

Botany Biological Evaluation

for the

Moskee Project



BLACK HILLS NATIONAL FOREST

Bearlodge Ranger District in Sundance, Wyoming

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PURPOSE

The Forest Service has established direction in the Forest Service Manual to guide habitat management for proposed, endangered, threatened, and sensitive plant species. The direction establishes the process, objectives, and standards for conducting a Biological Evaluation. This process ensures that Forest Service actions do not contribute to loss of viability of federally listed threatened, endangered, or proposed plant species, or Region 2 (R2) Sensitive plant species; or contribute to a trend towards Federal listing under the Endangered Species Act of any species. The R2 Manual Supplement 2600-2006-1 provides additional direction for conducting analysis required in Biological Evaluations. The purpose of this Biological Evaluation is to identify the likely effects of the proposed action to R2 Sensitive plant species and their habitats.

This document tiers directly to the Final Environmental Impact Statements (FEISs) for the Forest Plan and Phase 2 Forest Plan Amendment (USFS 1996, 2005) and the associated BEs (Appendices H and C, respectively). The Forest Plan, as amended, provides direction and ensures that project activities are in compliance with Forest Plan Goals, Objectives, Standards, and Guidelines, and any other applicable laws, regulations, and policies.

AFFECTED ENVIRONMENT

The Moskee project area lies 14 miles southeast of Sundance, Wyoming, in the Bearlodge Ranger District of the Black Hills National Forest and includes approximately 25,515 acres, with approximately 22,445 acres of National Forest System (NFS) lands and 3,070 acres under private ownership. Table 1 shows legal description of the project area.

Table 1. Project area legal description

Township	Range	Section(s)
50 North	61 West	1, 12, 17, 16, 20-22, 25-29, 36
50 North	60 West	16-21, 24, 28-33
49 North	61 West	1, 12, 13, 24, 25, 36
49 North	60 West	4-9, 16-21, 28-33
48 North	60 West	9
<i>Sixth Principal Meridian</i>		

Main access to the project area is the Grand Canyon Road (NFSR [National Forest System Road] 875) via Moskee Road (County Road 141). Project landmarks include Bald Mountain, Wagon Canyon, Scott-Hardy Spring, and Grand Canyon.

The Moskee project area includes management areas 4.1 and 5.1:

4.1 – Limited Motorized Use and Forest Products Emphasis. These areas are managed for non-motorized recreation, while providing for timber production, forage production, visual quality and a diversity of wildlife. Roads provide intermittent commercial access, but are normally closed to other than administrative use.

5.1 – Resource Production Emphasis. These areas are managed for wood products, water yield, and forage production, while providing other commercial products, visual quality, diversity of wildlife, and a variety of other goods and services. Numerous open roads provide commercial access and roaded recreation opportunities, while closed roads provide non-motorized recreation opportunities.

The Moskee project area contains a variety of habitats. Most of the area, particularly the ridges and upper slopes, are dominated by ponderosa pine (*Pinus ponderosa*). Mixed conifer-deciduous communities are common in the project area as well. North-facing slopes are typically dominated by paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), or a combination of the two species, and often contain a pine component as well. Meadow communities are relatively common in the wide valley bottoms of the project area.

The project area contains habitat considered suitable to support several R2 Sensitive plant species. Some of this suitable habitat is considered high-quality habitat for Sensitive plant species and consists of stands of birch and birch/aspen mix as well as some riparian habitats. These sites often have a high percentage of canopy cover and/or contain above-average moisture; they usually support a diversity of understory species, including mosses and lichens. Additionally, the project area contains open grassland habitats that are suitable habitat for certain *Botrychium* species. These grassland areas could represent high-potential habitat for prairie moonwort (*Botrychium campestre*) and narrowleaf grapefern (*Botrychium lineare*).

PREFIELD REVIEW & SPECIES CONSIDERED AND EVALUATED

Federally Listed Plant Species:

A list of Federally endangered, threatened, proposed, and candidate species has been provided by Brian T. Kelly of the U.S. Fish and Wildlife Service (USFWS), Wyoming State Office, and last updated on April 14, 2006. **No federally endangered, threatened or proposed plant species occur on the Black Hills National Forest.**

Region 2 Sensitive Plant Species:

The Black Hills National Forest received the Region 2 Forest Service Sensitive species list in 1993 (revised March 21, 1994) from the Regional Forester. This list has gone through updates and the current list was signed on April 28th, 2005. Table 2 displays R2 Sensitive plant species that occur in the Black Hills National Forest and their habitats. See Appendix C of the FEIS for the Phase 2 Amendment (USFS 2005d) for detailed information on the R2 Sensitive plant species that occur in the Black Hills National Forest.

