities pose a threat to this plant.

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

None known.

C. ***Disease or predation.***

Grazing or browsing has not been observed, but the possibility exists that this species could be threatened by grazing since it is unprotected by thorns or spines and is apparently not aromatic (Damude and Poole 1990). According to Turner (1983), the type of locality in which this plant species occurs was intensively grazed by goats in the past and continues to be grazed by cattle.

D. ***The inadequacy of existing regulatory mechanisms.***

This species is not currently protected by either Federal or State regulations.

Current Conservation Efforts: A status report on *P. congesta* (Turner 1983) documented the author's relocation of the type locality and clarified the taxonomy of the genus *Paronychia* in Texas. Damude and Poole (1990) completed a revised status report in December, 1990. This report gave further information regarding biological vulnerability and threats and supported the preparation of a proposed rule to list bushy whitlow-wort as endangered.

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

This plant's restricted range and probable reduced genetic variability leave it vulnerable to extinction.

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Damude, N. and J. Poole. 1990. Revised Status Report on *Paronychia congesta*. Texas Parks and Wildlife Department. Texas Natural Heritage Program, Austin, Texas.

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PETITION TO LIST

Fickeisen plains cactus
(*Pediocactus peeblesianus* var. *fickeiseniae*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Pediocactus peeblesianus* var. *fickeiseniae* (Cactaceae) as a valid variety is uncontroversial (e.g., Kartesz 1998).

NATURAL HISTORY

This small cactus grows on exposed layers of Kaibab limestone on canyon margins and well-drained hills in Navajoan desert or grasslands from the Gray Mountain vicinity to the Arizona Strip in Coconino and Mohave counties (U.S. Fish and Wildlife Service 1992).

POPULATION STATUS

The Arizona Game and Fish Department in 1998 noted 23 element occurrences for this cactus,

including historical ones. Accurate estimates of population sizes are unavailable; in surveying plots during demographic monitoring, individual plants in a population are not counted. Accurate counts are also a problem because in times of drought this plant has a tendency to "disappear" by shrinking into the ground.

The U.S. Fish and Wildlife Service classifies *Pediocactus peeblesianus* var. *fickeiseniae* as a candidate for Endangered Species Act protection with a listing priority number of 6. The Arizona Natural Heritage Program lists this taxon as Critically Imperiled.

LISTING CRITERIA

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

Historical range: Arizona.

Current range: Coconino and Mohave counties, Arizona.

Land ownership: This plains cactus occurs on lands managed by the Bureau of Land Management (BLM), the Navajo Nation, the Arizona State Land Department, possibly the U.S. Forest Service, and possibly on private land.

The major potential human induced threats to this cactus are off-road vehicles and trampling associated with livestock grazing. Trampling has been observed in monitoring plots established for this species (Hughes 1996). Vehicular traffic driving across drylands impacts this cactus. This occurs with mining and recreational activities. Although uranium mining is not a threat today, uranium mining booms in the past have impacted this species and could do so in the future.

Of greater concern is that the sites where this cactus occur are located adjacent to scenic canyon overlook areas. This makes impacts from recreational hiking and vehicular traffic a constant threat. Both Mainstreet Road and the Mount Trumbull Road pass next to known populations, so it is likely that road construction has disturbed some historical populations. Mortality data demonstrate some disturbances from trampling by livestock. It is also possible that habitat of the cactus may be modified by livestock grazing.

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

Illegal collection is a potential threat for all species of cacti, but is a specific and definite threat for the genus *Pediocactus*. One population was noted in a 1978 file note as being seriously

reduced. Patrol of these areas is infrequent because they are in very remote locations.

C. ***Disease or predation.***

Predation by rodents is a source of mortality for this cactus. Whether the occasional high numbers of cacti eaten by rodents and other herbivores result solely from drought, or from livestock grazing of other plants needed by other herbivores during drought, is unknown (Hughes 1996).

D. ***The inadequacy of existing regulatory mechanisms.***

This cactus is protected from collection by the Arizona Native Plant Law (Arizona Game and Fish Department 1997) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); however, CITES does not regulate take or domestic trade. The Arizona law prohibits collection of members of the genus *Pediocactus* in particular and, more broadly, all members of the family Cactaceae (Phillips et al. 1982).

Current Conservation Efforts:A conservation agreement continues to be under consideration in cooperation with the BLM. However, the proposed conservation strategy and agreement is in need of additional development. At this point, the conservation agreement as proposed has not included landowners beyond BLM.

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

This cactus is a narrow endemic restricted to Kaibab limestone derived soils. It consists of distinct clusters of populations that are often isolated by long distances (Hughes undated). Because of its rare and disjunct occurrence, the cactus is vulnerable to depopulation by damage to areas where it occurs. The plant seems to have a low reproductive capacity (low seed production), so rapid increase in numbers does not occur even after favorable weather. Moderate increase in numbers may occur two to three times every ten years. Given its small population, low reproductive potential, and environment, this plant is highly vulnerable.

REFERENCES

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PETITION TO LIST

parachute beardtongue
(*Penstemon debilis*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Penstemon debilis* (Scrophulariaceae) as a valid species is uncontroversial (e.g., Kartesz 1998; Hartman and Nelson 2001).

NATURAL HISTORY

Penstemon debilis is a mat-forming perennial herb with thick, bluish leaves, each about 2 cm long and 1 cm wide. Funnel-shaped, white to pale lavender flowers bloom June-July. It grows on steep, white shale talus at 2,500 meters (8,200 feet) in elevation on the southern escarpment of Mount Callahan, above the Colorado River west of the town of Parachute, Colorado. The total known range is about 90 hectares (220 acres). It is restricted to the Parachute Creek Member of the Green River Formation in the Piceance Basin. This geological stratum is the major source of oil shale in the United States and this species is one of several oil shale endemic plant species.

POPULATION STATUS

Penstemon debilis is known from only two locations, one comprised of approximately 100

individuals, the other approximately 1,000 individuals. The Green River Formation is fairly widespread in the Piceance Basin and has been extensively searched. However, additional populations of this species have not been discovered. Details of the species' life history are unknown.

The U.S. Fish and Wildlife Service classifies *Penstemon debilis* as a candidate for Endangered Species Act protection with a listing priority number of 5. The Colorado Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA:

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

Historical range: Colorado.

Current range: About 90 hectares on the **s**outhern escarpment of Mount Callahan, above the Colorado River west of the town of Parachute, Colorado.

Land ownership: Of the two known populations, one is privately owned by Occidental Oil and the other is federally owned as one of several Naval Oil Shale Reserves. Disposition of the Naval Oil Shale Reserves has been proposed, and its ownership and management status is unknown at this time. The level of threat will change from non-imminent to imminent if mining is initiated in the habitat. If the U.S. Fish and Wildlife Service waits until increased mining activity takes place or until the land passes into private ownership, the species will likely be extirpated.

There have been extensive surveys for rare plants in oil shale substrates throughout the Piceance Basin. Additional occurrences of *Penstemon debilis* have not been discovered. This species appears to be an extremely rare edaphic endemic that occurs on a substrate at high risk for destruction.

This species is threatened by destruction of its habitat for oil shale production or other energy development. Although oil shale and energy development was not progressing at the time of writing of the U.S. Fish and Wildlife Service candidate assessment form due to economic considerations, the U.S. Fish and Wildlife Service noted that the economic climate could change at any time making such projects financially viable. The largest of the two populations occurs on land owned by Occidental Oil. The much smaller population occurs on Naval Oil Shale Reserve property.

Since the species' discovery, The Nature Conservancy has attempted, without success, to negotiate with Occidental Oil for protective status for occupied habitat. Negotiations were suspended due to lack of progress. The Naval Oil Shale Reserve is managed for energy production with ongoing exploration (test wells) for oil and gas. The property was recently surveyed for rare species in preparation for changes in ownership and management. Proposed alternatives for changes in management include, among others, selling to private parties and full development by the Department of Defense for oil.

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

None known.

C. ***Disease or predation.***

None known.

D. ***The inadequacy of existing regulatory mechanisms.***

Penstemon debilis has little or no Federal regulatory protection at either of its two known locations. There are no State regulations that protect rare plant species in Colorado.

Current Conservation Efforts: Negotiations for conservation agreements for this species have not been successful.

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

Other than randomly occurring natural events, none known.

REFERENCES:

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O'Kane, S.L., Jr., and J.L. Anderson. 1987. *Penstemon debilis* (Scrophulariaceae): a new species from Colorado endemic to oil shale. Brittonia 39(4):412-416.

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PETITION TO LIST

Graham's beardtongue
(*Penstemon grahamii*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Penstemon grahamii* (Scrophulariaceae) as a valid species is uncontroversial (e.g., Kartesz 1998; Hartman and Nelson 2001).

NATURAL HISTORY

Morphology:
Penstemon grahamii is a low perennial herb with one to several stems, 5-20 cm tall, minutely whitish-pubescent, and becoming glandular-pubescent in the inflorescence. Leaves are 2-4 cm long, thick and leathery, dark green to grayish green, the lower leaves narrowed to a leaf-stem base and with prominent veins, the upper leaves clasping the stem. Flowers are crowded into a narrow inflorescence; they are large (3-3.8 cm long), showy, tubular, light to deep lavender, with a densely golden-yellow bearded sterile stamen protruding from the opening. The flowering period is from late May to early June.

Habitat:
Penstemon grahamii is restricted to calcareous soils derived from oil shale barrens of the Green River Formation in the Uinta Basin of northeastern Utah and adjacent Colorado.

POPULATION STATUS

The species' range is composed of an arc of small scattered populations from the vicinity of Raven Ridge near the White River in Rio Blanco County, Colorado, then westward across southern Uintah County, Utah, to the vicinity of Sand Wash near the Green River and the point where Carbon, Duchesne, and Uintah Counties meet, a distance of about 60 miles. The species population is estimated at about 7,000 individuals, with about 95 percent occurring in Utah.

The U.S. Fish and Wildlife Service classifies *Penstemon grahamii* as a candidate for Endangered Species Act protection with a listing priority number of 5. The Colorado and Utah Natural Heritage Programs list this species as Imperiled.

LISTING CRITERIA

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

Historical range:	Colorado, Utah.
Current range:	Colorado, Utah (an arc of small scattered populations from the vicinity of Raven Ridge near the White River in Rio Blanco County, Colorado, then westward across southern Uintah County, Utah, to the vicinity of Sand Wash near the Green River and the point where Carbon, Duchesne, and Uintah Counties meet, a distance of about 60 miles).
Land ownership:	Most of the species population is on public land managed by BLM, with some populations on private, State of Utah, and Ute Tribal land.

Most of the occupied habitat of *P. grahamii* is within developed and expanding oil and gas fields with several wells and access roads within the species' occupied habitat. The location of *P. grahamii* habitat exposes it to the possibility of habitat destruction from off-road vehicle use, road, pipeline, and well site construction in connection with oil and gas development. With such a small population and limited occupied habitat, any destruction, modification, or curtailment of

the habitat would have a highly negative impact on the species. If commercial oil shale recovery becomes a reality, maintenance of most populations of *P. grahamii* would be extremely difficult. Virtually every population is associated with high grade oil bearing strata of the Evacuation Creek Member of the Green River Formation (i.e., the Mahogany Zone).

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

Collection of plants and seeds is a significant threat due to the desire of rock-garden enthusiasts to obtain this very attractive plant. The seeds of *P. grahamii* are advertised for sale in rock-gardening catalogs. Should the locations of these populations become commonly known they could become devastated by amateur and professional plant collectors.

C. ***Disease or predation.***

The species is heavily grazed by wildlife (rodents, rabbits and possible deer) and by livestock (primarily sheep) grazing. Livestock trampling is affecting some populations. Historic overgrazing is thought to have cause the extirpation of some *P. grahamii* populations.

D. ***The inadequacy of existing regulatory mechanisms.***

No Federal or State laws or regulations specifically protect *P. grahamii*. The Bureau of Land Management administratively recognizes this species for special management consideration, but does not have the legal authority to require Federal mineral lease holders to modify their mineral recovery plans and on-the-ground actions solely to protect this species. Many populations occur on private lands patented for oil shale mining. Populations on these lands have no protection.

Current Conservation Efforts: None.

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

The populations of *P. grahamii* may not currently be at levels that would ensure the species' long-term demographic stability.

REFERENCES:

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PETITION TO LIST

DeBeque phacelia
(*Phacelia submutica*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

This species is treated as a variety, *Phacelia scopulina* var. *submutica* (Hydrophyllaceae), by Kartesz (1998) and Hartman and Nelson (2001)

NATURAL HISTORY

Morphology:
DeBeque phacelia is a low growing annual plant with light yellow or cream-colored tubular flowers, often with a purple tinge, in crowded racemes. Its stems are often deep red and more or less hairy with straight and fairly stiff hairs. The elliptic-oblong, obtuse, and cuneate leaves typically become reddish at maturity and occur in a small rosette 2 to 5 centimeters (0.8 to 2 inches) across and tall (O'Kane 1987).

Habitat:
DeBeque phacelia occurs on moderately steep exposures of clay derived from the Atwell Gulch and shire members of the Wasatch Formation (O'Kane 1987). The species is limited to soils with a high clay content. The plant is a narrow endemic, with populations known only from suitable

clay (adobe) soils in Mesa and Garfield Counties, Colorado. The species sometimes grows on what appear to be very steep slopes; however, individuals are found on small benches and on ridge tops where the slope is less extreme.

POPULATION STATUS

There are about 50 populations of this species. In a given year, a population may produce no individual plants, or it may produce thousands. Populations of the species are small, and no known populations occur on more than 5 acres. Most of the known populations occur on lands managed by the Bureau of Land Management. A few populations occur on Forest Service lands, and some populations are on private land.

The U.S. Fish and Wildlife Service classifies *Phacelia submutica* as a candidate for Endangered Species Act protection with a listing priority number of 11. The Colorado Natural Heritage Program lists this taxon as Imperiled.

LISTING CRITERIA:

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

Historical range: Colorado.

Current range: Mesa and Garfield Counties, Colorado.

Land ownership: Most populations occur on Federal land, but some are on private land.

This plant has a very narrow distribution, occurring in just two Counties in Colorado. Domestic livestock grazing, OHV use, reservoir development, and weed invasion are potential threats.

This species is limited to a very small area and occurs on a specialized substrate. The occurrence of the species' habitat coincides with high quality oil and gas reserves, especially in Coon Hollow and Sulphur Gulch. Some populations may have already been impacted.

Although plants apparently are not eaten by herbivores, the presence of large herbivores is detrimental in that the species cannot tolerate habitat trampling. Trampling probably increases site compaction and erosion and alters the microhabitat the species prefers. Trampled sites do not exhibit the cracked soil surface seen at other sites.

Populations above the Dry Fork of Roan Creek will be impacted by the proposed Roan Creek Reservoir (this reservoir is now being considered as a source of water for Las Vegas, Nevada). Road improvements needed to handle increased recreational traffic associated with Roan Creek Reservoir could affect several populations.

The OHV use is a potential impact to the species. The OHV use occurs on BLM lands in the area now and could increase in the future. Tire tracks were located within the habitat. Weed invasion is also a potential threat.

Individual populations are susceptible to extirpation from stochastic variations in population demographics because (1) the species is an annual, (2) its population size (number of individuals) varies widely from year to year, and (3) population size in acreage is small.

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

Overutilization does not appear to be a threat; however, small populations could be adversely affected by scientific collection, especially in years when few individuals germinate and grow. Collection in a poor year could have an irreversible adverse effect on demographics.

C. ***Disease or predation.***

None known.

D. ***The inadequacy of existing regulatory mechanisms.***

Because the species is not listed as either Threatened or Endangered by the U.S. Fish and Wildlife Service, it receives no legal protection from federal statutes. Colorado has no rare plant protection legislation. Currently no habitat protection exists.

Current Conservation Efforts: The status of and threats to this species have changed since publication of the 1987 status report, and its designation as a category 1 species. Nearly twice the number of populations are now known, but oil shale development, which appeared unlikely with stable crude oil prices, may now occur if there is a significant increase in the price of crude oil, as appears likely in the near future. The Colorado Rare Plant Technical Committee should review the status of this species immediately.

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

Populations along county roads could be sprayed with herbicides.

REFERENCES:

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PETITION TO LIST

white fringeless orchid
(*Platanthera integrilabia*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The white fringeless orchid, *Platanthera integrilabia* (Orchidaceae), was first recognized as a distinct taxon in 1941 when D.S. Correll described this plant as a variety of *Habenaria blephariglottis*, *H. blephariglottis* var. *integrilabia* (Correll 1941). C.A. Leur elevated the taxon to full species status and placed it in the genus *Platanthera* (Leur 1975). This species is now usually known as *Platanthera integrilabia* (e.g., Williams and Williams 1983; Kartesz 1998), although Cronquist published the name *H. correllii* (also *H. correlliana*, presumably one of these two names an editing error) for this taxon in 1991 (Gleason and Cronquist 1991).

