

## **Additional information and determination for the Cement Project Area and Biological Evaluation based on new species information.**

**Prepared by:**

/s/ Deanna Reyher

**Deanna Reyher - Ecologist, Botanist, Soil Scientist**

/s/ Beth Burkhart

**Beth Burkhart - Botanist**

### **Introduction**

A Region 2 sensitive plant species, *Botrychium lineare* (narrowleaf grapefern, slender moonwort) was recently (December 2003) determined to occur approximately 5 miles to the north of the Cement Project Area northern boundary. *B. lineare* was only known to occur in Colorado within USFS Region 2 until the documentation of this Black Hills occurrence. The Black Hills occurrence of *Botrychium* species was located on June 19, 2003, and live plant specimens were collected and sent to Dr. Donald Farrar to validate identities with enzyme electrophoresis analyses (laboratory work is needed for definitive identification for many of the *Botrychium* species because of morphological similarities). Other *Botrychium* species are documented to occur on the Black Hills, but this is the first documented site of *B. lineare* within the Black Hills, and in the state of Wyoming. Because this species has not been documented to occur within the Black Hills, information is not currently available in Black Hills National Forest programmatic level documents for this supplement to tier to. In November 2003, an assessment for three *Botrychium* species (Beatty et al 2003) that included *B. lineare* within USFS Region 2 was completed and this supplement tiers to that document. Since this species was never known, or expected to occur in the Black Hills, and was not known to occur in Wyoming or South Dakota, *B. lineare* was not included in the Biological Evaluation process for the Cement Project Area. Therefore a prefield review or field reconnaissance was not completed for this species. The following information, analysis and determination supplements the Biological Evaluation for the Cement Project Area for *B. lineare*.

### ***Botrychium lineare* (Narrowleaf grapefern, Slender moonwort)**

#### **Species Description**

*B. lineare*, known as narrowleaf grapefern (or slender moonwort), is a small perennial fern with a pale green leaf about 2 to 7 inches long. Spore-producing fronds were documented on *Botrychium* individuals located on June 19, 2003 at the Dugout Gulch site on the Black Hills NF (Forest Service Records 2003). *Botrychiums* are dependent on mycorrhizal fungi throughout their life cycle. These specialized fungi assist moonworts with water and nutrient uptake. The fungal association allows moonworts to remain dormant for several years at a time. Such prolonged dormancy can be advantageous

during periods of drought or some other condition that is limiting to the species. Moonwort spores germinate underground and develop into belowground, non-photosynthetic gametophytes, which produce gametes (sperm and egg). The fertilized zygote then develops roots, stem, and the aboveground visual, fern-like, spore producing structure, the sporophyte. Leaf primordia (specialized leaf-producing cells) for several years are present just below the soil surface, and only one primordium matures each season (Beatty et al 2003).

Typically, moonworts are long-lived (i.e. 10-15 years), colonizing plants that may require disturbed sites to become established (Don Farrar personal communication 1996, 2003c, 2004). This is consistent with the *B. lineare* occurrence conditions from the Black Hills – on old native surface roadbed and ongoing low level disturbance.

Refer to the Regional assessment (see Introduction) for a full *B. lineare* species description.

### **Distribution and Status**

US Fish & Wildlife Service: Candidate species for CA, CO, ID, MT, OR, WA (FWS 2002a). Agency Status: USFS Region 2: Sensitive based on Colorado occurrences and candidate status (USDA Forest Service 2003, 2003b). Heritage Ranks: Global - G1 (Beatty et al. 2003); State WY- No status. No previous *B. lineare* occurrence has been documented in Wyoming (Beatty et al 2003).

Historical and current occurrences of *B. lineare* have been documented in Idaho, Oregon, Montana California, Washington and Colorado, and in New Brunswick, Quebec and New Brunswick, Canada (FWS 2002). Based on new occurrence information (2003 and 2004) and continued herbarium searches of historic vouchers, the species is also now documented from Utah, Wyoming (Black Hills occurrence) Alaska, and the Yukon Territory and new additional occurrences have been found in Glacier National Park, MT (Farrar 2004). It is expected that the global rank and state heritage ranks will be changed to reflect increasing occurrence information for *B. lineare*.