Prior to the 2004 field season, a prefield review of Region 2 Sensitive plant species, other target plant species, and high-probability plant habitat was completed using the Black Hills National Forest Plant Database (USFS 2007), Wyoming Natural Diversity Database records, and communication with District personnel. Based on the prefield review, it was determined that additional surveys were needed. The Moskee project area was surveyed in 2004 by a qualified contractor. Additional surveys conducted for other projects but falling within the Moskee project area boundary were conducted during the 1995 field season. All survey data is considered in this Biological Evaluation.

All R2 Sensitive plant species and other target plant species occurring in the Black Hills National Forest were considered in the evaluation. Suitable habitat exists in the Moskee project area for several R2 Sensitive plant species known to occur within the Black Hills. Suitable habitat is habitat that meets the requirements of a species. Habitat requirements differ by species, and not all requirements are understood at this time. Habitat may be suitable but unoccupied and may exhibit varying degrees of quality.

Based on the most current information and professional judgment, species with habitat preferences differing from habitat types present within the Moskee project area were not analyzed in the effects analysis portion of this document. Table 2 summarizes R2 Sensitive plant species

known to occur in the project area, those having suitable habitat in the project area, and those species with habitat preferences differing from habitats present within the Moskee project area and a rationale for their exclusion from effects analysis.

Table 2. R2 Sensitive plant species for the Black Hills National Forest

Scientific Name	Common Name	Black Hills Distribution and Habitat	Species Known To Occur in Project Area?	Suitable Habitat Present in Project Area?	Addressed in NEPA Document?
<i>Botrychium campestre</i>	Prairie moonwort, Iowa moonwort	Prairie moonwort is extremely inconspicuous. Rangewide, it is considered a grassland species associated with sandy grassland habitats in prairies, dunes, railroad sidings, and fields over limestone. There are currently 5 confirmed sites on NFS lands in the Black Hills. Other sites exist on private lands and at Wind Cave National Park. Black Hills sites are found on limestone in open grassland habitats usually with high forb diversity and often with a high percentage of bare and rocky soils. Little bluestem (<i>Schizachyrium scoparium</i>) and western snowberry (<i>Symphoricarpos occidentalis</i>) occur at the majority of sites.	No	Possibly; suitable habitat not fully understood	Yes
<i>Botrychium lineare</i>	Narrowleaf grapefern; slender moonwort	Four occurrences are confirmed on NFS lands in the Black Hills, located on Bearlodge and the Hell Canyon Ranger Districts. All sites occur in open conditions on limestone. Two sites are located on old (estimated 15-25 years) native-surface roadbeds. A 3 rd site is located adjacent to a gravel roadbed in open grassland. The 4 th site, located on a large north-facing hillside, is not associated with any roads. Elsewhere in its range, this species has often been documented in areas of road disturbances and other human and natural disturbances.	No	Possibly; suitable habitat not fully understood	Yes
<i>Botrychium multifidum</i>	Leathery grapefern	Currently, on the Black Hills, the majority of known sites are in mesic areas next to riparian dominated by white spruce (<i>Picea glauca</i>) or mixed spruce-pine along small, perennial streams in more or less open areas, in or near old stream channels where water is no longer flowing on a permanent basis but may still receive water scouring disturbance by occasional flooding events. Currently known populations are located only a few meters from stream channels along Iron Creek, Nelson Creek, and Lost Cabin Creek, all in the Norbeck Wildlife Preserve or Black Elk Wilderness. One exception is a single site in the Bear Lodge Mountains in a steep, narrow drainage with birch/hazelnut community on sandstone. Plants are found on moss-covered sandstone boulders and streambank berms near occasional pools of water. In general, plants in the Black Hills are associated with mossy mats, frequently <i>Climacium</i> . Individuals of leathery grapefern have been found in duff under spruce, in grassy margins along streams, on sand/gravel bars along streams, and in mesic soils near hiking trails. Currently known to occur at 4,620-6,400 feet elevation.	No	Yes	Yes
<i>Carex alopecoidea</i>	Foxtail sedge	In the Black Hills, foxtail sedge is currently known from two general areas: Cement Ridge area along the South Dakota-Wyoming border, and in the Bear Lodge Mountains in Wyoming. Foxtail sedge has been found along open, perennial streams, often with old beaver dams or ponds. Occurrences are primarily documented in the transitional areas between saturated soils and the more mesic upland areas. Currently known elevation range is 3,840-5,900 feet.	No	Yes	Yes
<i>Cypripedium parviflorum</i>	Yellow lady's slipper	Habitat in the Black Hills includes stream banks under spruce or deciduous overstories, moist cliffs (usually north-facing), and moist areas/seeps under spruce or mixed conifer forest.	No	Yes	Yes