NATURAL HISTORY

Morphology:
Platanthera integrilabia is a perennial herb with a light green stem, 60 centimeter (cm) (23 inches (in)) long, that arises from a tuber. The leaves are alternate with entire margins and are narrowly elliptic to lanceolate in shape. The lower leaves are 20 cm (8 in) long and 3 cm (1 in) wide. The upper stem leaves are much smaller. The white flowers are borne in a loose cluster at the end of the stem. The upper two flower petals are about 7 millimeters (mm) (0.3 in) long and the lower petal (the lip) is about 13 mm (0.5 in) long. The plants flower from late July through September and the small narrow fruiting capsules mature in October (Shea 1992).

Habitat:
Platanthera integrilabia grows in wet boggy areas at stream heads and on seepage slopes. It is often associated with *Sphagnum* in partially, but not fully, shaded areas. The species currently occurs within the Appalachian Plateau Physiographic Province in Kentucky, Tennessee, and Alabama, the Coastal Plain Physiographic Province in Alabama, and the Blue Ridge Province in Georgia and Tennessee (Shea 1992).

POPULATION STATUS

Historically, there were at least 90 populations of *Platanthera integrilabia*. Currently there are only 53 extant sites supporting the species. The species was originally known from Alabama, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia. It has been extirpated from Mississippi, North Carolina, and Virginia. The following summary of the current distribution of the species is from Medley (1980), Shea (1992), White (1998), Deb White (Kentucky State Nature Preserves Commission,1999 cited in U.S. Fish and Wildlife Service candidate assessment form), and Andrea Shea (Tennessee Department of Environment and Conservation, 1999 personal communication cited in U.S. Fish and Wildlife Service candidate assessment form).

Alabama currently supports eight populations of *Platanthera integrilabia*. Marion County has two sites for the species, both of which are privately owned. One of these sites supported 40 flowering plants in 1991, and the other was estimated to support 1,000 to 3,000 in 1998. Tuscaloosa County has one privately owned site with 17 flowering plants. Winston County has one privately owned site that had 31 flowering plants in 1991 and 1 plant in 1998. Jackson County has one privately owned site that was estimated to support 6 to 12 plants in 1998. Calhoun County has two populations that are on the Department of Defense's Fort McClellan. In 1998, one of these sites had 500 to 750 plants and the other had 75 plants. The lands supporting the species on Ft. McClellan are considered excess by the Department of Defense. It is not currently known who will eventually be responsible for these sites. Claiborne County has one site that supported about 100 plants in 1998; this site is on lands managed by Talladega National Forest.

Georgia currently supports eight populations of *Platanthera integrilabia*. Carroll County has two privately owned sites. In 1991, one of these had 31 flowering plants and an estimated 5 to 35 plants in 1998. The other had 1 flowering plant in 1991 and an estimated 5 to 15 plants in 1998. Cobb County has one privately owned site that had three flowering plants in 1991. Coweta, Rabun, Forsyth, and Chattooga Counties each have one privately owned site. The most recent (1990 to 1998) records for these sites indicate that they supported 15 to 50, 39, 2, and "a few" flowering plants, respectively. The only Federally owned site is in Stephens County on the Chattahoochee National Forest. This site supported 11 flowering plants in 1991.

Kentucky is the only State where a majority of the sites are under Federal ownership. McCreary County has three sites for the species, all of which are within Daniel Boone National Forest. In

1991, the largest of these sites contained 96 flowering plants, one of the others had 3 plants and the third had 33 plants. Pulaski County has two known populations; one, supporting 104 flowering plants in 1991, is in the Daniel Boone National Forest, and the other, for which there are no recent estimates of population size, is small and privately owned. Whitley County has one small, privately owned site. There are no recent estimates of the size of this population. Laurel County has two sites for the species, the largest of which (1,745 plants in 1997) is completely on Daniel Boone National Forest land, while the other is partially on Forest Service land and partially on privately owned land. There are no recent estimates of the size of this last small population.

There are two records for *Platanthera integrilabia* in Mississippi. One of these is an 1863 collection from Alcorn County and the other is a 1974 collection from Tishomingo County. The species has apparently been lost from these sites and is considered extirpated from the State. Historically, North Carolina supported at least two populations of the species. One of these was in a Henderson County bog that has been almost completely destroyed and the other was in Cherokee County. The species is believed to be extirpated from North Carolina. South Carolina supports one State-owned site in Greenville County. This site is in an isolated location and has not been visited since 1989. During the last visit, the site supported 11 flowing plants.

In Tennessee, Franklin County supports five privately owned *Platanthera integrilabia* sites. Four of these are very small and contained 2, 3, 5 and 10 plants, respectively, in 1991. The fifth site is larger and contained 200 to 300 plants in 1998. Grundy County supports nine populations. Three of these are on State-owned lands and in the most recent surveys contained 6, 6 and 34 plants, respectively. The remaining six sites are on privately owned land and in the most recent surveys contained 0, 4, 118, 150, 250, and 1,000+ plants, respectively. Sequatchie County has three privately owned populations. One of these had 7 flowering plants in 1991, the second had 12 in that same year, and the third had 91 plants in 1996. Marion County has three populations. Two of the Marion County sites are small and privately owned, one of these had 2 plants and the other 10 plants in 1991. The third site is State-owned and supported 65 flowering plants in 1998. Van Buren County has four privately owned sites supporting *P. integrilabia*. In the most recent surveys of these populations, they contained 76, 86, 128, and 525 flowering plants, respectively. Bledsoe County has two State-owned sites; one had 50 plants in 1989 and the other had 600 plants in 1998. There are two federally owned sites in the State. One is in McMinn County on land managed as a Botanical Area by the Cherokee National Forest. In 1998, thousands of plants were observed at this site. The other federally owned site is also on the Cherokee National Forest, in Polk County. In 1996, this site contained 40 plants.

In 1942, *Platanthera integrilabia* was collected from Lee County in southwestern Virginia. The species not been seen in Virginia since then and is believed to be extirpated.

The U.S. Fish and Wildlife Service classifies *Platanthera integrilabia* as a candidate for Endangered Species Act protection with a listing priority number of 5. The South Carolina, Georgia, Mississippi, and Kentucky Natural Heritage Programs list this species as Critically Imperiled. The Tennessee and Alabama Natural Heritage Programs list this species as Imperiled.

LISTING CRITERIA

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

Historical range:	Alabama, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia.
Current range:	Alabama, Georgia, Kentucky, South Carolina, Tennessee.
Land ownership:	Federal (U.S. Forest Service and Department of Defense) 23 percent, State (South Carolina State Parks, Tennessee State Parks and State Forests) 13 percent, and private 64 percent.

Shea (1992) reported that several populations have been lost to habitat-altering activities such as road construction, residential and commercial construction, and soil and site hydrology-altering projects that reduced site suitability for the species. She estimated that these activities continued to threaten at least 50 percent of the remaining populations in 1992. Several of the known populations are in or adjacent to powerline rights-of-way. Mechanical clearing of these areas may benefit the species by maintaining adequate light levels; however, the use of herbicides could pose a significant threat to the species. All-terrain vehicles have damaged several sites and pose a threat to most sites (Shea 1992).

White (1998) notes that most of the known sites for the species occur in areas that are managed specifically for timber production. Timber management is not necessarily incompatible with the protection and management of *Platanthera integrilabia*. However, care must be taken during timber management to ensure that the hydrology of the bogs that support the species is not altered, that any heavy equipment used is kept out of the species' habitat, and that the vegetation is managed in a manner that maintains suitable light and moisture conditions. Natural succession can result in decreased light levels. This decrease can initially cause reduced vigor, flowering, and reproduction. If continued, it can make a site unsuitable for the species. Loss of sites to residential and other construction activities remains a threat to most of the privately owned populations. Timber management, if not carried out with the welfare of the species in mind, could negatively alter or destroy its habitat.

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

Collecting for commercial and other purposes is a threat to *Platanthera integrilabia*. Shea (1992) reports that the species may have been extirpated from its type locality by collecting and that, at that time, at least two Tennessee nurseries sold plants collected from wild populations. Because of the small size of many populations, collecting, even for scientific purposes, could easily extirpate the species from many areas.

C. ***Disease or predation.***

Zettler and Fairey (1990) stated that herbivory and disease both threatened this species. They reported herbivore damage to *Platanthera integrilabia*, ranging from 11 percent to almost 24 percent of the plants present at the South Carolina and Georgia sites they studied. They also noted plant damage caused by several fungal pathogens. White (1998) reported that herbivory (primarily by deer) continues to threaten the species at several sites, and that at one site it is threatened by wild boar rooting.

D. *The inadequacy of existing regulatory mechanisms.*

Some of the sites supporting *Platanthera integrilabia* are under the jurisdiction of State and Federal wetlands protection regulations such as those developed under the Clean Water Act. However, because of their size and isolation from larger aquatic systems, most sites are not under the jurisdiction of these programs. Additionally, many of the activities that threaten the species would take place in areas adjacent to, rather than in, the bogs supporting the species and therefore are not subject to wetlands regulations regardless of the size or location of the wetland.

Of the states currently having populations of *Platanthera integrilabia*, only Tennessee and Georgia have legislation that provides some protection for the species at the state level. These states regulate commerce and taking of the species without the permission of the landowner.

Current Conservation Efforts: The Nature Conservancy has registered one of the privately owned Grundy County, Tennessee, sites as a natural area. In 1980, this site supported 250 plants; however, the number of plants present in recent years has been greatly reduced and some active management of the site may be needed. One of the 12 sites in Federal ownership is designated as a Botanical Area by the U.S. Forest Service. The South Carolina site and several of the Tennessee sites are within State parks. This provides these sites with some degree of protection, but does not necessarily ensure that they will receive the management that may be needed to maintain the species.

Several years ago, the U.S. Fish and Wildlife Service and the U.S. Forest Service initiated discussions on the feasibility of developing a conservation agreement to protect *Platanthera integrilabia*. No recent work has been devoted to this effort because of the large number of sites in private ownership and the inability to develop an agreement that would protect enough populations to ensure the long-term survival of the species.

The U.S. Fish and Wildlife Service provided a grant to the Kentucky State Nature Preserves Commission to develop site conservation plans for the higher quality *Platanthera integrilabia* sites that remain in existence. A report containing conservation plans for 29 sites was prepared by White (1998). The threats to most sites and the active management needs identified in this report indicate that long-term protection of *Platanthera integrilabia* can best be achieved through the Federal listing process. The U.S. Fish and Wildlife Service has discussed this candidate elevation proposal with Dennis Krusac and Wayne Owen of the U.S. Forest Service's Southern Region. They support the elevation of this species to candidate status and have offered to work with the U.S. Fish and Wildlife Service in protecting the populations that occur on Forest Service lands (U.S. Fish and Wildlife Service candidate assessment form).

The Department of Defense is aware of the presence of *P. integrilabia* on Fort McClellan and the need to provide for its protection as they consider various alternatives in the disposal of excess lands on this Army base. The Natural Heritage Programs and/or State Plant Protection Programs in Alabama, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia have all been contacted concerning elevation of this species to candidate status. All have supported this effort and offered their assistance in protective efforts in the future (U.S. Fish and Wildlife Service candidate assessment form).

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

Little, if any, vegetative reproduction takes place in *Platanthera integrilabia*, and it is apparently primarily dependent upon sexual reproduction. Zettler and Fairey (1990) reported that only 2.8 percent to 4.6 percent of the plants within a population flower in any given year and of these, only 6.9 percent to 20.3 percent will set seed. This results in a very low production of seeds and, consequently, a limited ability to reproduce at most sites. White (1998) notes that the recovery of this species will be dependent upon active management rather than just preservation of its habitat. Because of the species' dependence upon moderate to high light levels, some type of active management to prevent complete canopy closure is required at most locations. Invasive nonnative plants such as Japanese honeysuckle (*Lonicera japonica*) and kudzu (*Pueraria lobata*) threaten several sites and, if left uncontrolled, can extirpate the species (Zettler and Fairey 1990).

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PETITION TO LIST

Red Mountain stonecrop
(*Sedum eastwoodiae*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 07/01/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 09/27/85:
CNOR 02/21/90:
CNOR 09/30/93:
CNOR 02/28/96: C
CNOR 09/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 06/13/02: C

TAXONOMY

Although this taxon was at one time given only subspecific status, Denton (1993) restored the taxon's former status as a full species, *Sedum eastwoodiae* (Crassulaceae), which continues to be recognized (e.g., Kartesz 1998).

NATURAL HISTORY

This species is known from very restricted occurrences in almost barren, rocky openings in lower montane coniferous forest habitats associated with serpentine-derived soils on Red Mountain. The species has not been found anywhere other than on lands administered by the Bureau of Land Management on Red Mountain and is found between 1,125 to 1,216 meters (3,700 to 4,000 feet) in elevation (California Department of Fish and Game (CDFG) 1997).

POPULATION STATUS

Dr. Michael Baad has annually monitored eight permanent plots on Red Mountain since 1987.

Canopy coverage in the plots decreased from a high of 630 cm^2 in 1988 to a low of 415 cm^2 in 1993, and rebounded to 627 cm^2 in 1995 (Baad 1998). Dr. Baad concluded that no dramatic changes have occurred in the populations of Red Mountain endemic plants since 1987. The plant populations have experienced little human impact. Fluctuations in population parameters have apparently been caused largely by normal variation in the physical and biological environments of the plants (Baad 1998).

The U.S. Fish and Wildlife Service classifies *Sedum eastwoodiae* as a candidate for Endangered Species Act protection with a listing priority number of 5. The California Natural Heritage Program lists this species as Critically Imperiled.

LISTING CRITERIA

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

Historical range: California

Current range: Red Mountain, Mendocino County, California

Land ownership: The three populations are found on lands administered by the Bureau of Land Management.

Although mining does not now occur in the species' habitat, potential future surface mining of nickel and chromium on Red Mountain threatens the populations (personal communication 1994 cited in U.S. Fish and Wildlife Service candidate assessment form; CDFG 1997; personal communication 2001 cited in U.S. Fish and Wildlife Service candidate assessment form). Current mining claimants have paid their fees for 63 mining claims on Red Mountain. Most likely, any mining operation on Red Mountain or Little Red Mountain would be an open-face bench type that would involve removal and processing of the mineral-bearing ore which contains the nickel, chromium, and cobalt. (BLM 1988). All vegetation and habitat for *Sedum eastwoodiae* would be removed. Ore would be processed on public or adjacent private lands. Overburden and processed soil disposal areas would be needed, along with a transportation system, perhaps involving cable trams across Cedar Creek Canyon (BLM 1988). Although no scientific evidence is available to suggest such secondary effects, additional biological values of the habitat may be lost through habitat fragmentation, alteration of hydrology, and increases in airborne particulates that may depress pollinator success (Saunders et al. 1991; Meffe and Carroll 1997).

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

None known at this time.

C. *Disease or predation.*

None known at this time, but some unknown rodent species severs the flowering stems before the plant is able to set seed (personal observation 1994 cited in U.S. Fish and Wildlife Service candidate assessment form).

D. ***The inadequacy of existing regulatory mechanisms.***

This taxon is not listed by the State of California and receives little protection from State laws.

Current Conservation Efforts: The primary threat to this species is the potential for future mining activities. Whether or not mining occurs depends on the future economic feasibility of mining and the demand for minerals. The holders of mining claims could engage in a validation process of their mining claims and thereby be granted patent to the lands on Red Mountain. If the lands were to be patented into private ownership and mining commenced, neither the U.S. Fish and Wildlife Service or the BLM could offer any protection of the land beyond elevating the profile and plight of the plant species in a proposed or final rule. The Arcata Field Office, BLM, supports the U.S. Fish and Wildlife Service listing the species on Red Mountain (U.S. Fish and Wildlife Service candidate assessment form).

From 1987 through 1998, the Red Mountain endemic plants experienced little human impact (Baad 1998). It is not believed that the development of a conservation agreement would provide any protection against the future patenting of existing mining claims.

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

The small number of individual plants and the small number of populations make this species vulnerable to random environmental events.

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PETITION TO LIST

Ramshaw Meadows sand verbena
(*Abronia alpina*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic staus of *Abronia alpina* (Nyctaginaceae) as a valid species is uncontroversial (e.g., Hickman 1993; Kartesz 1998).

NATURAL HISTORY

Abronia alpina is found on arkosic gravel meadow margins between lodgepole pine forest and sagebrush scrub communities surrounding Ramshaw and Templeton Meadows. Elevation ranges between 2,621 to 2,652 meters (8,600 to 8,700 feet). The soils are sterile, porous, subject to extreme diurnal temperature change and easily disturbed. The plant is a small, deeply-rooted perennial, 2.5 to 15.2 centimeters (1 to 6 inches) across.