In addition to documenting new occurrences of *B. lineare*, recent work being completed by Dr. Donald Farrar is revealing genetic similarity between *B. campestre* (prairie moonwort) and *B. lineare*. Dr. Farrar plans to continue analyses to resolve whether the taxa warrant taxonomic separation (Farrar 2003d).

Other *B. lineare* occurrences in USFS Region 2 on Forest Service administered land include five occurrences in Colorado, with two occurrences in Pike-San Isabel National Forest, one occurrence in White River National Forest, and two occurrences in Arapaho-Roosevelt National Forest. One other occurrence within the Region 2 boundary, but not on Forest Service administered lands, is located in Rocky Mountain National Park, CO (Beatty et al. 2003).

The number of aboveground stems of North American occurrences of *B. lineare* is typically small, with 2 to 100 individual stems documented at various sites (Beatty et al. 2003). However, there are new occurrences of large sites in Glacier National Park, and

near St. Mary, MT with observations of larger numbers of individual stems, with one occurrence having an estimated 1,000 aboveground stems (Farrar 2004). The number of plants belowground is generally much larger than the number that are visible aboveground and it is estimated that what can be observed aboveground may represent only about 10% of the individuals at a given occurrence (Farrar 2004). Surveys, field identification of moonworts and monitoring efforts are complicated by *Botrychium* biology. The combination of many characteristics (including, but not limited to, the relatively short period since *B. lineare* has been described to science; the fact that the species may be a habitat generalist; the fact that species is small in stature, difficult to find, and scarce at a number of occurrences; and the number of recent new occurrences being documented) indicates that there is likely an underestimate of the actual North American population size, conclusions as to their range wide distribution is problematic (Farrar 2004, Beatty et al. 2003). In reviewing recent information, Dr. Farrar stated that, given the abundance of *B. lineare* around Glacier NP along with additional occurrences documented in the Yukon Territory and Alaska, *B. lineare* may be principally a northern species and may be distributed throughout the Canadian mountains to Alaska. If this is the case, he believes this may be why more southern disjunct occurrences, being warmer and/or drier, have fewer individuals in locations observed.

As stated in the Introduction, the current distribution of *B. lineare* in the Black Hills National Forest is the 2003 occurrence at Dugout Gulch, Wyoming. The Forest plans to pursue an agreement with Iowa State University to search for *Botrychium* species during June of 2004 and complete laboratory analyses on any plants collected to continue to add to *Botrychium* species status and distribution information in the Black Hills National Forest.

Refer to the Regional assessment (see Introduction) for further information on rangewide distribution and status.

### **Habitat**

Specific habitats and associated vegetation classifications for *Botrychium* species can be difficult to characterize since the vegetation and topography of observed sites vary greatly across their range (Beatty et al. 2003). Understanding habitat characteristics is also compounded by the fact that few sites have been described in detail. And although one species, such as *B. lineare* can be found in a range of habitats, *Botrychium* species likely have a suite of specific ecological requirements (Beatty et al. 2003).

Typical habitat descriptions for *B. lineare* are problematic because known sites are so different across its currently known range (Beatty et al. 2003). This species may be a habitat generalist since habitat across the range for *B. lineare* is quite variable and its' range stretches from sea level in Quebec to approximately 10,000 feet in Colorado. *B. lineare* has been observed growing in primarily open habitats and often in areas with documented disturbances, both human-caused (i.e. highway construction sites along Going-to-the-Sun Road in Glacier National Park) and natural (Farrar 2004). Only one observance to date has documented the species in a habitat with a closed canopy condition (Farrar 2004). *B. lineare* has been observed growing along the banks of a steep woodland trail in Montana, among deep grasses and forbs or in meadows in Colorado, in

a grassy area under a single spruce tree in Oregon, and on limestone cliffs with narrow, grassy, horizontal terraces in Quebec (Beatty et al. 2003, Farrar 2004). At least three of the populations in Montana were found growing along roadsides in disturbed areas in seemingly early seral, open habitat dominated by low-growing forbs rather than shrubs or trees (Beatty et al. 2003). Other documented sites occur in grass- and forb-dominated openings in meadows. Further information on these other occurrences across the species range can be found in Beatty et al 2003. In recent discussions with Dr. Farrar (2004), he mentioned that no recent sites documented to date are located out of mountain habitats (i.e. has not been found in areas like the Great Plains where *B. campestre* has been located). Dr. Farrar further described that locations have been limestone-based, with most being fairly rocky although a few sites have deep soil conditions.

