

CANDIDATE ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: Botrychium lineare

COMMON NAME: Slender moonwort

LEAD REGION: 1

INFORMATION CURRENT AS OF: January 31, 2003

STATUS/ACTION (Check all that apply):

New candidate

Continuing candidate

Non-petitioned

Petitioned - Date petition received: July 28, 1999

90-day positive - FR date: May 10, 2000

12-month warranted but precluded - FR date: June 6, 2002

Is the petition requesting a reclassification of a listed species?

Listing priority change

Former LP:

New LP:

Latest Date species first became a Candidate: June 6, 2002

Candidate removal: Former LP: (Check only one reason)

A - Taxon more abundant or widespread than previously believed or not subject to a degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

F - Range is no longer a U.S. territory.

M - Taxon mistakenly included in past notice of review.

N - Taxon may not meet the Act's definition of "species."

X - Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Ophioglossaceae (Adder's-tongue family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Idaho, Oregon, Montana, California, Washington, and Colorado; British Columbia, Quebec and New Brunswick, Canada

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Colorado, Idaho, Montana, Nevada, Oregon, and Washington.

LEAD REGION CONTACT: Scott McCarthy 503-231-6131

LEAD FIELD OFFICE CONTACT: Snake River Basin Office, Stephen Duke, 208-378-5345

BIOLOGICAL INFORMATION:

A member of the adder's-tongue family (Ophioglossaceae), Botrychium lineare is a small

perennial fern with a pale green leaf (trophophore) from 6 to 18 centimeters (2 to 7 inches) long. Leaf segments are typically linear and divided or forked at the ends. Spores mature primarily in late June and July. Similar to other *Botrychium* species, the tiny, lightweight spores may be disseminated by wind, water, or possibly by animal vectors (Zika et al. 1995).

Surveys and field identification of moonworts are complicated by their biology. The plants are small, difficult to find, and usually scarce. They cannot be positively identified in their immature states. Field identification is normally based on specimen morphology, and *B. lineare* is difficult to distinguish from other closely related moonworts. Fronds may appear above ground during some growing seasons, or may not appear at all during unfavorable seasons (Vanderhorst 1997). *Botrychium lineare* was initially described in 1994 and is considered to be one of the more distinctive of the moonworts (Wagner and Wagner 1994). The nearest relative of *B. lineare* is thought to be *B. campestre*, a widespread species that is typically found at lower elevations (Wagner and Wagner 1994). Recent genetic studies have shown that although *B. lineare* is closely related to *B. campestre*, it is a distinct taxon (Farrar 2000).

In the United States, *B. lineare* is currently known from a total of 12 widely disjunct populations in six states: three in Colorado (El Paso and Lake Counties), one in Idaho (Custer County), two in Oregon (Wallowa County), three in Montana (Glacier County), two in Nevada (Clark County) and one in Washington (Ferry County). Collectively, these 12 sites occur over a 528,360 square kilometer (204,000 square mile) area, with the closest distance between two populations approximately 6.9 kilometers (km) (4.3 miles mi)) and the furthest distance 1,651 km (1,026 mi) (Service, in litt., 2002). Three of the 12 known populations, two in Nevada and one in Idaho, were only recently discovered in surveys conducted in 2001 (Farrar 2002a, 2002b; Pierson 2003). No extant populations are known east of the Rocky Mountains (Farrar 2001). Historic populations, previously known from Idaho (Boundary County), Montana (Lake County), California (Fresno County), Colorado (Boulder County), and Canada (Quebec and New Brunswick), have not been seen for several years and may be extirpated (Wagner and Wagner 1994).