POPULATION STATUS

Townshend Bradegee described this taxon in 1899 from specimens collected by Joseph Purpus at "Monatchy" Meadows near Mt. Whitney in 1896. For a number of years, this species was thought to have been extirpated, but it was rediscovered in 1970 in Ramshaw Meadow, Tulare County, California. No plants have ever been found at Monache Meadow, therefore, the 1896 collection was either referenced erroneously as the type collection or has since become extinct.

Abronia alpina is known from one main population center in Ramshaw Meadow on the Kern Plateau of the Sierra Nevada and from one subpopulation in adjacent Templeton Meadow. Of the 34 recognizable subpopulations, all but the Templeton Meadow population are found around the borders of Ramshaw Meadow. Much of the Kern Plateau was surveyed during 1984-1989, and it is unlikely that additional surveys will locate new populations. The total estimated area occupied is approximately 6.25 hectares (15 acres). Population estimates from 1985-1994 range from a low of 69,652 plants in 1986 to 132,215 plants in 1987. Surveys conducted since 1994 indicate that no significant changes have occurred in population size or location. The population fluctuates from year to year without any clear trends.

The California Natural Heritage Program ranks *Abronia alpina* as Critically Imperiled.

The U.S. Fish and Wildlife Service classifies *Abronia alpina* as a candidate for Endangered Species Act protection with a listing priority number of 11.

LISTING CRITERIA:

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

Historical range: California.

Current range: Ramshaw Meadow and Templeton Meadow on the Kern Plateau, Tulare County, California.

Land ownership: The only known sites of this species are located on land owned by the U.S. Forest Service. Property within the center of Ramshaw Meadow and adjacent to the sand flats supporting *Abronia alpina*, however, is privately owned by Mammoth Meadows Associates.

The primary threat to *Abronia alpina* habitat is disturbance from trampling by cattle, packstock, and hikers. The dry gravel soils are easily disturbed by foot or livestock use. Trails pass through many of the subpopulations. In 1995, approximately 600 to 700 cattle were trailed through Ramshaw Meadow. See factor E for further discussion. The Ramshaw Meadow ecosystem may be altered by lowering of the water table due to downcutting of the South Fork of the Kern River. Lodgepole pine appears to be encroaching into occupied *Abronia* habitat.

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

None known.

C. ***Disease or predation.***

Gopher activities may result in significant destruction of *A. alpina.* Whole plants have been known to disappear, possibly either eaten or used for den building. In some areas, soil has been pushed up around gopher burrows and completely covered *A. alpina* plants. *Abronia alpina* is not eaten by cattle or deer, but light grazing by rabbits and gophers has been observed. Ant herbivory also has been observed in some subpopulations.

D. ***The inadequacy of existing regulatory mechanisms.***

Current Conservation Efforts: This species is the subject of a draft conservation agreement that was written by Inyo National Forest.

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

Significant trampling of *Abronia alpina* subpopulations by cattle has occurred in the past. Livestock use is currently limited to trailing along a designated route through Ramshaw Meadow twice during the grazing season. Some of the subpopulations are protected by fencing, while the protection of others is dependent on close adherence to the trailing route.

Due to the extremely limited geographic range of the species, biological factors such as disease or pest outbreak and random chance events associated with the highly variable climate can pose a serious threat to the species. *Abronia alpina* apparently is slow to recover from disturbance because of reproductive and dispersal limitations, short life span, and high annual fluctuation in population numbers. Inbreeding depression may also threaten the species.

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PETITION TO LIST

Georgia rockcress
(*Arabis georgiana*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

Arabis georgiana (Brassicaceae) was first collected in 1841 by Boykin from the vicinity of the Chattahoochee River in Georgia. Several other collections of this species were made in the late 1800's. However, Harper was the first to recognize its distinctiveness, after seeing it in fruit in 1901 on the bank of the Chattahoochee River in Stewart County, Georgia. Harper later described it as a distinct species in 1903 (Allison 1995). The taxonomic status of *Arabis georgiana* as a valid species is uncontroversial (e.g., Kartesz 1998).

NATURAL HISTORY

Arabis georgiana grows in a variety of dry situations, including shallow soil accumulations on rocky bluffs, ecotones of gently sloping rock outcrops, and in sandy loam along eroding riverbanks. It is occasionally found in adjacent mesic woods but it will not persist in heavily shaded conditions. This species is adapted to high or moderately high light intensities and occurs on soils which are circumneutral to slightly basic (Allison 1995, *in litt.* 1999 cited in U.S. Fish and Wildlife Service candidate assessment form, Patrick et al. 1995).

POPULATION STATUS

Populations of *Arabis georgiana* are known from the Gulf Coastal Plain, Piedmont, and Ridge and Valley physiographic provinces of Alabama and Georgia. Extensive searches have been conducted for this species throughout these provinces in Alabama and Georgia for over 5 years (Allison 1995, *in litt.* 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). *Arabis georgiana* is rare throughout its range. Allison (1995) surveyed 205 sites over nine counties in Georgia and discovered only four new populations (a two percent success rate). Currently a total of 19 populations are known from four counties in Alabama (Bibb, Elmore, Russell, and Wilcox Counties) and six counties in Georgia (Clay, Chattahoochee, Floyd, Gordon, Harris, and Muscogee Counties). A historical location from Stewart County, Georgia, has not been relocated despite repeated searches (Allison 1995, *in litt.* 1999 cited in U.S. Fish and Wildlife Service candidate assessment form).

During surveys, populations of this species were found typically to contain a limited number of individuals restricted over a small area (personal communication cited in U.S. Fish and Wildlife Service candidate assessment form) . Of the nine known populations in Georgia, six of them consist of only 3 to 25 plants; the remaining three populations have 51 to 63 individuals (Allison 1995). The larger populations are primarily in the Ridge and Valley physiographic region of Alabama, particularly in Bibb County. This species was documented at 18 sites (representing 7 populations) in Bibb County (*in litt.* 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). Four of these seven populations include 5 to 20 plants and one population each consists of 50, 83, and 180 plants. The remaining three Alabama populations, in the Coastal Plain region of Alabama, have population sizes of 12, 24, and 51 plants (*in litt.* 1999 cited in U.S. Fish and Wildlife Service candidate assessment form).

The Georgia Natural Heritage Program ranks *Arabis georgiana* as Critically Imperiled. The Alabama Natural Heritage Program ranks *Arabis georgiana* as Imperiled.

The U.S. Fish and Wildlife Service classifies *Arabis georgiana* as a candidate for Endangered Species Act protection with a listing priority number of 11.

LISTING CRITERIA

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

Historical range: Alabama, Georgia.

Current range: Alabama, Georgia.

Land ownership Three sites are located on federal land (two sites on the Fort Benning Military Reservation and one on Jackson Park National Historical Site); all others are on private land, including two on property owned by The

Nature Conservancy.

One population of *Arabis georgiana* in Floyd County, Georgia, appears to be a surviving remnant of a once larger population. The primary habitat at this locality has been extensively quarried (Allison 1995). It is likely that other populations on rocky bluffs, in the Piedmont and Ridge and Valley provinces, were destroyed by quarrying or impoundments. Rock bluffs along rivers have also been favored sites for hydropower dam construction. The construction of a dam in Harris County, Georgia, destroyed a portion of suitable habitat for a population of *Arabis georgiana* and the current population there may also represent a remnant of a once much larger population (Allison 1995). Habitat degradation, more than its outright destruction, is the most serious threat to this species' continued existence. Most of the Coastal Plain rivers surveyed were considered unsuitable for *Arabis georgiana* because the bank had been disturbed to the point where there was no remaining vegetation buffer (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). Disturbance, associated with timbering, road building, and grazing, has created favorable conditions for the invasion of exotic weeds in this species' habitat (see Factor E).

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

Overutilization is not known to pose a threat to this species.

C. *Disease or predation.*

Allison (1995) observed plants damaged from grazing at one site (Allison 1995). However, disease and predation are not thought to be a significant threat to this species.

D. *The inadequacy of existing regulatory mechanisms.*

Arabis georgiana is listed as Threatened by the State of Georgia (Patrick et al. 1995). This State listing provides legal standing under the Georgia Wildflower Preservation Act of 1973. Georgia law prohibits the removal of this species from public land and regulates the taking and sale of plants from private land. The greater problem of habitat destruction and degradation is not addressed by this law. *Arabis georgiana* is considered endangered in Alabama but that state has no protective legislation for plants.

Only three populations occur on public land - two populations on the Fort Benning Military Reservation in Chattahoochee County, Georgia, and Russell County, Alabama, respectively, and one population on the Jackson Park National Historic Site. Whether or not these populations are being adequately protected on these sites is unknown.

Current Conservation Efforts: The U.S. Fish and Wildlife Service funded a status survey on this species throughout its range in Georgia and Alabama).

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

The primary threat to *Arabis georgiana* is the ongoing degradation of its habitat. Disturbance of most of the known sites has provided opportunities for the invasion of aggressive exotic weeds, especially Japanese honeysuckle (*Lonicera japonica*). *Arabis georgiana* is not a strong competitor. It is usually found in areas where growth of other plants is restrained due to the shallowness of the soils or the pioneer status of the site (eroding riverbanks) (Allison 1995). However, exotics are effectively invading these riverbank sites and the long-term survival of the five riverbank populations in the Coastal Plain province is questionable (Allison 1995). This species is only able to avoid competition with exotics where the soil is the limited (rocky bluffs).

Competition from exotics, enhanced by adjacent land use changes, likely contributed to the loss of the population at the type locality in Stewart County, Georgia (Allison 1995). Four additional populations are currently being negatively affected by competition with exotics. Japanese honeysuckle was observed actually growing on individual plants of *Arabis georgiana* at three sites. In a fourth area, plants growing in a mat of Nepalese browntop (*Eulalia viminea*) have declined in number from 17 individuals to a single plant (Allison 1995). Five other populations are imminently threatened by the nearby presence of exotics (Allison 1995, Allison in litt. 1999). Thus, 47 percent of the known populations (9 of 19) are currently threatened by exotic species.

Populations of *Arabis georgiana* are healthiest in areas receiving full or partial sunlight. Those populations occurring in forested areas will decline as the forest canopy closes. The decline of a population in Bibb County, Alabama, was attributed to canopy closure (*in litt.* 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). In addition, the small number of individuals at the majority of the sites makes these populations highly vulnerable to local extinctions from stochastic events.

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PETITION TO LIST

Blodgett's silverbush
(*Argythamnia blodgettii*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 12/15/80:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Argythamnia blodgettii* (Euphorbiaceae) as a valid species is uncontroversial (e.g., Kartesz 1998; Wunderlin and Hansen 2000).

NATURAL HISTORY

Argythamnia blodgettii is a small, suffrutescent (semi-woody) perennial plant. Its range is restricted to southern Florida in Miami-Dade and Monroe Counties. On the Miami-Dade County mainland it grows in pine rockland and edges of rockland hammock. In the Florida Keys it grows in pine rockland, rockland hammock, and coastal berm, particularly in open sunny gaps or edges (Bradley and Gann 1999). It tolerates some degree of disturbance, even growing in the bottoms of abandoned rock quarries at Windley Key Fossil Reef State Geological Site. Its historical distribution was from central Miami-Dade County to Key West in the Florida Keys.

This species is shade intolerant and requires periodic burning to reduce competition from woody vegetation.

POPULATION STATUS

Argythamnia blodgettii was once known from the John Pennekamp Coral Reef State Park, Brickell Hammock, Key West, and Stock Island, where it is extirpated. This species is now known from fewer than 9,000 plants at 11 protected sites, and fewer than 1,000 plants at five non-protected sites (two personal communications cited in U.S. Fish and Wildlife Service candidate assessment form). *Argythamnia blodgettii*'s restricted ecological range and drastic loss of habitat suggest that the number of individuals is declining.

The Florida Natural Heritage Program ranks *Argythamnia blodgettii* as Imperiled. The State of Florida lists this species as Endangered (Wunderlin and Hansen 2000).

The U.S. Fish and Wildlife Service classifies *Argythamnia blodgettii* as a candidate for Endangered Species Act protection with a listing priority number of 11.

LISTING CRITERIA

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

Historical range: Florida.

Current range: Florida.

Land ownership *Argythamnia blodgettii* individuals have been found on 11 Federal, State and county managed sites: Camp Owaissa Bauer, Castellow Hammock Environmental Education Center, Charles Deering Estate, Everglades National Park, Larry and Penny Thompson Park, Lignumvitae Key State Botanical Site, National Key Deer Refuge, Ned Glenn Nature Preserve, Pine Ridge Sanctuary, Whispering Pine Hammock, and Windley Key Fossil Reef Geological Site. The species is also known from five private, non-protected sites.

Habitat loss is threatening the survival of *Argythamnia blodgettii*. This species once occurred at the John Pennekamp Coral Reef State Park, Brickell Hammock, Key West, and Stock Island, but is now extirpated due to development. Habitat loss continues to occur throughout its remaining habitat and most of *Argythamnia blodgettii*'s remaining suitable habitat has been negatively altered by human activity. Pine rocklands in Miami-Dade County have been reduced to about 11 percent of their former extent (Kernan and Bradley 1996). Of the estimated historical extent of 74,000 hectares (ha) (182,780 acres), only 8,140 ha (20,106 acres) of pine rocklands remained in 1996.

Outside of the Everglades National Park, only about 1 percent of the Miami Rock Ridge pinelands have escaped clearing, and much of the remaining pinelands is in small remnant blocks

isolated from other natural areas (Herndon 1998). Florida had a 15.3 percent increase in the human population from April 1, 1990, to July 1, 1998, and was ranked as the fourth fastest growing State in the nation during 1998 (U.S. Census Bureau 1998). Given the popularity of South Florida, this trend is expected to continue. The regional water control efforts conducted throughout South Florida may negatively impact *Argythamnia blodgettii* by altering the hydrology within the plant's range.

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

None are known.

C. ***Disease or predation.***

None are known

D. ***The inadequacy of existing regulatory mechanisms.***

The Florida Department of Agriculture and Consumer Services has designated *Argythamnia blodgettii* as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur.

Current Conservation Efforts: In 1979, Miami-Dade County enacted the Environmentally Endangered Lands Covenant Program which gives private land owners of pine rockland habitat a tax break if they agree to not develop the property and to manage it for a period of ten years (U.S. Fish and Wildlife Service 1998). Although the *Argythamnia blodgettii* populations on public lands are protected from development, they are still under threat from exotic vegetation. There are no specific conservation activities for *Argythamnia blodgettii* on public lands. There are no current conservation activities for the *Argythamnia blodgettii* sites located on private lands. The U.S. Fish and Wildlife Service has developed a multi-species recovery plan for the threatened and endangered species of South Florida. This plan is ecosystem-based and includes many recommendations for conservation of the communities where *Argythamnia blodgettii* occurs (U.S. Fish and Wildlife Service 1999).

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

Fire suppression and exotic plant invasions are threatening the survival of *Argythamnia blodgettii*. Fire is required to maintain the pine rockland community. Under natural conditions, lightning fires typically occurred at 3- to 7-year intervals. With fire suppression, hardwoods eventually invade pine rocklands and shade out understory species like *Argythamnia blodgettii*. Fire suppression has reduced the size of the areas that do burn and habitat fragmentation has prevented fire from moving across the landscape in a natural way. Thus, many pine rockland communities have moved past their normal "fire subclimax" and are succeeding to tropical

hardwood hammock communities.

Exotic species have also altered the type of fire that occurs in pine rocklands. Historically, pine rocklands had an open low understory where natural fires remained patchy with low temperature intensity, thus sparing many native plants such as *Argythamnia blodgettii*. The current density of exotic plant overgrowth throughout *Argythamnia blodgettii*'s range has created a situation that may no longer allow the species to be conserved through fire. Dense vegetative growth can create intense fire temperatures and longer burning periods. Pine rockland plants cannot tolerate these extreme conditions. Given the current conditions, exotic plant control may require an alternate, more labor intensive method. One such method, hand chopping followed by spot herbicide treatment, requires extensive man-hours and is very costly. This method may not be feasible for publically owned lands, given the acreage of land, and current staffing and budget constraints.

Exotic plant taxa have significantly affected pine rocklands. As a result of human activities, at least 277 taxa of exotic plants are now known to have invaded pine rocklands throughout South Florida (U.S. Fish and Wildlife Service 1998). A few of these exotic plants include the Brazilian pepper (*Schinus terebinthifolius*), burma reed (*Neyraudia reynaudiana*), and melaleuca (*Melaleuca quinquenervia*). Many exotic nuisance plant species threaten the native vegetation with extirpation or extinction. Given the species' narrow range and the small number of individuals that exist, *Argythamnia blodgettii* is extremely vulnerable to natural catastrophic events such as hurricanes and tropical storms, which could extirpate existing populations.