There were no known occurrences of *B. lineare* in Wyoming (Beatty et al. 2003) prior to the December 2003 confirmation on the Black Hills National Forest. Habitat similar to that described for Colorado, Montana and Idaho is also available elsewhere in Wyoming (Beatty et al 2003). Across the range of *B. lineare*, not all habitat as described is occupied, and populations are generally discontinuous across the landscape.

As mentioned previously, the Black Hills occurrence is currently the single *B. lineare* location known in Wyoming. If Dr. Farrar's hypothesis that *B. lineare* is a northern species is correct, it is likely that if additional occurrences of *B. lineare* were found on the Black Hills National Forest, they would be small and discontinuous, as documented elsewhere in the southern part of the species range.

Baseline inventory documentation of the *B. lineare* occurrence on the Black Hills shows habitat similarities as well as differences to occurrences elsewhere. The Black Hills occurrence is located on an old, native-surface roadbed dominated by graminoids and forbs. The roadbed site where the species occurs is very open (0% canopy cover of trees) and sunny with a trace of snowberry (*Symphoricarpos spp.*) shrubs beginning to become established. Portions of the roadbed are covered with log debris and other naturally occurring brush. There is no disturbance currently resulting from vehicles. Some low intensity disturbances are occurring in the vicinity and at the occurrence. A small ephemeral drainage located about 8 feet upslope of the occurrence drains onto the road and through the prairie moonwort occurrence area, creating a water disturbance. Cattle disturbance of the site has occurred in past seasons as evidenced by manure, however, no use by cattle had occurred during the 2003 grazing season at the time of the site observations. Elk disturbance of the roadbed area was evidenced by hoof tracks. The lower slopes immediately adjacent to the roadbed are dominated by paper birch (*Betula papyrifera*) and bur oak (*Quercus macrocarpa*) with a thick shrub layer of hazelnut (*Corylus cornuta*) (Forest Service records 2003).

### **Biological Determination**

At the project level, *B. lineare* is not subject to the informal consultation processes used at the Forest plan level with the Fish and Wildlife Service (MOA of 08/30/00 and 94-SMU-058 of 01/25/94). The Black Hills baseline occurrence information was sent to the Fish and Wildlife Service in Cheyenne, Wyoming on January 9, 2003 and a copy of this supplement will also be provided.

There is much uncertainty regarding risks to *B. lineare*. Disturbances and land management activities may create and maintain suitable habitat for this species or may negatively impact existing populations, depending on the disturbance intensity and frequency (Beatty et al. 2003).

Many uncertainties exist with *B. lineare* because research/literature is very limited for this species and little is known about its habitat in the Black Hills since there is one documented occurrence. Consequently, additional personal contact was recently made to get the latest information from Dr. Don Farrar, who is recognized for his work with *Botrychium* species in North America and has experience with *Botrychium* species in the Black Hills.

Because of the uncertainties and limited information for this species in the Black Hills and in the Rocky Mountain Region, it is difficult to assess whether the activities associated with Alternative 2 Modified for the Cement Project Area would have no effect, a potential adverse effect or a beneficial effect on prairie moonwort. Based on the information that is available, a determination of “May adversely impact individuals, but not likely to result in a loss of viability on the Planning Area, nor cause a trend toward federal listing or a loss of species viability range-wide” (USDA Forest Service 2003) is made for *Botrychium lineare* relative to implementation of Alternative 2 Modified of the Cement Project Area.