The total number of individuals observed at the 12 extant population sites varies, with observations ranging from 2 to 162 individuals (Edna Rey-Vizgirdas, Service, in litt., 2000; Farrar 2002; Pierson 2003). These observed counts should be viewed only as estimates since *Botrychium* species are difficult to survey for, do not always come up every year. They can exist below ground for most of their life cycle, and the appearance of above ground fronds is affected by general habitat and climatic conditions. Populations with the largest number of individuals ($n > 15$) were found in Montana (Glacier National Park and Blackfeet Indian Reservation), Colorado (Pikes-San Isabel National Forest), Idaho (Sawtooth National Forest) and Nevada (Humboldt-Toiyobe National Forest). Extant sites for *B. lineare* are generally small in area, although there are exceptions. The Idaho population site in the Sawtooth National Forest was surveyed in 2002 and *B. lineare* occurred in several small patches over a 121 ha (300 ac) area with most of the observed 162 individuals found in two primary vertical patches of habitat approximately 100 meters (m) (328 feet (ft)) apart (K. Pierson 2003). Nine of the 12 *B. lineare* populations occur on Federal land, including the Pike-San Isabel National Forest (Colorado), Sawtooth National Forest (Idaho) Glacier National Park (Montana), Humboldt-Toiyobe National Forest (Nevada), Wallowa-Whitman National Forest (Oregon), and Colville National Forest (Washington). One population occurs on private land in Lostine Canyon, Oregon, which is a private in-holding within the Wallowa-Whitman National Forest. The site in

Lake County, Colorado is currently only known from a herbarium specimen consisting of two *B. lineare* plants collected in 1992 at approximately 3,243 m (10,640 ft) near Leadville, Colorado. This specimen was previously misidentified as *B. minganense* (Toby Spribille, Kootenai National Forest, *in litt.*, 2000). No *B. lineare* plants were found at this site when it was surveyed in August 2000 (T. Spribille, *in litt.*, 2000).

All *Botrychium* species are believed to be obligately dependent on mycorrhizal fungi (the symbiotic association of a fungus with the roots of a vascular plant) throughout their life cycle. Similar to orchids, *Botrychium* species can remain dormant for 1 or more years, and cannot be identified with certainty in their immature stages. The ecology of moonworts and their vulnerability to management activities such as prescribed fire are not well understood (Zika et al. 1995; Vanderhorst 1997).

A specific habitat description for *B. lineare* is problematic because of its current and historically disjunct distribution in North America with habitats found ranging from sea level in Quebec to over 3,000 m (9,840 ft) at sites in Boulder County, Colorado and Custer County, Idaho. Wagner and Wagner (1994) described its habitat as “deep grass and forbs of meadows, under trees in woods, and on shelves on limestone cliffs, mainly at higher elevations”, but they also acknowledge that it is difficult to describe a typical habitat since the known sites are so different. Some botanists consider *B. lineare* to be a habitat generalist (Maria Mantas, Flathead National Forest, pers comm., 2002), and believe that *B. lineare* is a rare plant that is difficult to survey for and observe in the wild and is often found along roadsides in disturbed habitats (Steve Shelley, U.S. Forest Service (Forest Service), pers. comm., 2002). Mr. Shelley believes that *B. lineare*, often co-occurring with other *Botrychium* species, may be an opportunistic colonizer, colonizing “disturbed” habitats that can be considered a type of early successional habitat. *Botrychium* spores are small and lightweight enough to be carried by air currents. This dispersal mechanism may explain the broad and often disjunct distribution patterns exhibited by moonworts (Vanderhorst 1997). Three of the known Montana *B. lineare* populations occur on roadsides in early seral habitat (i.e., open habitat dominated by low-growing forbs (herbs) rather than shrubs or trees) (T. Spribille, *in litt.*, 2000). Other *B. lineare* sites occur in grass- to forb-dominated openings in forests characterized by cone-bearing trees such as pine, spruce, and fir species (Paula Brooks, Forest Service, pers. comm., 2000); densely vegetated fen (saturated soil) sites associated with seep springs (Nevada) (Farrar 2002b); and also along high-elevation windswept ridges in sparse, rocky vegetation on black, somewhat volcanic soils (Idaho) (Farrar 2002a). It is common for several *Botrychium* species to occur together (Farrar 2002a) in what has been called “genus communities” by researchers, a sympatric pattern of distribution which is unexplained (Vanderhorst 1997).