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PETITION TO LIST

Georgia aster
(*Symphyotrichum georgianum*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 2/21/90:
CNOR 9/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

Jones (1983) provided evidence from analyses of morphology, cytology, geographic distribution, and ecology confirming the status of this taxon as a distinct species. As part of a major revision of the genus *Aster* (Asteraceae), Nesom (1994) placed this species, formerly known as *Aster georgianus*, in the genus *Symphyotrichum*, a change that has been accepted by other authorities (e.g., Kartesz 1998).

NATURAL HISTORY

Georgia aster is a relict species of post oak savanna/prairie communities that existed in the southeast prior to widespread fire suppression and the extirpation of large native grazing animals. Most remaining populations survive adjacent to roads, utility rights-of-way and other openings where current land management mimics natural disturbance regimes. Most populations are small, and since the species' main mode of reproduction is vegetative, each isolated population probably represents just a few genotypes. Many populations are threatened by woody succession due to fire suppression, development, highway expansion/improvement, and herbicide application.

Georgia aster has large heads [5 centimeters (cm) (2 inches (in)) across], with dark purple rays up to 2 cm (0.8 in) long, and thick, lanceolate to oblanceolate, scabrous, clasping leaves. Flowering occurs from early October to mid-November. Disc flowers are white with purplish

tips on the corollas, anthers purple and pollen whitish. As the flowers age, the corollas turn a darker purple, so there is a difference between colors of early and mature disk corollas. The ribbed achenes are up to 4 millimeters (0.1 in) long, with evenly distributed spreading trichomes. Various species of butterflies and bumblebees have been observed pollinating the flowers, but these have not yet been identified to species (Matthews 1993).

Plants are usually colonial, with 1 (sometimes 2) stems arising from each underground part. The stems and leaves are scabrous. The habitat consists of dry oak-pine flatwoods and uplands in the piedmont of North Carolina, South Carolina, Georgia, and Alabama. *Symphyotrichum georgianum* can be distinguished from the similar *Aster patens* by its dark purple flowers (compared to the light lavender flowers of *A. patens*). *Aster grandiflorus* is another similar species, but it can be distinguished by its yellow disk flowers (compared to the white disk flowers of *Symphyotrichum georgianum*).

Georgia aster occupies a variety of dry, upland habitats. The primary controlling factor appears to be the availability of light. The species is a good competitor with other early successional species, but tends to decline when shaded by woody species. Populations can persist for some undetermined length of time in the shade, but these rarely flower (Matthews 1993), and reproduce only by rhizomatous expansion. Soils vary from sand to heavy clay, with pH ranging from 4.4 to 6.8 at the sites sampled thus far (Matthews 1993).

POPULATION STATUS

Historically, 97 populations of Georgia aster were known to exist; 34 of these have apparently been destroyed. The species appears to have been eliminated from one of the five states in which it originally occurred (i.e., Florida). In most cases the exact cause of extirpation was not documented, but herbicides, highway construction, fire suppression, and residential and industrial development have all altered the historic landscape in which Georgia aster once flourished.

The Natural Heritage Programs of North Carolina, Georgia, and Alabama rank the Georgia aster as Imperiled.

The U.S. Fish and Wildlife Service classifies Georgia aster as a candidate for Endangered Species Act protection with a listing priority number of 5.

LISTING CRITERIA

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

Historical range: Alabama, Florida, Georgia, North Carolina, and South Carolina.

Current range: Alabama, Georgia, North Carolina, and South Carolina.

Land ownership: Six percent of the surviving sites (four sites) are owned by the U.S. Forest Service (Uwharrie National Forest), one percent(one site) is owned by the U.S. Army Corps of Engineers, and the remaining ninety-three percent are on private lands.

Most remaining populations of this species survive adjacent to roads, railroads, utility rights-of-way and other openings where land management mimics natural disturbance regimes, but where they are inherently vulnerable to accidental destruction from herbicide application, road shoulder grading, and other maintenance activities. Many populations are now threatened also by development (several are within planned residential subdivisions), highway expansion/improvement, and by woody succession due to fire suppression. Two of the remaining populations are located adjacent to active quarries, which could eliminate the plants in the process of expansion. Most of the remaining populations are small, with 60 percent of them being no larger than 10 square meters (116 square feet) in size. Georgia aster has apparently been eliminated from 4 counties in Alabama, 1 county in Florida, 11 counties in Georgia, 1 county in North Carolina, and 5 counties in South Carolina; it remains in 31 counties in 4 states (Alabama, Georgia, North Carolina, and South Carolina).

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

Possibly in part because of its rarity, this species is not known to be a significant component of the commercial trade. However, it is an exceptionally attractive aster, with a low growth habit that could make it desirable to collectors and horticulturists. In addition, one of the surviving populations occurs within a heavily-used commercial recreation area, where it is threatened by trampling.

C. ***Disease or predation.***

Disease and predation are not known to be a problem for this species. However, very little detailed information is available on its life history and interactions with potential predators and pathogens. The cause of the demise of most of the 34 extirpated populations is undocumented, so it is possible that disease and/or predation are an extant, but undocumented, problem. Obviously, with fewer and smaller populations remaining, disease or predation could represent a more serious threat to this species' survival now than they would have historically.

D. ***The inadequacy of existing regulatory mechanisms.***

None of the states within the range of this species offer legislative protection for habitat. A few states protect state-listed species from taking by others, but do not protect them from the landowner. Only 5 populations of Georgia aster are known to occur on public lands (4 on National Forests; 1 on U.S. Army Corps of Engineers' lands), but they are currently offered no protection on these sites. Also, a primary threat to this species' continued existence is fire suppression; at least one of the states within the species' range has proposed legislation to ban

prescribed burns, which could seriously hinder efforts to protect this species and ensure its long-term survival.

Current Conservation Efforts: The U.S. Fish and Wildlife Service is identifying and approaching private landowners in an attempt to gain their cooperation in our efforts to protect the species. The U.S. Fish and Wildlife Service has initiated discussions with the U.S. Forest Service about managing and protecting their 4 populations, and gained their tentative commitment to conduct prescribed burns on at least 2 of these sites.

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

Disturbance (fire, native grazers, etc.) is a part of this species' habitat requirements. The historic sources of this disturbance have been virtually eliminated from Georgia aster's range, except where road, railroad and right-of-way maintenance are mimicking the missing natural disturbances. However, more utility companies and railroads are shifting to herbicide spraying instead of mowing for longer-lasting control of vegetation growth. Repeated mowing of Georgia aster populations during the height of the growing season can reduce population vigor, and may eventually kill plants, but is not nearly as destructive as herbicide application. Wildfires, once a part of the landscape, have virtually been eliminated, and prescribed burns are becoming harder to implement (see Section D above).

Ninety-three percent of the surviving populations occur on private lands, where there is no protection of any kind. Two are on the edge of active quarries, and one is located within a heavily-visited commercial recreation facility where it is potentially threatened by trampling. Several other sites are threatened by the encroachment of invasive exotic plants, particularly kudzu, which is choking out virtually all the native vegetation. Extended drought may be a problem for this species, with one population reportedly at least top-killed before it could produce seed; it is unknown what long-term effects drought has on this species. Little is known of Georgia aster's life history and population biology, but preliminary evidence indicates that it may be self-sterile (Matthews 1993). With 41 percent of the surviving populations of these rhizomatous plants having fewer than 50 stems, these small populations may represent single clones that are incapable of sexual reproduction; their long-term survival may be compromised by severe loss of genetic diversity.

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PETITION TO LIST

Horseshoe milkvetch
(*Astragalus equisolensis*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 12/15/80:	
CNOR 11/28/83:	
CNOR 9/27/85:	
CNOR 2/21/90:	
CNOR 9/30/93:	
CNOR 2/28/96:	C
CNOR 9/19/97:	C
CNOR 10/25/99:	C
CNOR 10/30/01:	C
CNOR 6/13/02:	C

TAXONOMY

Kartesz (1998) treats this taxon, *Astragalus equisolensis* (Fabaceae), as a variety, *Astragalus desperatus* var. *neeseae*.

NATURAL HISTORY

Astragalus equisolensis grows on sand and sandy silt soils derived from the Duchesne River Formation and Pleistocene alluvium immediately above that geologic formation. The species is a component of the salt-desert shrub community dominated by *Artemisi*a, *Atriple*x, and *Tetradymia* species.

POPULATION STATUS

Astragalus equisolensis is restricted to a single population in the vicinity of Horseshoe Bend of the Green River in the center of the Uinta Basin in Uintah County, Utah. The species range is a

discontinuous series of small stands over an area of about 10 kilometers (6 miles) across. The total number of *A. equisolensis* individuals is estimated at about 10,000.

The Utah Natural Heritage Program ranks *Astragalus equisolensis* as Critically Imperiled.

The U.S. Fish and Wildlife Service classifies *Astragalus equisolensis* as a candidate for Endangered Species Act protection with a listing priority number of 8.

LISTING CRITERIA:

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

Historical range: Utah.

Current range: Near Horseshoe Bend of the Green River in the center of the Uinta Basin in Uintah County, Utah

Land ownership: Bureau of Land Management.

The total population of *A. equisolensis* is estimated to be about 10,000 individuals occurring sporadically over a range of about 30 square miles (Welsh and Neese 1984, Franklin 1992). The occupied habitat of *A. equisolensis* is within a developed and expanding oil and gas field with several wells and access roads within the species' occupied habitat. The location of the habitat of *A. equisolensis* exposes its population to the likelihood of habitat destruction from off-road vehicle use, road, pipeline, and well site construction in connection with oil and gas development. With such a small population and limited occupied habitat, any destruction, modification, or curtailment of the habitat would have a highly negative impact on the species. Recent oil and gas development projects are projected to directly impact occupied habitat of the species by increasing by a factor of four the current level of habitat disturbance (personal communication cited in U.S. Fish and Wildlife Service candidate assessment form).

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

None known

C. *Disease or predation.*

None known

D. *The inadequacy of existing regulatory mechanisms.*

No Federal or State laws or regulations specifically protect *A. equisolensi*s. The BLM administratively recognizes species for special management consideration, but does not have the

legal authority to require Federal mineral lease holders to modify their mineral recovery plans and on-the-ground actions solely to protect this species.

Current Conservation Efforts: No specific actions have been taken to protect this species other than BLM's administrative consideration of the species' special status as a candidate species.

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

The populations of *A. equisolensis* may not be at levels that would ensure the species long-term demographic stability.

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PETITION TO LIST

Sleeping Ute milkvetch
(*Astragalus tortipes*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The taxonomic status of *Astragalus tortipes* (Fabaceae) as a valid species is uncontroversial (e.g., Kartesz 1998).

NATURAL HISTORY

Astragalus tortipes grows in a mixed desert scrub community with several other "Four Corners" endemics such as *Eriogonum clavellatum* and *Astragalus cronquistii*. Timing of initiation of spring growth varies from year to year in response to favorable temperature and moisture, and the life cycle from flowering to fruiting is completed in about 2 weeks.

POPULATION STATUS

This species is found on the Ute Mountain Ute Indian Reservation in a restricted area on the southeastern flank of Sleeping Ute Mountain, approximately 15 miles southwest of Cortez, Montezuma County, Colorado. It grows in scattered colonies on the lower slopes of ridges and knolls between 1,585-1,768 meters (5,200-5,800 feet) elevation. In April and May of 2000 a survey was conducted (Colyer 2000). The surveyors found the milkvetch on 24 of 30 knolls, ridges, or drainage areas surveyed over a 10 square mile-area. Though the area encompassing the plant's range is about 64,000 acres the plant only occurs on 500 acres within the range (Colyer

2000). With knowledge of the habitat requirements, it was estimated by the surveyors that the plant's range could extend another 0.5 mile to the southeast on Ute Mountain Ute land.

This species was first discovered in 1985. A field survey to determine its range, population size, and distribution was conducted in 1989 by Anderson (Anderson and Porter, 1994). General botanical surveys in the only known location with similar habitat (at the foot of the Henry Mountains in Utah) failed to locate any individuals of this species (Neese 1980, as referenced in Anderson and Porter, 1994).

Prior to the spring 2000 survey there were an estimated 2,000-3,000 individual plants. Prior to 2000 the number of locations was not recorded. According to the U.S. Fish and Wildlife Service candidate assessment form, the spring 2000 survey identified 3,744 plants at 24 locations, extended the known range of the species, and identified only minor existing threats to the species in a few areas. A long-term conservation agreement was to be discussed with the Ute Mountain Ute Tribe in 2001; the lack of an agreement could hinder the milkvetch's existence by allowing future impacts to the plant to occur. Oil and gas development may occur in the future, but according to the U.S. Fish and Wildlife Service candidate assessment form only a few plant locations are on terrain that would be impacted. Based on the above information, the U.S. Fish and Wildlife Service concluded that the Sleeping Ute milkvetch should be retained on the candidate list, but with a reduced listing priority number (U.S. Fish and Wildlife Service candidate assessment form, 10/30/01 Candidate Notice of Review).

The Colorado Natural Heritage Program ranks *Astragalus tortipes* as Critically Imperiled.

The U.S. Fish and Wildlife Service classifies *Astragalus tortipes* as a candidate for Endangered Species Act protection with a listing priority number of 8.

LISTING CRITERIA:

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

Historical range: Colorado.

Current range: Scattered colonies on the Ute Mountain Ute Indian Reservation in a restricted area on the southeastern flank of Sleeping Ute Mountain, approximately 15 miles southwest of Cortez, Montezuma County, Colorado.

Land ownership: This species occurs solely on Ute Mountain Ute Indian Tribal lands. The Towaoc Canal was constructed by the Bureau of Reclamation, which has jurisdiction over the canal itself and associated rights-of-way. The canal is approximately 10 feet wide where it bisects the milkvetch colonies and the road right-of-way is approximately 20 feet wide including shoulders. The

Dolores Water Conservancy District and the Ute Mountain Ute Tribe share operation and maintenance duties.

The Towaoc Canal was constructed from 1991-1993 through the western end of the plant's range, which impacted four colonies and fragmented the plant's distribution. Previously, this area was not accessible by vehicle, but canal construction has opened the area to vehicle use and associated impacts. Operation and maintenance of the canal also may have continued effects. Another impact to the habitat was a seismic grid that was laid out through the area in 1985 and 1986 with seismic lines through some of the colonies.

However, there was no evidence of the lines during an October 2000 field trip by U.S. Fish and Wildlife Service and other agency employees and there are currently no plans for oil or gas drilling in this area. This species occurs a few miles east of an agricultural area (the Ute Farms) being irrigated by the Towaoc Canal. The agricultural area is expected to expand eastward in the future with uncertain impacts to the milkvetch. According to the U.S. Fish and Wildlife Service (candidate assessment form), impacts of this expansion will likely be limited because the milkvetch occurs in topographically hilly country. Excavation of borrow material about 20 years ago destroyed individual plants in an isolated colony 1-2 miles north and east of the other colonies. Currently, off-highway vehicle use on the hills adjacent to the excavated site is destroying individuals of this same colony. Despite prior and ongoing disturbance this colony was the sixth largest in 2000. Any additional activity that results in surface disturbance or alteration of habitat conditions where this species occurs will further threaten its continued existence.

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

None known.

C. ***Disease or predation.***

During the spring 2000 survey it was observed that a handful of plants were clipped off by Gunnison prairie dogs (*Cynomys gunnisoni*). Given the small number of milkvetch clipped off by the prairie dogs, and the small numbers of prairie dogs in the area, it is unlikely that prairie dog herbivory is more than a minor threat to the species (U.S. Fish and Wildlife Service candidate assessment form).

D. ***The inadequacy of existing regulatory mechanisms.***

No local, State, Federal, or tribal regulations serve to protect or conserve this species. Without a long-term conservation agreement with the Ute Mountain Ute Tribe and without listing and consequent protection under Section 7 and 10 of the Endangered Species Act, development or recreational threats could continue to impact this species resulting in its eventual extinction.

Current Conservation Efforts: No conservation agreements have been undertaken for this species, though a conservation agreement is proposed to be entered into by the U.S. Fish and

Wildlife Service with the Ute Mountain Ute Tribe and other involved parties.

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

Cattle trailing could impact some individuals plants, particularly along the canal, but this is currently a minor impact and cattle do not appear to graze on the milkvetch (U.S. Fish and Wildlife Service candidate assessment form). Pollinators can likely fly across the Towaoc Canal so genetic interchange is still possible but there may be some limitation of seed dispersal east and west of the Canal with an unknown impact to the milkvetch. If insecticides or herbicides are applied to future agricultural areas adjacent to Sleeping Ute milkvetch colonies, pesticide drift could occur and impact the milkvetch or its pollinators. Though no research has been conducted on these plants, the current population level could be approaching genetically minimum viable population thresholds and may be a factor in potential extinction.