The rationale for the above determination is based upon the following:

1. The 2003 *B. lineare* occurrence is not located within the Cement Project boundary and will not be disturbed by the activities associated with the project. While the full extent of the distribution of *B. lineare* in the Black Hills is currently unknown, the appearance of aboveground sporophytes at the new site is indicative of a viable population with extensive supporting underground biomass (including mycorrhizae) (Dr. Farrar, personal communication 2004). Therefore, while loss of individuals may occur in any currently unknown sites (there may not be any) in the Cement Project Area, the viable population at the known occurrence site will not be affected.
2. The baseline data for this occurrence documents that the species is able to colonize past disturbance areas, and the species is currently persisting at the known occurrence with limited ongoing disturbances (Forest Service Records 2003).
  - a. Although it is uncertain, because of the species’ persistence with disturbance and its colonization of disturbance areas (Farrar 2004), despite the fact that aboveground stems may be negatively affected, beneficial short- and long-term effects may be realized by the 1,700 acres of prescribed burning in the Cement Project Area. Dr. Farrar (2004) believes that when a population has aboveground growth, a fast moving fire may not negatively impact it. The fire may remove aboveground stem portions,

but would not be expected to affect belowground individuals or parts. Dr. Farrar shared that an area reviewed after a fire had an increase in the number of *Botrychium* (species?) stems. Dr. Farrar indicated that burning may release more nutrients to the soil that may immediately benefit the mycorrhizae and *Botrychium* species. He said this would be consistent with observations of other fungi that “flush” after fires. Prescribed fire may provide the disturbance needed for site colonization. Although unknown, an intense fire (from wildfires or a prescribed burn), that may have high severity effects such as deep soil heating, could potentially negatively effects to both the belowground and aboveground portions of *B.lineare*.

- b. An unknown site occurrence could expand, if present, or site conditions could be altered as a result of some level of disturbance (i.e. earlier successional conditions including shrub shade reduction, disturbed site conditions, and changes in plant competition patterns) that would be favorable for colonization by *Botrychium* spores, as long as associated mycorrhizae and other microsite conditions are present (Farrar personal communication 2003c).
  - c. Skidding activity disturbances that do not occur when the ground is frozen could result in belowground disturbance that may impact some unknown individuals. Conversely, skidding may create conditions suitable for colonization sites for *B. lineare* (Farrar 2003c).
3. Some portions of the project area will be taken to a more open canopy condition that could benefit the *B. lineare* (i.e. seed and seed tree cuts – 10 to 40 BA and 10 to 40% canopy cover; patch clearcuts). Although specific data is lacking on the Black Hills National Forest, the earlier successional conditions that occur with opening the overstory canopy could produce conditions that may be beneficial to site colonization by this wind-dispersed, spore-producing species, if the associated mycorrhizal species and other microsite conditions are present (Farrar 2004).
  4. Approximately 4,300 acres of the total 17,510 Forest Service-administered lands in the project area will receive various levels of disturbance associated with timber harvest activities. In addition, approximately 2,300 acres of fuels reduction and prescribed fire are planned for the Cement Project Area, with some areas overlapping with harvest activity sites. Approximately 5,011 acres, or less than 30% of the project area, is expected to experience various intensities of project-associated activities (i.e. skidding, road construction, road reconstruction, fire line construction for prescribed burning, fuels reduction), which may impact or eliminate *B. lineare* individuals. Approximately 70% of the total project area will not be affected by the project activities associated with Alternative 2, Modified.
  5. Noxious weeds will be treated in the Cement PA as weed occurrences are located. Although uncertainty exists, weed competition as well as herbicide application are

considered to be potential risks to *B. lineare* (Beatty et al 2003, FWS 2002, Farrar 2004). Herbicide sprayed during the period before *B. lineare* leaves emerge, or after the leaves have withered, is expected to have little to no direct effects on a *B. lineare* occurrence (Farrar 2004). Residual effects of herbicides to *B. lineare* or the associated mycorrhizae are unknown (FWS 2002). If herbicide spraying would occur at an unknown occurrence site at the time aboveground portions of *B. lineare* could react to the herbicide (this would be in June based on the single occurrence information the Forest has), then a negative effect to those individuals would likely be realized. However, Dr. Farrar (2004) shared that there would likely be enough belowground spores, gametes, juveniles, etc. such that not all of any one occurrence would be affected by herbicide treatment. In addition, if a *B. lineare* occurrence may exist at a herbicide application site, the population would likely benefit from reducing weed competitors.

6. Since *B. lineare* is not known to occur within the Cement Project Area, no cumulative effects are anticipated.

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