Scientific Name	Common Name	Black Hills Distribution and Habitat	Species Known To Occur in Project Area?	Suitable Habitat Present in Project Area?	Addressed in NEPA Document?
		Occasionally found higher on mesic forest slopes. Currently known to occur at 3,500-6,500 feet elevation.			
<i>Epipactis gigantea</i>	Giant helleborine	In the Black Hills, this species is known only from Cascade Springs in Fall River County, South Dakota at 3,400 ft. It appears to depend on the constant moisture and warmth provided by the springs. No other warm springs are known on NFS lands in the Black Hills.	No	No; no warm springs in project area	No
<i>Lycopodium complanatum</i>	Trailing clubmoss	Known occurrences are on shaded, north-facing slopes in white spruce/paper birch forest in moist side drainages. Known elevation range is 5,000-5,820 feet.	No	No; spruce habitat is absent from the project area	No
<i>Platanthera orbiculata</i>	Large round-leaf orchid	Found on shady, north-facing slopes in paper birch/hardwood stands, and occasionally in conifer forests on damp, rich humus soil. Currently known elevation range is 4,350-6,150 feet.	No	Yes	Yes
<i>Salix candida</i>	Sage willow	One verified extant occurrence west of Deerfield (McIntosh Fen, 6,000 feet elevation). Also a historical collection from the general area of "from Loring Siding to Minnekahta" (unknown if the historical collection is from private or NFS land). Habitat includes cold seep- or spring-fed saturated substrates produced by unusual hydrologic conditions where sedimentary layers of the Limestone Plateau intersect impermeable schist or shale of the crystalline Central Core. Community type associated with the occurrence is wet meadow fen.	No	No; the unusual hydrologic conditions do not occur in the project area	No
<i>Salix serissima</i>	Autumn willow	Habitat includes fens and wet meadows. Known from McIntosh Fen, Middle Fork of Boxelder Creek (5,800 feet), Nahant (5,620 feet), and Silver Creek (5,850 feet). Appears to occur in the same unique hydrologic conditions as <i>Salix candida</i> .	No	no; the unusual hydrologic conditions do not occur in the project area	No
<i>Sanguinaria canadensis</i>	Bloodroot	Bloodroot occupies floodplains, forested terraces, drainage bottoms, and north-facing footslopes in open, rich hardwood plant communities. The currently known range in the Black Hills is limited to the northeast portion of the Black Hills, from the east side of Spearfish Canyon to west of Tilford. Currently known elevation range is 3,940-5,000 feet.	No	No; outside of geographic range	No
<i>Viburnum opulus</i> var. <i>americanum</i>	Highbush cranberry	Occasional at middle elevations in wet, shaded habitats along streams, springs, and canyon bottoms. The large majority of documented occurrences are in drainage bottoms or lower parts of slopes with dry/mesic to moist soil conditions with partial shading. Known sites are primarily associated with paper birch /ironwood (<i>Ostrya virginiana</i>) and birch/hazelnut (<i>Corylus cornuta</i>), with or without spruce or aspen. A few sites are in pine/oak (<i>Quercus macrocarpa</i>). Paper birch is present at almost all known sites. Elevation range is 3,800-5,700 feet.	No	Yes	Yes
<i>Viola selkirkii</i>	Great-spurred violet	Known occurrences are restricted to high-elevation, cold, shaded to open microhabitats associated with vegetated granitic rock outcrops or white spruce forest with a highly variable understory. All known occurrences on NFS lands in the Black Hills are in Black Elk Wilderness or Norbeck Wildlife Preserve. Elevation range is 5,300-7,000 feet.	No	No; habitat conditions are not present in the project area	No

Habitat category for Sensitive plant species with suitable habitat in the project area is displayed in Table 2. Species are grouped into appropriate habitat categories for analysis.

Table 3. R2 Sensitive Plant Species with Suitable Habitat in Project Area

Scientific Name	Common Name	Habitat Category for Analysis
<i>Botrychium campestre</i>	Prairie moonwort	*
<i>Botrychium lineare</i>	Narrowleaf grapefern	*
<i>Botrychium multifidum</i>	Leathery grapefern	Riparian meadow
<i>Carex alopecoidea</i>	Fox-tail sedge	Riparian meadow
<i>Cypripedium parviflorum</i>	Yellow lady's slipper	Moist forest/riparian meadow
<i>Platanthera orbiculata</i>	Large round-leaved orchid	Moist forest
<i>Viburnum opulus</i> var. <i>americanum</i>	Highbush cranberry	Moist forest/riparian meadow

*These species are not placed in a habitat category. They are analyzed separately.