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PETITION TO LIST

Northern wormwood
(*Artemisia campestris* var. *wormskioldii*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

This taxon has a history of some nomenclatural confusion, now apparently clarified. *Artemisia campestris* var. *wormskioldii* (Asteraceae) is the valid name (e.g., Hitchcock and Cronquist 1976; Kartesz 1998).

NATURAL HISTORY

Artemisia campestris var. *wormskioldii* is restricted to exposed basalt, cobbly-sandy terraces, and sand habitat along the banks of the Columbia River at elevations ranging from 50–150 meters (160–500 feet).

POPULATION STATUS

Historically, at least eight populations of *Artemisia campestris* var. *wormskioldii* occurred within the species' range. This plant was previously collected from sites along the banks of the Columbia River near the mouth of the John Day River in Wasco County, Oregon, to the vicinity of Hood River in Hood River County, Oregon, a distance of 80 kilometers (km) (50 miles (mi)) (Washington Natural Heritage Program and Bureau of Land Management 1999). All of the

historical locations have been surveyed recently, and no populations were found. It is likely that disturbances due to the construction of several dams and subsequent flooding of habitat resulted in the extirpation of the historical occurrences (Carlson 1997; Rush 1999).

Currently, this species is known from only two sites, which are separated by approximately 322 km (200 mi) of the Columbia River, in Klickitat and Grant Counties in Washington. These two populations were discovered in 1983 (Carlson 1997). Three large hydroelectric dam/reservoir complexes (Priest Rapids Dam, McNary Dam, and John Day Dam) are located between the two sites (Carlson 1997; Rush 1999). Both populations are found just downstream of dams where current habitat most resembles historic habitat. There may be little or no suitable habitat between the two known populations because much of the original river bank has been inundated by the construction of the three dams and the use of riprap along the river banks; however, remnant populations may remain (Carlson 1997).

The Miller Island population in Klickitat County, Washington, occurs in the Columbia River Gorge National Scenic Area which is managed by the U.S. Forest Service (Forest Service). This population is found near water level in the crevices of basalt outcrops, compacted cobbly terrace, and sand. Seventy-five plants occupied less than 0.4 hectare (ha) (1 acre (ac)) at this site in 1989 (Kaye 1995). During monitoring in 1995, 335 plants were recorded, and 109 of these plants were flowering (Kaye 1995). The majority of the plants, 319 individuals, were found on a sandy substrate. Many of these were small seedling-sized individuals, either seedlings or second year individuals less than 5 centimeters (cm) (2 inches (in.)) tall. Few of the 16 remaining plants, which were found on bedrock, were small (average height was 9.0 cm (3.5 in.)). The more numerous smaller individuals found on the sandy substrate suggests that seedling recruitment on bedrock is limited when compared with sandy substrate.

The five-fold difference in population sizes between 1989 and 1995 indicates the likelihood of a large yearly variation in seedling recruitment, with few or no seedlings produced in 1989. The 1989 survey, however, may have missed a portion of the population, particularly small plants. A total of 142 flowering plants were counted in June 1999. Nonflowering plants were not counted, however, because of the difficulty in distinguishing *Artemisia campestris* var. *wormskioldii* from var. *scouleriana*, which also occurs at this site (Rush 1999).

The Beverly population in Grant County, Washington, occurs on land owned and managed by the Bureau of Reclamation (BOR) along the shore of the Columbia River and on several "islands" composed mostly of compacted cobbly terrace (Rush 1999). This population appears to be restricted to an area of compacted cobbles with varying amounts of sand and little, if any, soil development (Carlson 1997). In 1989, several hundred to possibly 1,000 individuals occupied approximately 4 ha (10 ac) at the Beverly site (Carlson 1997; Rush 1999). During the winter and spring of 1996–1997, the Beverly population was inundated by water, and the population was significantly reduced (*in litt.* 1998 cited in U.S. Fish and Wildlife Service candidate assessment form; Rush 1999). During surveys of the Beverly site, biologists from Calypso Consulting in April 1997, and from the Washington Natural Heritage Program in July 1997, observed that the vegetation composition had changed markedly. Very little native vegetation was found on the site, and the weedy annual grass *Bromus tectorum* and a State-listed noxious weed *Centaurea*

diffusa were abundant (*in litt.* 1998 cited in U.S. Fish and Wildlife Service candidate assessment form). Only 28 *Artemisia campestris* var. *wormskioldii* plants could be positively identified in July 1997, and the area of occupancy had been reduced to less than 0.4 ha (1 ac) (Carlson 1997). In April 1999, 65 plants were mapped in a monitoring plot established in the densest part of the population, and an additional 30 plants were counted in surrounding areas (Rush 1999). In November 2000, an additional subpopulation on a nearby "island" was found. A total of 1300 plants in the three subpopulations were counted. Generally, the numbers of plants are static or decreasing (personal communication 2000 cited in U.S. Fish and Wildlife Service candidate assessment form).

The Washington Natural Heritage Program ranks *Artemisia campestris* var. *wormskioldii* as Critically Imperiled.

The U.S. Fish and Wildlife Service classifies *Artemisia campestris* var. *wormskioldii* as a candidate for Endangered Species Act protection with a listing priority number of 3.

LISTING CRITERIA:

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

Historical range: Oregon, Washington.

Current range: Two sites, separated by approximately 322 km of the Columbia River, in Klickitat and Grant Counties in Washington.

Land ownership: All of the known populations are on Federal land. The Miller Island population in Klickitat County, Washington, occurs in the Columbia River Gorge National Scenic Area, managed by the Forest Service. The Beverly population in Grant County, Washington, occurs on land owned and managed by the BOR along the shore and on several "islands" of the Columbia River.

The construction of dams along the Columbia River, and possibly railroad and highway construction, resulted in the direct loss of suitable habitat as well as individuals and populations of *Artemisia campestris* var. *wormskioldii* (Carlson 1997). Losses of habitat and individuals probably occurred not only because of disturbances from dam construction, but also from the resulting inundation. Much of the existing river bank is riprap, which is not suitable habitat (Carlson 1997; Rush 1999).

Recreational activity at both the Miller Island and Beverly sites leads to trampling of plants. At Miller Island, the *Artemisia campestris* var. *wormskioldii* population is immediately adjacent to an area that is suitable for landing a boat and is used as a beach (Carlson 1997; Rush 1999). The small size of the population, and its proximity to the boat landing site, make it particularly

vulnerable to trampling pressure. The Beverly site has been affected by recreational use, including picnicking, camping, hunting, and vehicular traffic. This site is accessible during low water levels by four-wheel drive vehicles via a primitive road that passes through portions of the population. Individual plants within the tracks of this road are subject to damage from vehicular traffic (Rush 1999). The decline in the number of plants at the Beverly site is probably directly related to access to the site by vehicles, and a campsite is located in an area where plants were known to occur (Rush 1999; personal communication 1999 cited in cited in U.S. Fish and Wildlife Service candidate assessment form).

Two years of above annual rainfall in 1996 and 1997, high runoff, and likely higher than normal releases of water from the upstream Grand Coulee and Wanapum Dams, produced excessively high water levels on the Columbia River at the Beverly population (Rush 1999). The high water levels may have washed away *Artemisia campestris* var. *wormskioldii* from the site. Signs of deposited silt, sand, and debris are found on the site, providing a suitable substrate for.growth of *Bromus tectorum* (*in litt.* 1998 cited in cited in U.S. Fish and Wildlife Service candidate assessment form).

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

There is no evidence that *Artemisia campestris* var. *wormskioldii* has been used for commercial or recreational purposes. Several cuttings, however, have reportedly been taken from the Miller Island populations (Carlson 1997). The species may have some potential as a rock garden plant; other species of *Artemisia* are commonly sold in nurseries for this purpose (*in litt.* 1998 cited in cited in U.S. Fish and Wildlife Service candidate assessment form). Overutilization for scientific or educational purposes is not known. The populations, however, are small enough that even low levels of collecting could pose a serious threat.

C. ***Disease or predation.***

There is no evidence that disease or predation is a concern for *Artemisia campestris* var. *wormskioldii*, although herbivory (cattle grazing) could be a threat. The Miller Island population was until recently within an area grazed by cattle (Carlson 1997). While the palatability of this species is not known, some individual plants growing in a very loose substrate (sand) are easily uprooted by cattle. Disturbance of the habitat by cattle grazing also may have contributed to the increase of nonnative plant species (Carlson 1997).

D. ***The inadequacy of existing regulatory mechanisms.***

Artemisia campestris var. *wormskioldii* is designated as endangered by the Washington Department of Natural Resources (Washington Natural Heritage Program 1997). There is, however, no State Endangered Species Act for plants and no existing regulatory mechanisms provide protection for this species in Washington. *Artemisia campestris* var. *wormskioldii* is listed as endangered by Oregon Department of Agriculture (OAR 603–073–0070), as provided by the Oregon Endangered Species Act. Listed species in Oregon receive protection only on State-owned and State-managed lands, which includes any non-Federal public lands. *Artemisia*

campestris var. *wormskioldii* is managed as a sensitive species by the Forest Service, which provides special management consideration when planning projects that may affect the species.

Current Conservation Efforts: The Washington Natural Heritage Program, using funding provided under section 6 of the Endangered Species Act, prepared a conservation strategy and monitoring plan for *Artemisia campestris* var. *wormskioldii* (Rush 1999). Management objectives include identifying and scheduling management actions that will remove or limit threats to this species. The primary conservation goals of this plan are to protect existing populations and habitat and to maintain occupied and potential habitats in a condition that will sustain *A. campestris* var. *wormskioldii*.

At the Beverly site, Grant County PUD is involved in relicensing of Priest Rapids and Wanapum Dams (personal communication 2000 cited in U.S. Fish and Wildlife Service candidate assessment form). They are reportedly developing a study plan that will include demographic modeling and a study of the effects of water levels, including groundwater. They are also reportedly working with the BOR to limit public access to the area because of recreational impacts to this site, and will be doing weed control (hand pulling) to remove knapweed and cheatgrass.

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

In addition to direct loss of habitat as a result of dam construction, the manipulation of waterflows by hydroelectric dams is a major threat to this species. The severity of spring floods has been reduced or eliminated in most years, and populations may be inundated for much of their growing season. Manipulated water regimes do not mimic historic water flows and have affected the ability of these plants to grow, flower, reproduce, and colonize (Rush 1999). Altered water regimes, as well as recreational uses and grazing, have also allowed nonnative plants to invade both sites (Rush 1999).

At Beverly, the area previously occupied by *Artemisia campestris* var. *wormskioldii* is now covered with *Bromus tectorum*, an aggressive annual grass that invades disturbed areas and outcompetes native vegetation for resources (water and nutrients) and displace native vegetation (*in litt.* 1998 cited in cited in U.S. Fish and Wildlife Service candidate assessment form). *Bromus tectorum* is widespread and abundant in eastern Washington and is easily transported by wind or on vehicles, and thus may have been introduced at this site this way. *Centaurea diffusa*, a Washington State class-B noxious weed (RCW 17.10, Chap 16–750) is also present and spreading at the Beverly site, and was found scattered throughout the Miller Island site in 1999 (*in litt.* 1998 cited in U.S. Fish and Wildlife Service candidate assessment form). This species poses a serious threat to the region and also has the ability to outcompete native plants.

The extreme loss of habitat that has resulted in two small, widely separated populations may affect the viability of *Artemisia campestris* var. *wormskioldii*. Small isolated populations are more vulnerable to a variety of ecological and genetic factors, as well as naturally occurring random events (Gilpin and Soule 1986; Given 1994; Schemske et al. 1994). Disease, insect damage, and unfavorable weather, including flooding or drought, could cause extinction of this

species. The Beverly population apparently was greatly reduced by inundation of the site during the 1996–1997 winter and spring. Also, an herbicide application is suspected to have caused the destruction of a large concentration of *A. campestris* var. *wormskioldii* along a vehicle track at this site.

Threats related to the loss of genetic variation due to random changes in gene frequencies (genetic drift) are increasingly significant in smaller populations. Loss of genetic variation can affect disease resistance, response to climatic change, and reproductively compatible gene combinations (genotypes). Small populations are more susceptible to increased inbreeding, which can lead to reduced fitness of offspring.

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PETITION TO LIST

Florida brickell-bush
(*Brickellia mosieri*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:
CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

Brickellia mosieri (Asteraceae) is recognized as a valid species name by Wunderlin and Hansen (2000), although Kartesz (1998) treats this taxon as a variety, *Brickellia eupatorioides* var. *floridana*.

NATURAL HISTORY

Brickellia mosieri is an endemic perennial plant known only from the Miami Rock Ridge in Miami-Dade County, Florida (Small 1933, Long and Lakela 1971, Wunderlin 1998). The current and historic ranges are similar. This species occurs in pine rocklands. It is shade intolerant and requires periodic burning to reduce competition from woody vegetation.

POPULATION STATUS

The total number of individuals has been estimated to be fewer than 1,000 plants. A total of fewer than 900 plants occur at eight preserve sites: Camp Owaissa Bauer, Larry and Penny Thompson Park, Navy Wells Park, Nixon Smiley Pineland Preserve, Pine Shore Park, Rockdale,

Ron Ehman Park, and Seminole Wayside Park. Fewer than 100 plants occur unprotected at the U.S. Naval Observatory in Miami (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). The species was historically known from other sites on the Miami Rock Ridge, where it is now extirpated (Bradley and Gann 1999).

The Florida Natural Heritage Program ranks *Brickellia mosieri* as Critically Imperiled. This species is listed as Endangered by the State of Florida (Wunderlin and Hansen 2000).

The U.S. Fish and Wildlife Service classifies *Brickellia mosieri* as a candidate for Endangered Species Act protection with a listing priority number of 5.

LISTING CRITERIA

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

Historical range:	Miami-Dade County, Florida.
Current range:	Nine sites on the Miami Rock Ridge in Miami-Dade County, Florida.
Land ownership	The remaining *Brickellia mosieri* plants are small, isolated populations located on eight different preserved sites and one non-protected site throughout the Miami Rock Ridge in southern Miami-Dade County.

Much of the habitat of *Brickellia mosieri* has been negatively altered by human development. Pine rocklands in Miami-Dade County have been reduced to about 11 percent of their former extent (Kernan and Bradley 1996). Of the estimated historical extent of 74,000 hectares (ha) (182,780 acres), only 8,140 ha (20,106 acres) of pine rocklands remained in 1996. Outside Everglades National Park, only about 1 percent of the Miami Rock Ridge pinelands have escaped clearing, and much of the remaining pinelands is in small remnant blocks isolated from other natural areas (Herndon 1998). Florida had a 15.3 percent increase in the human population from April 1, 1990, to July 1, 1998, and was ranked as the fourth fastest growing state in the nation during 1998 (U.S. Census Bureau 1998). Given the popularity of South Florida, this trend is expected to continue. The regional water control efforts conducted throughout South Florida may have negative effects on *Brickellia mosieri* through the alteration of the region's hydrology.

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

None are known.

C. *Disease or predation.*

None are known.

D. ***The inadequacy of existing regulatory mechanisms.***

The Florida Department of Agriculture and Consumer Services has designated *Brickellia mosieri* as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur.

Current Conservation Efforts: In 1979, Miami-Dade County enacted the Environmentally Endangered Lands Covenant Program which gives private land owners of pine rockland habitat a tax break if they agree to not develop the property and manage it for a period of ten years (U.S. Fish and Wildlife Service 1998). The U.S. Fish and Wildlife Service has developed a multi-species recovery plan for the threatened and endangered species of South Florida. This plan is ecosystem-based and includes many recommendations for conservation of the pine rockland community (U.S. Fish and Wildlife Service 1999).

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

Fire suppression and exotic plant invasions are the greatest threats to *Brickellia mosieri*. Fire is required to maintain the pine rockland community. Under natural conditions, lightning fires typically occurred at 3- to 7-year intervals. With fire suppression, hardwoods eventually invade pine rocklands and shade out understory species such as *Brickellia mosieri*. Fire suppression has reduced the size of the areas that do burn and habitat fragmentation has prevented fire from moving across the landscape in a natural way. Thus, many pine rockland communities have moved past their normal "fire subclimax" and are succeeding to tropical hardwood hammock communities.

Exotic species have also altered the type of fire that occurs in pine rocklands. Historically, pine rocklands had an open low understory where natural fires remained patchy with low temperature intensity, thus sparing many native plants such as *Brickellia mosieri*. The current density of exotic plant overgrowth throughout the range of *Brickellia mosieri* has created a situation that may no longer allow the species to be survive fires. Dense vegetative growth can create intense fire temperatures and longer burning periods. Pine rockland plants cannot tolerate these extreme conditions. Given the current conditions, exotic plant control may require an alternate, more labor intensive method. One such method, hand chopping followed by spot herbicide treatment, requires extensive man-hours and is very costly. This method may not be feasible for the preserve managers, given the acreage of land and current staffing and budget constraints.