THREATS:

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

Three *Botrychium lineare* sites, two in Glacier National Park and one on the Blackfeet Indian Reservation in Montana, are all located on disturbed, roadside habitats where they may be affected by road maintenance activities, such as herbicide spraying, mowing, or by vehicles that pull off the road to look at wildlife (T. Spribille, *in litt.*, 2000; Tara Williams, Glacier National Park, *in litt.*, 2000). The Glacier National Park sites have been flagged in recent years to discourage mowing or disturbance from routine maintenance activities. Although such activities

are ongoing and have likely affected these sites in the past, the degree of disturbance and the timing of these activities may affect the survival and reproduction of this species. Despite these possible threats, B. lineare continues to persist in Glacier National Park based on recent monitoring surveys (T. Williams, pers comm., 2003). For example, road maintenance activities that occur prior to spore maturation and dispersal could adversely affect the reproduction of B. lineare. During 2000, herbicide spraying was conducted along the road where the largest known B. lineare population occurs on the Blackfeet Indian Reservation; although much of the roadside vegetation was killed it is unknown whether the population was directly sprayed or impacted (Mary Weatherwax, Blackfeet Environmental Office, pers. comm., 2000). Future surveys should provide more information on the status of this population. The residual effect of herbicide spraying on B. lineare is unknown. Some herbicides are known to be resident in the soil for long periods of time, affecting the plants that persist there (65 FR 7339).

The Botrychium lineare site in Lake County, Colorado (near Leadville) is apparently located within a Superfund site (T. Spribille, in litt., 2000). This site is currently threatened by activities and associated disturbance related to the construction of a concrete conduit. An asphalt bike path constructed through the upper portion of the site was completed in July 2000, and major construction and excavation to install the concrete conduit was observed in August 2000. Although other Botrychium species, including B. lunaria and B. minganense, were found at this site, no B. lineare plants were observed despite intensive surveys conducted in August 2000 (T. Spribille, in litt., 2000).

In our June 6, 2001 12-month finding, we described possible threats to one of two B. lineare along the Pikes Peak toll road from road maintenance. The Forest Service, however, in a 2002 re-assessment of threats to the two Pikes Peak B. lineare sites stated there are no imminent threats to either site. Both sites occur downhill, off the road, and there are no determinable impacts from road maintenance or recreation (Barb Maslinton, Forest Service, pers comm., 2002).

Habitat succession and fire suppression may affect B. lineare. However, the relationship of habitat succession and fire suppression to the persistence of B. lineare at a particular site is unclear. For example, in a biological assessment for sensitive plants in the Lostine River canyon, a Forest Service botanist notes that “Botrychium species seem to be found in areas that receive natural disturbances such as fire and landslides but we are not yet able to predict what disturbance interval or successional stage best suits them” (Hustafa 1999). Controlled (prescribed) fires or wildfires could also affect habitat for B. lineare, but the response of this species to fire is not currently known. We are not aware of any plans to implement controlled burning programs in B. lineare habitat at this time.

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

The plant is not a source for human food, nor is it currently of commercial horticulture interest. Therefore, overutilization is not considered to be a threat to this species at the present time.

C. Disease or predation.

Botrychium lineare may be affected by grazing from livestock or wildlife at some sites, but specific effects of grazing on the species is unknown. However, if grazing by livestock or

wildlife species occurs prior to the maturation and release of spores, the capacity for sexual reproduction of affected plants may be compromised. For example, the proximity of both B. lineare populations in Oregon to trails and developed recreation sites could result in grazing or trampling by horses or other domestic animals. One B. lineare site (on the Colville National Forest) occurs within a grazing allotment but is fenced to exclude livestock (K. Ahlenslager, Forest Service, in litt., 2000). Although open range grazing is common on the Blackfoot Indian Reservation, the B. lineare population on the Reservation appeared to be ungrazed when it was discovered in July 2000 by a Forest Service botanist (T. Spribille, in litt., 2000).

Disease is not currently known to be a threat to this species.