Exotic plant taxa have significantly affected pine rocklands. As a result of human activities, at least 277 exotic plant taxa are now known to have invaded pine rocklands throughout South Florida (U.S. Fish and Wildlife Service 1998). The most serious threats are from Brazilian pepper (*Schinus terebinthifolius*) and Burma reed (*Neyraudia reynaudiana*). Others, including melaleuca (*Melaleuca quinquenervia*), may also be problems. Management of pine rocklands in Miami-Dade County is complicated by the fact that most of the remaining habitat occurs in small

fragmented areas bordered by urban development. Areas near the managed pine rockland that contain exotic species can act as a seed source of exotics allowing them to continue to invade the pine rockland (Bradley and Gann 1999).

Given the small number of individuals within the narrow range of this species, catastrophic events such as hurricanes and tropical storms may negatively affect *Brickellia mosieri*, potentially extirpating remaining populations.

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PETITION TO LIST

Calliandra locoensis
(*Calliandra locoensis*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The genus *Calliandra* (Fabaceae) is composed of about 130 species that are strictly endemic to the Americas (Barneby 1998). Species previously described as belonging to the genus in Africa, Madagascar, and Asia have been excluded based on specific morphological features. Twenty-five native species of *Calliandra* have been reported for the Antilles. Of those, three are native to Puerto Rico: *Calliandra portoricensis*, *C. haematomma*, and *C. locoensis*. The latter, *C. locoensis*, is endemic to Puerto Rico and was only discovered in 1991 during a study of the flora of the Susua Commonwealth Forest. Garcia and Kolterman (1992) described it in 1992 and it is recognized as a valid species by Kartesz (1998).

NATURAL HISTORY

Gonzalez (1998) studied aspects of the distribution, abundance, population structure, phenology, pollination, breeding system, and germination of *Calliandra locoensis*. Flowering was found to be synchronous and seasonal, occurring primarily during the dry season, and was found to be more prolific in sunnier areas. Honey-bees, five species of butterflies, and birds (bananaquits (*Coereba flaveola*) and the Puerto Rican emerald hummingbird (*Chlorostilbon maugeus*)) were observed visiting the flowers. The species exhibited a low degree of self-compatibility in pollination tests. Seeds do not appear to have a biotic dispersal agent, but rather are dispersed by dehiscence, which may be a factor in limiting the distribution of this species. Seeds have a short viability period and require mesic conditions for germination.

POPULATION STATUS

Currently, the species is known from only two localities in the Susua Commonwealth Forest in southwestern Puerto Rico, known as El Quebrada and El Cerro. During recent studies, scientists located and marked 398 individuals greater than 0.5 meters (1.6 feet) in height at the El Quebrada locality and 299 at the El Cerro locality. Seedlings were abundant at both locations (Gonzalez 1998).

The Susua Commonwealth Forest, managed by the Puerto Rico Department of Natural and Environmental Resources, is located in the municipalities of Yauco and Sabana Grande in southwestern Puerto Rico and encompasses approximately 1,314 hectares (3,245 acres). The forest lies within the subtropical moist forest life zone, the most extensive life zone found on the island. The majority of the forest is covered by serpentine outcrops, interspersed with Nipe and Rosario clay soils. These areas have a poor water-holding capacity; therefore, the vegetation is more xeric than might be expected based on the rainfall received in the region.

Topography is mountainous in both forests, characterized by steep ravines and intermittent streams. Mean annual precipitation in the Susua Forest has been reported to be 1,339 millimeters (53 inches). Much of the vegetation in the forest was cut for cultivation, grazing, charcoal production, and wood prior to its designation as a public forest. The vegetation may be described as semi-evergreen to deciduous forest (Silander et al. 1986).

The U.S. Fish and Wildlife Service classifies *Calliandra locoensis* as a candidate for Endangered Species Act protection with a listing priority number of 5.

LISTING CRITERIA

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

Historical range:	Puerto Rico.
Current range:	Two localities, El Quebrada and El Cerro, in the Susua Commonwealth Forest in southwestern Puerto Rico.
Land ownership:	Both known localities occur on land managed by the Puerto Rico Department of Natural and Environmental Resources.

Calliandra locoensis is endemic to Puerto Rico and known only from two localities. Activities known to have occurred in the past in the area include the planting of crops such as coffee, avocado, and oranges, the production of charcoal and firewood, and cattle grazing. The populations are easily accessible and may be threatened by developments proposed within the forest, as well as by management practices. Recent proposals for development in the forest have included the establishment of hotels and the construction of roads. Management practices that

might affect the species include the development and maintenance of trails and the effects of increased visitor use, including fire in this xeric environment. No management plan for the forest has been prepared.

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

None known.

C. *Disease or predation.*

Neither disease nor predation have been documented as factors affecting this species.

D. *The inadequacy of existing regulatory mechanisms.*

The Commonwealth of Puerto Rico has adopted a regulation that recognizes and provides protection for certain Commonwealth listed species. However, *Calliandra locoensis* is not on this list. Federal listing would provide protection under the Act, and, by virtue of the existing cooperative agreement under section 6 of the ESA, would ensure its addition to the Commonwealth list.

Current Conservation Efforts: Scientists at the University of Puerto Rico, Mayaguez Campus, through a cooperative agreement with the U.S. Fish and Wildlife Service, have studied aspects of the life history of *Calliandra locoensis*. Efforts at propagation of the plant have been initiated.

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

One of the most important factors affecting the continued survival of this species is its limited distribution. Damage caused by Hurricane Georges in 1998 in the Susua Forest was severe. Landslides, defoliation, and tree fall were extensive. Nevertheless, while individual specimens of *C. locoensis* were affected, such disturbance may play an important role in reproduction and recruitment (e.g., increased flowering in sun-exposed areas, seed dispersal). Because of the vegetation's xeric nature, a catastrophic spontaneous or man-caused fire could devastate an entire population. The reduction in pollinator availability due to introduced animals or pesticides may affect fruit and seed set. The spread of the Africanized honeybee (*Apis mellifera*) could have an adverse effect on pollination of *C. locoensis*.

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PETITION TO LIST

Calyptranthes estremerae
(*Calyptranthes estremerae*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 09/30/93:
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 06/13/02: C

TAXONOMY

The taxonomic status of *Calyptranthes estremerae* (Myrtaceae) as a valid species is uncontroversial (e.g., Kartesz 1998).

NATURAL HISTORY

William Estremera discovered *Calyptranthes estremerae* in the area of Camuy, Puerto Rico, and described it in 1985. It is a small tree, reaching 10 to 15 meters in height. Young twigs are compressed and glandular-punctate. Leaves are elliptic, broadly elliptic or suborbicular, from 7 to 10 centimeters (cm) (2.7 to 3.9 inches) long and 5 to 5.7 cm (1.9 to 2.2 inches) broad, rounded at the apex and rounded or obtuse at the base. Leaves are also glandular-punctate on both surfaces and chartaceous. Inflorescences are 2 to 4, paniculate with peduncles up to 6 cm in length. The flowers are white and the fruit unknown (Liogier 1994).

POPULATION STATUS

This endemic tree was originally known only from the area of the Cavernas de Camuy (Camuy Caves) in northwestern Puerto Rico. Several individuals are known from the recreation area adjacent to the Caves (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form). An individual was later reported from the Río Abajo Commonwealth Forest, in northern Puerto Rico. During the Biological Assessment conducted

for the construction of Highway #10 through the Río Abajo Commonwealth Forest, an additional four individuals in two groups were located. All four trees were small, approximately 2 meters (6.6 feet) in height. All four individuals were to be affected by the construction of the highway. One was transplanted and still survives in the Puerto Rico Department of Natural and Environmental Resource nursery (personal communication 1999 cited in U.S. Fish and Wildlife Service candidate assessment form, Puerto Rico Highway and Transportation Authority 1994).

All individuals occur within the subtropical moist forest life zone, the most extensive life zone in Puerto Rico, overlying a limestone substrate. Those individuals at the Cavernas de Camuy occur in an area that was previously disturbed by the development of the recreation area. The Río Abajo Commonwealth Forest is located in the municipalities of Utuado and Arecibo. The Forest has very irregular topography, subterranean drainage, caves, natural depressions or sinkholes and haystack hills or "mogotes" typical of karst geological formation. Mean annual precipitation is approximately 200 cm (78 inches). Soils are limestone derived and well drained. The vegetation has been described as semi-evergreen and deciduous forest (Department of Natural Resources 1976).

The U.S. Fish and Wildlife Service classifies *Calyptranthes estremerae* as a candidate for Endangered Species Act protection with a listing priority number of 5.

LISTING CRITERIA

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

Historical range: Puerto Rico.

Current range: Vicinity of Cavernas de Camuy (Camuy Caves) in northwestern Puerto Rico and Río Abajo Commonwealth Forest in northern Puerto Rico.

Land ownership: Both the Cavernas de Camuy and the Río Abajo Commonwealth Forest are publicly owned and managed by the Commonwealth of Puerto Rico, the former by the Compañia de Fomento Recreativo and the latter by the Department of Natural and Environmental Resources.

Four individuals were eliminated for the construction of Road #10 through the Río Abajo Commonwealth Forest, one of which was transplanted in the Department of Natural and Environmental Resources' nursery. It was to be planted during 1999. While several individuals remain at the Cavernas de Camuy, and the agency is aware of their presence, they are located in an area of the facilities where any expansion might result in their elimination. Additional facilities, such as a hotel, have recently been proposed for development in the Río Abajo Commonwealth Forest, despite its public ownership.

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

These factors have not been documented as threats to the species.

C. *Disease or predation.*

Neither disease nor predation has been documented as threats to the species.

D. *The inadequacy of existing regulatory mechanisms.*

The Commonwealth of Puerto Rico has adopted a regulation that recognizes and provides protection for certain Commonwealth listed species. However, *Calyptranthes estremerae* is not yet on this list. Federal listing would provide some level of immediate protection under the Endangered Species Act. By virtue of an existing cooperative agreement with the Commonwealth under section 6 of the Endangered Species Act, Federal listing will also ensure the addition of this species to the Commonwealth list. The Río Abajo Commonwealth Forest does not currently have a management plan that considers the protection of this species.

Current Conservation Efforts: Surveys of the distribution and abundance of *Calyptranthes estremerae* have been conducted. One individual was removed from the wild to the nursery of the Department of Natural and Environmental Resources.

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

One of the most important factors affecting the continuing survival of this species is its limited distribution. Fewer than ten individuals are currently known. Because the population is so extremely small, the risk of extinction is extremely high. Catastrophic natural events, such as the passing of Hurricane Georges in 1998, may dramatically affect forest species composition and structure, felling large trees and creating numerous canopy gaps.

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PETITION TO LIST

Parish's checkerbloom
(*Sidalcea hickmanii parishii*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 7/1/75:	
CNOR 12/15/80:	
CNOR 11/28/83:	
CNOR 9/27/85:	
CNOR 2/21/90:	
CNOR 9/30/93:	
CNOR 2/28/96:	C
CNOR 9/19/97:	C
CNOR 10/25/99:	C
CNOR 10/30/01:	C
CNOR 6/13/02:	C

TAXONOMY

Parish's checkerbloom, *Sidalcea hickmanii* ssp. *parishii* (Malvaceae) was first described by Benjamin Robinson in 1897 as *S. hickmanii* var. *parishii* based on collections made from the western slopes of the San Bernardino Mountains (Abrams 1951). Anstruther Davidson and G. L. Moxley published the combination *S. parishii* in 1923, based on a description by Robinson. In 1957, Hitchcock published the new combination *S. hickmanii* ssp. *parishii* to apply to the San Bernardino Mountains material (Hitchcock 1957). At the same time, he included one collection made by Ralph Hoffmann from Mission Pine in Santa Barbara County, with the note that its more densely hairy character might merit recognition as a fifth geographic race (Hitchcock 1957). However, the Santa Barbara material, along with with the plants from the San Bernardino Mountains, has continued to be recognized as *S. hickmanii* ssp. *parishii* (e.g., Munz 1974, Hickman 1993; Kartesz 1998).

NATURAL HISTORY

Sidalcea hickmanii parishii occurs in openings in chaparral and open coniferous forest between 915 and 2,300 meters (m) (3,000 and 7,500 feet (ft)) in elevation.

POPULATION STATUS

Historically, this subspecies was collected from Santa Barbara and San Bernardino counties. In 1981, Tim Krantz rediscovered 20 plants near Barton Flats, San Bernardino County, where it had last been seen in 1924 by Peirson in a burned area (Krantz 1981).

In 1995, a U.S. Forest Service (Forest Service) botanist located two other small occurrences near Barton Flats, together supporting eight plants, in the same general area as Krantz's collection and where collections had been made earlier this century. Despite focused surveys for this taxon and wide-ranging surveys conducted to create a flora of the San Bernardino Mountains, no other occurrences have been located in San Bernardino County (two *in litt*. 1998 cited in U.S. Fish and Wildlife Service candidate assessment form). Because the plant seems to be a fire-follower, there is a possibility it will appear if its habitat is burned (Krantz 1981; Munro-Burgess and DePuydt 1993). However, two burns in the Barton Flats area were surveyed for this taxon in 1995 and no plants were found (*in litt*. 1995 cited in U.S. Fish and Wildlife Service candidate assessment form).

In Santa Barbara County, this taxon is known historically from three regions in Los Padres National Forest -- Big Pine Mountain, Sierra Madre Ridge, and McKinley Peak. Surveys for this plant conducted by the Forest Service in 1993 and 1994 located no plants at Big Pine Mountain, where historical collections were made in the 1930s. On Sierra Madre Ridge, four small occurrences (of between 13 and 25 plants) were found, corresponding to the locations of historical collections. On McKinley Peak, a single large occurrence of about 600 individuals was located. Two of the four smaller occurrences located .during these surveys exhibited severe damage from cattle grazing and two were potentially threatened by road widening and grading (Munro-Burgess and DePuydt 1993); one population on Sierra Madre Ridge is adjacent to, and partially within, an Air Force communications facility and has been repeatedly exposed to herbicides (personal communication 1994 cited in U.S. Fish and Wildlife Service candidate assessment form).

In May 1997, a population of *Sidalcea hickmanii parishii* was found in San Luis Obispo County, on National Forest land. This site had been burned the previous year and represents a County from which this taxon had not been previously collected. The Forest Service conducted additional surveys of burned areas in September 1998.

This extension of the known range of this taxon is substantial and raises the possibility that additional populations have yet to be discovered on intervening, undeveloped, public lands. The U.S. Fish and Wildlife Service was to evaluate the status of *S. hickmanii parishii* again in early 1999, after receiving the new survey data and collecting additional information on fire history in Santa Barbara County, and campground and recreational development in San Bernardino

National Forest, San Bernardino County.

The California Natural Heritage Program ranks *Sidalcea hickmanii parishii* as Critically Imperiled.

The U.S. Fish and Wildlife Service classifies *Sidalcea hickmanii parishii* as a candidate for Endangered Species Act protection with a listing priority number of 9.

LISTING CRITERIA

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

Historical range: California.

Current range: Santa Barbara, San Bernardino, and San Luis Obispo Counties, California.

Land ownership: All known populations are located on public lands managed by the Forest Service.

Fewer than 10 plants are currently known from the southern portion of this taxon's range in San Bernardino National Forest. Because members of the *Sidalcea hickmanii* complex often emerge following fires, it is possible that other occurrences remain undetected in the area. However, San Bernardino National Forest is located within a two hour drive of 14 million people, has one of the highest visitor rates in the nation, and receives substantial impacts from recreational visitors (Forest Service 1988).

The area of the San Bernardino Mountains where historical collections were made near Seven Oaks and Barton Flats is heavily used by recreationists. Barton Flats supports campgrounds and group camps for over 500 visitors, 14 additional organizations' camps, 100 recreational residence cabins, and primary access roads and trails into the San Gorgonio Wilderness (Forest Service 1988). The occurrence of *S. hickmanii parishii* discovered in 1981 was located near a campground, and the disappearance of part of it in following years appears to have been caused by the expansion of a camp volleyball court (*in litt.* cited in U.S. Fish and Wildlife Service candidate assessment form).

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

None known.

C. *Disease or predation.*

Cattle grazing on Los Padres National Forest threatens known occurrences and trampling by cattle is a potential threat. In 1993 surveys, plants in two of the five populations in Santa Barbara

County were severely grazed. In one population, eight of the plants occurred on a steep slope that was inaccessible to cattle; of the five plants accessible to cattle, three were protected within wire experimental cages and were about 0.6 m (2 ft) tall, the remaining two plants had been grazed down to 10 to 15 centimeters (cm) (4 to 6 inches (in.)) (personal communication cited in U.S. Fish and Wildlife Service candidate assessment form; Munro-Burgess and DePuydt 1993). In the second population, 17 of the 20 plants had been grazed down to 5 cm (2 in.) in height. Cattle feces and hoof prints in the population suggested that the grazing was done by cattle (Munro-Burgess and DePuydt 1993).

Currently, three of the five populations are located in active cattle grazing allotments (personal communication 1997 cited in U.S. Fish and Wildlife Service candidate assessment form).

D. ***The inadequacy of existing regulatory mechanisms.***

Pursuant to the Native Plant Protection Act (Div. 2, chapter 10 sec. 1900 *et seq*. of the California Department of Fish and Game Code) and the California Endangered Species Act (Div. 3, chapter 1.5 sec. 2050 *et seq*.), the California Fish and Game Commission listed *Sidalcea hickmanii parishii* as rare in 1979. However, *Sidalcea hickmanii parishii* is known to occur only on Federal lands. The Forest Service considers state-listed plant species as sensitive species. The policy of the Forest Service is to work with the State in the conservation of these taxa, however State listing provides no consultation or other requirements for protection on Federal lands.

The management of sensitive resources on public lands managed by the Forest Service is guided by various policies and regulations, including the National Environmental Policy Act (NEPA) of 1969 (PL. 91-109, 42 U.S.C. 4321- 4347, 83 Stat 852). The NEPA requires disclosure of potential effects of Federal actions, and allows for comment by agencies and the public, but does not itself provide additional protections.

Current Conservation Efforts: A Memorandum of Understanding (MOU) between the Forest Service and the Fish and Wildlife Service was signed in 1996. In this MOU, the Forest Service agrees to determine the effects of cattle grazing on this taxon, develop guidelines for minimizing road maintenance impacts, develop burn plans, and conduct surveys. These activities have been partially completed. The Fish and Wildlife Service provided funding for the Forest Service to conduct surveys for this taxon. These surveys were completed in Fall 1998.

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

In surveys conducted in 1993, Munro-Burgess and DePuydt (1993) recorded that road maintenance activities had either damaged or buried all four of the plants found at one of the five populations. This population is one of two that are not in active cattle grazing allotments. Plants at one other population also occur along a roadside and are vulnerable to road maintenance activities.

Maintenance of an Air Force communication facility impacts one population. Construction activities in November 1996 were carefully conducted to avoid destroying any individual plants,

however solar panels, antennas and an entrance road are currently within or bisect the population (personal communication 1997 cited in U.S. Fish and Wildlife Service candidate assessment form; personal observation 1998 cited in cited in U.S. Fish and Wildlife Service candidate assessment form).

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PETITION TO LIST

Webber's ivesia
(*Ivesia webberi*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 12/15/80:
CNOR 09/30/93:
CNOR 06/13/02: C

TAXONOMY

The taxonomic status of Webber's ivesia (*Ivesia webberi*) as a distinct species is uncontroversial (e.g., Hickman 1993). The common name "Webber's ivesia" (e.g., Hickman 1993) is more etymologically appropriate than the name used on the U.S. Fish and Wildlife Service Candidate Species List, "Webber ivesia".

NATURAL HISTORY

Webber's ivesia (Rosaceae) is a low, spreading, perennial herb that occurs very infrequently in Lassen, Plumas, and Sierra Counties in California, and in Douglas and Washoe Counties in Nevada. The range of the species lies along the transition zone between the eastern edge of the northern Sierra Nevada and the northwestern edge of the Great Basin Desert (Witham 2000). This region is characterized by the climatic influences of high mountains within and adjacent to the high desert, with ponderosa and Jeffrey pine (*Pinus ponderosa* and *P. jeffreyi*, respectively) in the mountains and sagebrush steppe dominating the valleys (Witham 2000). The species occurs in immediate proximity to rapidly growing urban areas in the foothills of the Sierra and in the western Great Basin near Reno, Nevada. Webber's ivesia is restricted to sites with sparse vegetation and shallow, rocky soils composed of volcanic ash or derived from andesitic rock. Occupied sites generally occur on mid-elevation flats, benches, or terraces on mountain slopes above large valleys and are devoid of colluvial accumulation (loose deposit of rock debris) from upslope. The species generally occurs between 1,365 to 1,814 meters elevation (4,480 and 5,950 feet). This vernally moist, but otherwise dry and rocky habitat is typically dominated by a wide variety of cushion-like perennial herbs with low sagebrush (*Artemisia arbuscula*) and squirrel-

tail grass (*Elymus elymoides*) (Witham 1991, 2000). The unique soils and hydrology of the Webber's ivesia sites may exclude competition from other species. The shrink-swell of the clayey subsoils favors taprooted perennials and shallow-rooted, early annuals. The clayey soils and early spring saturation tend to exclude typical Great Basin species (Witham 2000).

POPULATION STATUS

Extensive field surveys for Webber's ivesia were conducted between 1990 and 1998 to verify and refine historical reports, locate any additional populations, and document the biology, ecology, and conservation status of the species (Duron 1990; Witham 2000). These data, together with information obtained from surveys performed in support of the 2000 status report, documented eight extant populations in Nevada (one new and seven historic) and seven extant populations in California (all historic). One historic site in Nevada (Pyramid Lake) is presumed erroneous, and three historic populations in California (American Valley, Indian Valley, and Webber Lake) are presumed extirpated or erroneous. The 15 currently known occurrences are clustered in seven general locations covering about 75 hectares (ha) (185 acres (ac)). In Washoe County, Nevada, five of the eight populations are clustered around north Reno, near the Peavine and Raleigh Heights areas, which are experiencing tremendous population growth. Another population in south Reno, near State Route 431, is also subject to impacts from urbanization. The Douglas County population is somewhat disjunct and occurs in the Pine Nut Mountains adjacent to U.S. Highway 395. Four of the seven California populations occur in eastern Sierra County on Federal lands managed by the U.S. Forest Service (Forest Service), Humboldt-Toiyabe National Forest (HTNF) in and around Dog Valley. The type locality is in Sierra Valley, Plumas County, and two sites occur in Lassen County in Evans Canyon and Constantia (Witham 2000). Surveys of approximately 1,619 ha (4,000 ac) of potential habitat in western Washoe County and in the Pine Nut Mountains in Douglas County, Nevada, documented no additional populations of the species. An unknown amount of potential habitat remains unsurveyed in Nevada. However, field observations indicate the likelihood of discovering any significant populations is low. In California, the western rim of Upper Long Valley in Sierra County is the only area supporting high quality potential habitat that has not been surveyed (Witham 2000).

The U.S. Fish and Wildlife Service classifies Webber's ivesia as a candidate for Endangered Species Act protection with a listing priority number of 5.

LISTING CRITERIA

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

Historical range: Nevada and California.

Current range: Nevada: Douglas and Washoe Counties.
California: Lassen, Plumas, and Sierra Counties.

Land ownership: The eight Nevada populations of Webber's ivesia occur on a total of about 12 ha (30 ac) on Federal lands managed by the BLM, Carson City District (0.9 percent), HTNF (69.8 percent), and private lands (29.3 percent). The seven California populations occur on a total of about 65 ha (160 ac) on lands managed by the HTNF (84.9 percent), BLM, Susanville District (0.5 percent), California Department of Fish and Game (0.1 percent), and private or county lands (14.5 percent).

Threats to Webber's ivesia generally include urban development, authorized and unauthorized roads, off-road vehicle activities and other dispersed recreation, livestock grazing and trampling, fire and fire suppression activities including fuels reduction and prescribed fires, and displacement by noxious weeds (Forest Service 2001). Evidence of impacts from these types of use has been documented at the majority of Webber's ivesia populations (Witham 2000).

Development is currently the greatest threat to Webber's ivesia populations on private lands. At the time of the 1997-1998 field surveys, sites supporting three of the eight known Nevada populations were targeted for low-density housing development. A fourth site occurs adjacent to a recently developed high-density housing project and is subject to impacts associated with human use. Witham (2000) observed that three sites on private lands had been fenced, perhaps to protect the species; however, the proximity to newly graded roads and development indicates that these sites are highly imperiled. Rapidly increasing residential development, commercial development, and infrastructure improvements around the Reno area are a significant, imminent threats to five of the eight Nevada populations (Witham 2000). At least three of the California populations are threatened by private or municipal development. Two different sites on private lands face a significant, imminent threat from development and maintenance of utilities. In addition, dispersed recreation by residents with immediate access to these areas continues to increase, resulting in disturbance and fragmentation of habitat (Witham 2000). Most of the Webber's ivesia populations occur on or adjacent to dirt roads, which are prominent features of the eastern California and western Nevada landscape. Authorized and unauthorized roads present a serious threat to all of the populations on public lands as they contribute to increased off-road activity and habitat fragmentation. All but one of the extant populations, including the type locality in Sierra Valley, are affected by road development, maintenance, and associated off-road vehicle activity. This is considered a significant, imminent threat to six of the eight populations in Nevada and two of the California populations. Long-term population viability is at risk without focused planning of authorized roads, decommissioning of unauthorized roads, and the cooperation of land users (Witham 2000).

On Federal lands, livestock grazing is the dominant resource use within the range of this species. While the relatively sparse, low vegetation of most Webber's ivesia sites may be suboptimal for grazing, the lack of topography makes these sites attractive for allotment operators to install various range modifications, which likely concentrate trampling (Witham 2000). At least two of the populations in Nevada and three of the populations in California are affected by grazing and associated activities (Forest Service 2001; Witham 2000). Heavy grazing by cattle and sheep contributes to reduced vigor and potentially extirpation of this species. Plant size, number of leaf and flower stems, and number of viable fruit have been observed to be much reduced in areas

that are heavily grazed compared to average plants (Forest Service 1992). Neither the Forest Service nor the Bureau of Land Management (BLM) include specific conservation measures for this species in grazing permits for allotments where this species occurs (Witham 2000; personal communication 2002 cited in U.S. Fish and Wildlife Service candidate assessment form). Webber's ivesia habitats are generally conducive to establishment of staging areas for fire suppression activities because they are relatively flat and accessible (Witham 2000). Under these circumstances, plants are trampled, soils are disturbed or compacted, and the probability of an invasion by nonnative species is high. Evidence of impacts from these activities has been observed at two populations in Nevada and two populations in California (Forest Service 2001; Witham 2000).

As the urban interface continues to expand into wildland areas, fire suppression activities required to protect human life and property will intensify, increasing the threats to the species and its habitat (Witham 2000). Generally, undisturbed Webber's ivesia habitat is resistant to invasion by nonnative species. However, on sites where range improvements and/or disturbance associated with recreation or development have occurred, cheatgrass (*Bromus tectorum*) and medusahead (*Taeniatherum caput-medusae*) are becoming established and may eventually displace native plant species (Witham 2000; Forest Service 2001).

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

No known threats.

C. *Disease or predation.*

Webber's ivesia is not known to be palatable to livestock or wildlife. Other than livestock trampling of the plants and habitat discussed above, no disease or herbivory has been observed at any of the populations (Witham 2000).

D. *The inadequacy of existing regulatory mechanisms.*

Prior to 1996, Webber's ivesia was designated as a category 2 candidate for listing under the Endangered Species Act, as amended. In 1996, the U.S. Fish and Wildlife Service revised the method by which species are categorized to strengthen the scientific basis of the endangered species program. The revised candidate list replaced a system that identified nearly 4,000 candidate species under three categories. Under the revised list, only those species for which enough information to support a listing proposal existed (category 1) were maintained as candidates (61 FR 7595). As a category 2 candidate, Webber's ivesia was removed from candidate status because of the lack of sufficient information to support a proposal for listing at that time. The BLM and Forest Service have designated Webber's ivesia as a sensitive species in both California and Nevada (Weixelman and Atwood 1991; personal communication 2002 cited in U.S. Fish and Wildlife Service candidate assessment form). Both the BLM and Forest Service are directed to manage for sensitive species and their habitats and to consider these resources during project planning (BLM Manual 6840 and Forest Service Manual 2670 et seq.); however, no specific management guidelines to ensure the conservation of this species currently exist.

Because of a narrowly restricted range and existing threats, the participants of the 2000 Nevada Rare Plant Workshop, sponsored by the Nevada Native Plant Society, recommended that the State of Nevada consider the species for listing as critically endangered under Nevada Revised Statutes (NRS) 527.270 et seq. If the species were to be listed under the NRS, permits for the disturbance of habitat or taking of individuals would have to be obtained from the Nevada Division of Forestry. The adequacy of this law depends greatly on informed and cooperative landowners and land managers or some form of deterrent enforcement, which the current NRS do not articulate. Webber's ivesia is designated as threatened by the Nevada Native Plant Society, and is on the California Native Plant Society's (CNPS) 1B list (plants considered rare, threatened, or endangered in California and elsewhere). All plant species on the CNPS 1B list meet the definitions under the Native Plant Protection Act (Sec. 1901, Chapter 10) and the California Endangered Species Act (Secs. 2062 and 2067) of the California Department of Fish and Game Code, and are eligible for State listing. The species is not listed by California under its State Endangered Species Act, but plants on the CNPS 1B list must be fully considered during the environmental documentation process under the California Environmental Quality Act (CEQA) (Skinner and Pavlik 1994). However, CEQA only requires disclosure of a project's impacts on the species; it does not provide protective management for Webber's ivesia.

Current Conservation Efforts: Currently, no conservation strategies or agreements exist for Webber's ivesia. The Forest Service is in the early stages of developing a strategy to protect this species on National Forest System Lands. The intent is to produce a conservation agreement which may include identifying parcels for potential land exchanges and developing and implementing a monitoring program across the species' range. A conservation strategy for Dog Valley ivesia (*I. aperta* var. *canina*) is in draft form, and in this geographic area, Dog Valley ivesia and Webber's ivesia are sympatric. Thus, despite differences in habitat preferences between the two species, the final conservation strategy may benefit the Dog Valley population of Webber's ivesia.

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

Webber's ivesia may be vulnerable to stochastic perturbations, natural climatic shifts, or unprecedented climatic extremes due to its small, localized populations and its apparent adaptation to unusual edaphic conditions (Witham 2000). The population biology of this species remains relatively unstudied, and the importance of insect pollinators to successful reproduction is unknown. Therefore, fragmentation or losses of habitat through any of the threats discussed above may affect the long-term viability of potential pollinators as well as the species itself.

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PETITION TO LIST

Soldier Meadow cinquefoil
(*Potentilla basaltica*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 02/21/90:
CNOR 09/30/93:
CNOR 02/28/96: (R, A)
CNOR 6/13/02: C

TAXONOMY

Potentilla basaltica, the Soldier Meadow cinquefoil, is a low growing, rhizomatous, herbaceous perennial that was first recognized as distinct in 1982. It is also known as the basalt cinquefoil. The type specimen was collected in 1983 from Soldier Meadow, Humboldt County, Nevada, and the species was described by Tiehm and Ertter (1984). The species was later found also to occur in Ash Valley, Lassen County, California.

NATURAL HISTORY

The Soldier Meadow cinquefoil is known only from Soldier Meadow in Humboldt County, Nevada, and Ash Valley in Lassen County, California. It is restricted to moist meadows and seeps and their margins in alkaline, sandy soils between 1,320 and 1,555 meters (m) (4,330 and 5,100 feet (ft)) elevation (Knight 1990).

The Soldier Meadow cinquefoil begins flowering in May and continues through the summer (Knight 1990). It is believed that this species is capable of self-pollination (Knight 1990); insect pollination has not been documented or investigated (U.S. Fish and Wildlife Service 1997). Little research has been conducted to understand the life history of this species, its ecological requirements, population biology, or genetic variability.

The Soldier Meadow cinquefoil is associated with alkali meadows, seeps, and occasionally marsh habitats bordering the perennial thermal springs, outflows, and depressions in the Soldier

Meadow (U.S. Fish and Wildlife Service 1997). The meadows and springs systems in the Black Rock region typically support moist to saturated soils and are dominated by short to moderately tall perennial grasses and herbs (Nachlinger 1991). The alkali marshes generally have standing water of variable depth. Cover density is high, comprised of medium tall to tall vegetation, consisting primarily of grasses (Nachlinger 1991). The Soldier Meadow cinquefoil occurs along the mesic margins of streambanks where water temperature extremes are moderated (Knight 1990). The plants are not typically found in habitats adjacent to downstream reaches of the spring outflows, possibly due to higher nutrient concentrations, richer soils, and/or increased salt accumulations (Knight 1990).

POPULATION STATUS

In Nevada, The Soldier Meadow cinquefoil has been documented from a total of 10 small occurrences in Soldier Meadow in Humboldt County, totaling about 84,000 individuals in 1990 (Knight 1990). Soldier Meadow is located at the northern extreme of the western arm of the Black Rock Desert in the transition zone between the Basin and Range Physiographic Province and the Columbia Plateau Province. This region is characterized by cold, dry winters influenced primarily by cool, polar air masses, and by hot, dry summers influenced primarily by warm, tropical air masses (Nachlinger 1991). Soldier Meadow lies between the Calico Mountains to the west and the Black Rock Range to the east. The vegetation is broadly classified into four wetland communities and three upland communities, one of which is considered transitional. The wetland communities support a tremendous diversity of plants, with over 60 different species identified in the marshes, seeps, and meadows. As many as 45 thermal springs occur in the area at elevations ranging from 1,320 and 1,393 m (4,330 and 4,570 ft) (Nachlinger 1991). Some of the springs provide the only known habitat for the desert dace (*Eremichthys acros*), a federally listed species endemic to approximately 20 springs in Soldier Meadow (Knight 1990), as well as for the elongate mud meadows pyrg (*Pyrgulopsis notidicola*), a hydrobiid snail recently added to the U.S. Fish and Wildlife Service Candidate Species List.