D. The inadequacy of existing regulatory mechanisms.

Botrychium lineare is considered a sensitive species in Regions 2, 5, and 6 of the Forest Service, which include extant and historical B. lineare sites found in Colorado, Oregon, Washington, and California (Forest Service 1999, 2000). Because this species is listed under these regional sensitive species lists, the Forest Service has regulations that address the need to protect sensitive, candidate, and federally listed species (e.g., the National Forest Management Act). Forest Service Regions 1 and 4, which include extant and historical sites found in Montana and Idaho, do not have B. lineare on their regional sensitive species lists and are, therefore, not given any special consideration (Teresa Prendusi, Forest Service, pers comm., 2000; S. Shelly, in litt., 2000). However, the Forest Service does prohibit the collection of any native plants without a permit on Forest Service lands. Botrychium lineare is not on Canada's list of threatened or vulnerable species, so there is no special protection for this species in Canada.

Monitoring of some (but not all) B. lineare populations on Federal lands has been initiated in recent years (e.g., Idaho, Nevada). Monitoring helps to identify management actions that may be necessary to control habitat degradation and protect the species. One site occurring on the Colville National Forest has been fenced to protect the species from livestock grazing. Additionally, the Forest Service has been conducting or funding Botrychium surveys in recent years, primarily in Idaho, Montana, and Nevada. Although difficult to survey for, three new B. lineare populations sites were discovered in Idaho and Nevada (Farrar 2002a, 2002b; Pierson 2003).

The National park Service (NPS) has policies to promote the conservation of federally listed or candidate species and other rare or sensitive species within park boundaries (T. Williams, in litt., 2000). However, as discussed previously, the three Botrychium lineare sites in Glacier National Park are located on roadsides where they are subject to annual road maintenance activities or potential damage from vehicles. Although long-term protection of these sites may be difficult due to their location (i.e., adjacent to roads, which are potentially a source of recurring disturbance), B. lineare were detected again in 2002 at the Apikuni Flats site despite ongoing drought and hot conditions (T. Williams, pers. comm., 2003).

Although Botrychium lineare is considered to be rare and imperiled by the State natural heritage programs in Colorado, Montana, Oregon, and Washington, the State heritage program rankings are not legal designations and do not confer State regulatory protection to this species.

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

With the exception of the Idaho population site, most sites occupied by B. lineare are generally small with most less than 465 square meters (5,000 square feet) in area. The B. lineare plants at the smaller Pikes Peak site have not been located in the last few years, and only two plants were previously known, so the actual amount of occupied habitat is likely to be extremely small. No B. lineare plants were found at the Leadville site in 2000, so it is not possible to estimate the amount of occupied habitat. Of the two B. lineare sites in Oregon, the Lostine Canyon site occupies an area of approximately 10 X 10 m (30 X 30 ft) (Wagner and Wagner 1994), and the Hurricane Creek site is found in an area up to 1 ha (2.5 ac) in size (Oregon Natural Heritage Program 1999). The site in Washington (on the Colville National Forest) occupies an area of approximately 15 X 30 m (50 X 100 ft) (K. Ahlenslager, in litt., 2000). The larger of the two B. lineare populations on the Pike-San Isabel National Forest occupies an area of approximately 35 X 10 m (115 X 30 ft) (Carpenter 1996a, 1996b; Colorado Natural Heritage Program 1999). Botrychium lineare populations range in size from 2 to 162 plants, with six populations supporting more than 15 individuals.

The generally small size of most existing B. lineare populations makes this species vulnerable to extirpation due to naturally occurring events. A single environmental event could extirpate a portion or all of the individuals at a given site. Conversely, the disjunct nature of existing population sites over a wide geographic range covering nearly 528,360 square kilometers (204,000 square miles) in six western states likely means that additional, undetected B. lineare population sites exist.

Since the 12-month petition finding was published in the Federal Register on June 6, 2002 (67 FR 39035), the Service has requested and received some additional information regarding the status and distribution of B. lineare. Three new population sites of B. lineare, tentatively identified in 2001 and confirmed in 2002, have been found, one site in Idaho and two in Nevada. At this time, it appears that B. lineare occurs as a rare and widely disjunct species with 12 extant populations covering a 204,000 square mile area in six western states. Historic sites, most likely extirpated, encompass two additional states. Possible threats from road maintenance and recreational activities for some population sites, previously described in earlier findings (65 FR 30048; 66 FR 303068), have been re-assessed as not imminent or speculative at the present time. It is difficult to survey for the species due to its small size and irregular appearance above ground. The species seems to be a habitat generalist and is often found in disturbed habitats along roadsides. Although a seemingly rare species found generally in small area habitats, limited monitoring and survey efforts continue to locate some new population sites. Therefore, conclusions regarding B. lineare's overall distribution and specific habitat requirements, along with identifying possible conservation needs, are problematic at this time. Although we are not proposing a listing priority change or removal of candidate status at this time, any new information we receive on the distribution and threat/conservation actions of B. lineare may have a bearing on whether listing under the Endangered Species Act is still warranted.

FOR RESUBMITTED PETITIONS:

- a. Is listing still warranted? Yes
- b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes
- c. Is a proposal to list the species as threatened or endangered in preparation? No

d. If the answer to c. above is no, provide an explanation of why the action is still precluded: Since publication of the 2002 CNOR, the publication of a proposed rule to list this species has been precluded by other higher priority listing actions, and based on work scheduled we expect that will remain the case for the remainder of Fiscal Year 2004. Almost the entire national listing budget has been consumed by work on various listing actions taken to comply with court orders and court-approved settlement agreements, emergency listing, and essential litigation-related, administrative, and program management functions. We will continue to monitor the status of B. lineare's as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

LANDOWNERSHIP:

Of the 12 confirmed B. lineare populations, all but two populations occur on either Federal or Tribal lands. Two populations are located in the Pike-San Isabel National Forest, El Paso county, Colorado. Another Colorado site is currently only known from a herbarium specimen consisting of two B. lineare plants collected in 1992 at approximately 3,243 m (10,640 ft) near Leadville, Colorado. Three populations occur in Montana, two at Glacier National Park and one south of St. Mary's, Montana on the Blackfeet Indian Reservation. Eastern Oregon has two sites: one in the Eagle Cap Wilderness (Wallowa-Whitman national Forest) and another on private land in Lostine Canyon, Oregon, which is a private in holding within the Wallowa-Whitman National Forest. One site exists in the Colville National Forest, Ferry County, Washington. Three newly discovered 2001 sites have been confirmed and include a population of B. lineare found distributed over a nearly 121 ha (300 ac) area on the Sawtooth National Forest; and two sites in the Spring Mountains of southern Nevada in the Humboldt-Toiyabe National Forest.

PRELISTING:

No formal conservation agreements have been initiated for Botrychium lineare. In Washington, the single site that occurs on the Colville National Forest has been fenced to protect the species from livestock grazing. In Montana, one population site occurring along a roadside in Glacier National Park has been flagged to discourage mowing and other routing road maintenance activities. A recent re-assessment of two B. lineare sites located on National Forest lands near Pikes Peak in Colorado are considered relatively secure with no imminent or determinable threats from road maintenance or recreation activities.

REFERENCES:

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LISTING PRIORITY (place * after number)

THREAT

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

Rationale for listing priority number:

Magnitude: Most of the 12 known Botrychium lineare population sites are subject to threats of low magnitude. The species persists in disturbed roadside habitats in Montana and Colorado, areas subject to annual maintenance activities. The other remaining sites occur on primarily on public lands, often on isolated, high elevation habitats subject to impacts to seasonal, intermittent recreational hiking and livestock grazing impacts.

Imminence: As stated above, most human caused threats (i.e., road maintenance, recreation, and livestock grazing) are seasonal since most of the population sites occur at high elevation and are generally under snow for several months each year. One population site in Washington is fenced to exclude livestock grazing. Only one population site (Lake County, Colorado) has been impacted by direct habitat destruction in the recent past, and we are not currently aware of its status at this site.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all additions of species to the candidate list, removal of candidates, and listing priority changes.

Approve: Rowan Gould March 6,
Acting Regional Director, Fish and Wildlife Service 2003
Date

Concur: Steve Williams April 5, 2004
Director, Fish and Wildlife Service Date

Do not concur: _____
Director, Fish and Wildlife Service Date

Director's Remarks: _____

Date of annual review: January 2003

Conducted by: Steve Duke

Comments: _____