Five of the Soldier Meadow occurrences are found within the boundaries of an Area of Critical Environmental Concern (ACEC)/Research Natural Area (RNA) designated by the Bureau of Land Management (BLM) in 1983 to protect the desert dace and its habitat (48 FR 2598). This land designation theoretically offers protection to these five occurrences of Soldier Meadow cinquefoil which represent about 30 percent of the known areal extent of the species in Nevada. In 1992, The Nature Conservancy negotiated a land acquisition and conservation easement with the owners of the Soldier Meadow Ranch. Negotiations included the purchase of 736 hectares (ha) (1,820 acres (ac)) of desert dace habitat and the conservation easement encompassed 2,085 ha (5,150 ac). These lands were subsequently transferred to the BLM for permanent protection of the species. Also, the BLM acquired an additional 106 ha (262 ac) of desert dace habitat directly from the Soldier Meadow Ranch (U.S. Fish and Wildlife Service 1997). The lands acquired through these transactions encompassed the remaining 70 percent of the known Soldier Meadow cinquefoil habitat in Nevada. Despite extensive surveys of all spring systems in the Soldier Meadow area, this species has only been observed within an area of about 28 ha (70 ac)

(Nachlinger 1991).

In northeastern California, Soldier Meadow cinquefoil is known from just a single occurrence on private lands in Ash Valley near Ash Creek, where fewer than 1,000 individuals were observed in 1993 (California Department of Fish and Game (CDFG), Natural Diversity Data Base (NDDB), 2002). This population was found on the sub-alkaline border between a meadow system and the sagebrush-conifer ecotone, in an area previously disturbed by road construction (U.S. Fish and Wildlife Service 1997). Vegetation cover is generally sparse, and associated species include sagebrush (*Artemisia tridentata*), various rush species (*Juncus* spp.), sedge species (*Carex* spp.), and buttercup (*Ranunculus occidentalis*) (CDFG, NDDB, 2002). This site is presumed extant; however, surveys to relocate the species have not been conducted. Surveys in the vicinity of Ash Valley, and between Ash Valley and Soldier Meadow, have failed to located any additional populations (U.S. Fish and Wildlife Service 1997).

The U.S. Fish and Wildlife Service classifies the Soldier Meadow cinquefoil as a candidate for Endangered Species Act protection with a listing priority number of 5.

LISTING CRITERIA

Historical range: Nevada and California.

Current range: Soldier Meadow, Humboldt County, Nevada, and Ash Valley, Lassen County, California.

Land ownership: The Ash Valley, California, population of Soldier Meadow cinquefoil occurs on private lands. In Nevada, about 30 percent of the Soldier Meadow occurrences are found within the boundaries of desert dace ACEC/RNA managed by the BLM, Winnemucca District. The remaining 70 percent also occur on lands managed by the BLM, but without any special designation (U.S. Fish and Wildlife Service 1997).

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

In general, populations of Soldier Meadow cinquefoil are distant from urban centers; however, these areas are popular for recreation and are often affected by livestock grazing. While all of the occurrences of Soldier Meadow cinquefoil are currently presumed extant, all are being severely affected by land uses within and around Ash Valley in California and the Black Rock region in Nevada (CDFG, NDDB 2002; personal communication 2002 cited in U.S. Fish and Wildlife Service candidate assessment form; Nachlinger 1991; Knight 1990). Various direct impacts to Soldier Meadow cinquefoil populations and habitat have occurred in past years and continue to affect the species, including channelizing spring outflow for livestock and recreational uses; trampling by livestock; degradation or elimination of habitat for agriculture, livestock grazing, and recreational uses; development of hot springs and camping areas; roads and off-highway

vehicle activity; geothermal exploration; and introduction of invasive, nonnative species (Knight 1990).

The physical alteration of the spring systems and upland habitats in Soldier Meadow began well over 100 years ago, and the region has been used for livestock grazing for decades (U.S. Fish and Wildlife Service 1997). Many modifications to the landscape have occurred historically to accommodate these various uses. Changes to the hydrological regime through permanent and seasonal water diversions have resulted in the loss or alteration of Soldier Meadow cinquefoil habitat, as well as habitat that once supported the desert dace (U.S. Fish and Wildlife Service 1997). The spring systems and riparian areas that support this species are attractive to native and domestic grazers due to the presence of water, succulent vegetation adjacent to streams, and gentle topography (Minshall et al. 1989). Grazing affects the landscape by altering, reducing, or eliminating vegetation. Springs and riparian areas are negatively affected through channel widening, bank degradation, lowering of the water table, and increased sedimentation into streams (U.S. Fish and Wildlife Service 1997).

The Soldier Meadow cinquefoil is directly affected by grazing through the removal of vegetation which can expose soils, increase erosion potential, modify the hydrologic regime, and encourage invasion by nonnative species (Nachlinger 1991). Grazing has negatively affected nearly all of the Soldier Meadow cinquefoil occurrences through the loss of individuals and trampling of habitat. This activity has caused a decline of the species and the quality of its habitat in the Soldier Meadow area as it is part of an active grazing allotment (personal communication 2002 cited in U.S. Fish and Wildlife Service candidate assessment form).

Recreational use of the spring systems include bathing in the thermal springs and camping in the immediate vicinity of the outflows. Users have constructed rock dams and excavated the outflows to create deep pools that accumulate silt and sand (U.S. Fish and Wildlife Service 1997). Due to their proximity to the springs, Soldier Meadow cinquefoil plants are subject to damage associated with these activities (Nachlinger 1991). August through October is the highest recreational use period for this area, when the species is still flowering and beginning to produce fruit. Recreation use is encouraged by the gentle topography of the meadows and the prevalence of access roads (U.S. Fish and Wildlife Service 1997). Increased use of the spring systems for bathing and the upland sites for camping has resulted in the severe degradation of several Soldier Meadow cinquefoil sites. Between 1994 and 1995, visitor use had increased by 4,000 12-hour visitor days (BLM 1998). Today the area is becoming a well-known recreation area due to the very popular Burning Man Festival held annually about 48 kilometers (30 miles) south of Soldier Meadow and drawing some 45,000 visitors from all over the world. The visibility of the area has also increased due to the designation of the Black Rock Desert National Conservation Area in 2000 (personal communication 2002 cited in U.S. Fish and Wildlife Service candidate assessment form). In some areas, the landscape has been denuded of vegetation and soils have been compacted, offering little opportunity for reestablishment of the species (personal communication 2002 cited in U.S. Fish and Wildlife Service candidate assessment form). To gain access to these areas, recreational users and allotment permittees utilize a network of roads, many of which are not authorized or maintained. This has resulted in

fragmentation and degradation of the habitat. In addition, off-road vehicle tracks have been observed in the meadows where users have traversed the area to reach a spring or campsite (personal communication 2002 cited in U.S. Fish and Wildlife Service candidate assessment form; Nachlinger 1991).

The Soldier Meadow area was subject to intensive geothermal exploration in the 1970s. The maximum temperature of the aquifer was deemed insufficient to support economic development at that time; however, future exploration and resource development of this type could affect the groundwater system supplying the thermal spring habitat that supports the Soldier Meadow cinquefoil (U.S. Fish and Wildlife Service 1997). Some portions of the species' habitat are protected from exploration and development activities through the ACEC/RNA designation for the desert dace (U.S. Fish and Wildlife Service 1997). The wetland communities occupied by Soldier Meadow cinquefoil have also been subject to invasion by nonnative plant species. Some of the common nonnative species include, but are not limited to, smotherweed (*Bassia hyssopifolia*), Russian olive (*Elaeagnus angustifolia*), peppergrass (*Lepidium perfoliatum*), low whitetop (*Cardaria draba*), and cocklebur (*Xanthium strumarium*) (Nachlinger 1991). These nonnative species may compete with or displace native species, including Soldier Meadow cinquefoil, in disturbed areas or under conditions that favor their growth (U.S. Fish and Wildlife Service 1997). Invasion by nonnative species also causes degradation of native habitats and can result in monotypic stands of undesirable species. The most significant threats to the species continues to be recreational use of spring outflows for bathing, camping in the upland areas, and livestock grazing and associated activities. Current habitat conditions in Soldier Meadow as they relate to these activities and ecosystem health have not been monitored or quantified and are therefore difficult to discern; however, qualitative assessments of the area over time suggest that areas in and around the springs which support Soldier Meadow cinquefoil and the desert dace are steadily declining in habitat value (personal communication cited in U.S. Fish and Wildlife Service candidate assessment form).

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

Sites that are used for recreational bathing and camping are highly disturbed. As visitation increases in this area, impacts to the species and its habitat will become more severe.

C. ***Disease or predation.***

The Soldier Meadow cinquefoil is not known to be palatable to livestock or wildlife. Other than livestock trampling of the plants and its habitat discussed above, no disease or herbivory has been observed at any of the populations (Knight 1990).

D. ***The inadequacy of existing regulatory mechanisms***.

The Soldier Meadow cinquefoil was designated as a category 1 candidate species on February 21, 1990 (55 FR 6184). On July 26, 1995, this species was reassigned to category 2 candidate status and subsequently designated a species of concern (61 FR 7462). This designation was

assigned as a result of portions of the habitat coming under Federal (BLM) jurisdiction in 1993. The BLM classifies Soldier Meadow cinquefoil as a sensitive species. As such, the BLM is directed to manage for sensitive species and their habitats and consider these resources during project planning (BLM Manual 6840); however, no specific management guidelines to ensure the conservation of this species are currently being implemented.

The Soldier Meadow cinquefoil is not currently listed by the State of Nevada but is considered threatened by the Nevada Native Plant Society (Nevada Natural Heritage Program 2001). It is on the California Native Plant Society's (CNPS) 1B list (plants considered rare, threatened, or endangered in California and elsewhere). All plant species on the CNPS 1B list meet the definitions under the Native Plant Protection Act (Sec. 1901, Chapter 10) and the California Endangered Species Act (Secs. 2062 and 2067) of the CDFG Code, and are eligible for State listing. The species is not listed by California under its State Endangered Species Act, but plants on the CNPS 1B list must be fully considered during the environmental documentation process under the California Environmental Quality Act (CEQA) (Skinner and Pavlik 1994). However, CEQA only requires disclosure of a project's impacts on the species; it does not provide protective management for the Soldier Meadow cinquefoil.

Current Conservation Efforts: The Soldier Meadow cinquefoil habitat is within the Hot Springs pasture of the Soldier Meadow Allotment, which has been grazed by cattle for decades. In 1993, changes in the period of use and number of cattle on the pasture were implemented. These changes in livestock use were intended to reduce the potential for adverse effects on the habitat and to protect Soldier Meadow cinquefoil and the desert dace populations (U.S. Fish and Wildlife Service 1997). Studies to evaluate and monitor the effectiveness of the new grazing system were included as part of the Soldier Meadow Allotment Management Plan; however, to date, these studies have not been conducted (U.S. Fish and Wildlife Service candidate assessment form).

Other efforts to ensure conservation of the Soldier Meadow cinquefoil, including the Recovery Plan for the Rare Species of Soldier Meadows (U.S. Fish and Wildlife Service 1997), Soldier Meadow Activity Plan (BLM 1998), and informal consultations conducted with the BLM, articulated conservation measures and recommendations that, to date, have not been implemented. In addition, this species was not considered in the BLM's designation of the desert dace ACEC/RNA because it does not have Federal protective status. The Recovery Plan included The Soldier Meadow cinquefoil to ensure the long-term protection of the species. According to the Recovery Plan, this objective would be met when the abundance and distribution of the species is considered stable or increasing within the 10 subpopulations for 3 years, and when habitat modification and competing nonnative species no longer adversely affect the long-term survival of the species (U.S. Fish and Wildlife Service 1997). In 1998, BLM completed the Soldier Meadow Activity Plan and Environmental Assessment (Plan). The Plan is designed, among other things, to (1) address impacts to special status species from increased recreation, livestock and wild horse and burro grazing, and potential geothermal and mineral development and (2) to implement management actions and protect habitat for The Soldier Meadow cinquefoil. Some portions of this Plan have been implemented including increased area

use monitoring and enforcement. However, most of the specific recommended actions have not been taken. Almost 4 years have passed since the Plan was finalized, yet visitor use areas have not been designated, allowing for continued dispersed use of the area, which negatively impacts The Soldier Meadow cinquefoil and its habitat. The Plan integrated all resource management activities in the allotment, including preservation and protection of The Soldier Meadow cinquefoil and desert dace (BLM 1998). The management direction included in this document for these species has not been implemented.

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

Two reservoirs have been created at the south end of Soldier Meadow, and within the valley many of the spring outflows have been channelized. Water courses have been altered from historic patterns. The introduction and spread of Russian olive along the riparian zone is also likely to affect water flows (Knight 1990), which in turn influences soil moisture and other habitat characteristics.

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PETITION TO LIST

White River beardtongue
(*Penstemon scariosus* var. *albifluvis*)

AS A FEDERALLY ENDANGERED SPECIES

CANDIDATE HISTORY

CNOR 11/28/83:
CNOR 9/27/85:
CNOR 2/21/90:
CNOR 9/30/93:
CNOR 2/28/96: C
CNOR 9/19/97: C
CNOR 10/25/99: C
CNOR 10/30/01: C
CNOR 6/13/02: C

TAXONOMY

The status of *Penstemon scariosus* var. *albifluvis* as a taxonomically valid species is uncontroversial (England 1982).

NATURAL HISTORY

Morphology
The plant is a perennial that is probably moderately long-lived. This 15 to 50 cm tall plant has lavender to pale blue flowers that bloom from late May to June**.**

Habitat
The White River penstemon is restricted to calcareous soils derived from oil shale barrens of the Green River Formation in the Uinta Basin of northeastern Utah and adjacent Colorado. White River beardtongue is found on semi-barren areas on white (infrequently red) soils that are xeric, shallow, fine textured, and usually mixed with fragmented shale. It is found in pinyon-juniper / desert shrub and mixed desert shrub communities, at elevations ranging from 1524 to 2036 meters.

Distribution
The species range is composed of an arc of small scattered populations from the vicinity of Raven Ridge near the White River in Rio Blanco County, Colorado, then westward into southern Uintah County, Utah to the vicinity of Evacuation Creek, a distance of about 20 miles (30 kilometers).

Land ownership of the species habitat is a mosaic of Federal, State of Utah, and private lands. About 60 percent of the species population occurs on public lands managed by BLM. About 40 percent occurs on State of Utah and private lands.

POPULATION STATUS

The population is estimated at about 20,000 individuals with about 95 percent occurring in Utah. The species was described in the early 1980's, and little is known about the life history. There are currently three known populations, but the historical range prior to the species description in the early 1980's is unknown. Livestock grazing has degraded the habitat of the species, as well as resulted in direct take (ingestion). Additionally, the species' habitat on public lands exposes it to destruction from off-road vehicle use, and road, pipeline, and well site construction in connection with oil and gas development.

The U.S. Fish and Wildlife Service classifies the White River beardtongue as a candidate for Endangered Species Act protection with a listing priority number of 6.

LISTING CRITERIA

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

All of the occupied habitat of the White River penstemon is within developed and expanding oil and gas fields. Several wells and access roads are within the species' occupied habitat. The location of the species' habitat on public lands exposes it to destruction from off-road vehicle use, and road, pipeline, and well site construction in connection with oil and gas development. With such a small population and limited occupied habitat, any destruction, modification, or curtailment of the habitat would have a highly negative impact on the species. Virtually every population is associated with high grade oil bearing strata of the Evacuation Creek Member of the Green River Formation (i.e., the Mahogany Zone).

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

None known.

C. ***Disease or predation.***

The species is palatable to wildlife and livestock, and overgrazing of public lands is a major reason for the species' restricted range. The species is also vulnerable to livestock trampling because it occurs in public grazing allotments.

D. *The inadequacy of existing regulatory mechanisms.*

No Federal or State laws or regulations specifically protect *P. scariosus* var. *albifluvis*. The Bureau of Land Management administratively recognizes this species for special management consideration, but does not have the legal authority to require Federal mineral lease holders to modify their mineral recovery plans and on-the-ground actions solely to protect this species. Many populations occur on private lands patented for oil shale mining. These populations have no protection.

Current Conservation Efforts: None.

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

None known.

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