R2 Sensitive plant species with suitable habitat are addressed in the “EFFECTS ANALYSIS” and “SUMMARY OF DETERMINATION OF EFFECTS” sections of this document.

FIELD RECONNAISSANCE & SURVEY INFORMATION

Survey Methods

The Moskee project area was surveyed for Sensitive plant species, other target species, and high-probability plant habitat primarily during the 2004 field season. Other surveys were conducted within the project area during the 1995 field season. Information from all surveys conducted within the project boundary is used in the analysis of the proposed project.

The focus of surveys was not only on locating individual plants but also on identifying and mapping community types, associated species, indicator species, and the probability of an area to support Sensitive plant species.

Areas to survey were identified using a combination of GIS modeling (“hillshade”), aerial photographs, topographic maps, local knowledge, and professional judgment during field reconnaissance. Over the past several years, hillshade has been field verified and has proven to be very helpful in predicting suitable Sensitive plant habitat. Hillshade uses the length of exposure to and angle of the sun in relation to topography to predict shade and therefore moisture content across the landscape. It has been observed in the northern Black Hills that moisture is one factor driving the presence of suitable Sensitive plant habitat for the majority of these plant species. Hillshade may underestimate habitat but more often it overestimates high-probability plant habitat, and for this reason is best used in combination with other analysis tools. For the most part, areas that appeared to be high-probability habitat were surveyed with intuitive-controlled/general survey intensity¹ with the objective of identifying Sensitive plant habitat as well as location of individual target plants. Field reconnaissance was conducted in some areas considered low-probability.

2004 was a drought year, which made surveying for individual plant species more difficult. Some plants may have withered early while others may not have emerged at all. Some plant species may have been missed due to timing of surveys and drought conditions, but emphasis was placed on documenting community types, associated species, indicator species, and the perceived potential of an area to harbor Sensitive plant species. Surveying and managing for suitable plant habitat provides more inclusive field data and management than surveying and managing for

¹ See glossary, page 23

individuals alone.

Habitat Encountered During Survey

A small percentage of the Moskee project area is considered suitable habitat for Sensitive plant species. In general, the majority of the project area is low-probability habitat for R2 Sensitive plant species. Surface water is very limited in the area with little riparian habitat. Sources of water in the project area are generally small streams, springs, and seeps. Some water in the project area is captured in pipelines to feed stock tanks. It is estimated that suitable habitat makes up less than 3% of the project area. Suitable plant habitat is mapped in the Moskee Project Analysis File (item E009). Despite thorough surveys, there are no known Sensitive plant occurrences in the project area.

Suitable Sensitive plant habitats in the Moskee project area are moist birch and birch/aspen stands and areas where surface water is present. In general, high-quality sites have little to no disturbance from logging (skid trails, landings), livestock use (trailing, browsing), or recreation, and no more than minimal noxious weed infestation. High-quality forested stands typically are areas with a high percentage of canopy cover and above-average microsite moisture. The Moskee project area contains some high-quality stands dominated by birch. Since these sites often have a dense canopy and above-average moisture, they usually support a diversity of understory species, including mosses and lichens.

R2 Sensitive Plants Known to Occur

No Region 2 Sensitive plant species are known to occur in the Moskee project area. Habitat exists for several R2 Sensitive plant species, which are addressed in the “EFFECTS ANALYSIS” section.

PROJECT DESCRIPTION

Purpose of and Need for Action

The purpose of and need for action in the Moskee project area is to move the project area towards Forest Plan desired conditions by diversifying forest structure, maintaining or enhancing hardwood and meadow communities, providing for sustained commodity uses, reducing fire hazard and risk of mountain pine beetle infestation, decreasing unauthorized roads, and providing non-motorized recreational opportunities.

Summary of Alternatives

Alternative 1 (No Action): Alternative 1 represents the existing condition. Under Alternative 1, no new activities would occur. Changes may occur through ongoing activities (such as road maintenance), natural processes, or other management decisions in the future. This alternative provides a foundation for describing and comparing the magnitude of environmental changes associated with the action alternatives against those changes that would occur with no new action at this time.

Alternative 2 (Proposed Action): Alternative 2 proposes 5,908 acres of even-aged commercial timber harvest. Other activities include precommercial thinning (1,464 acres), mechanical fuel reduction (342 acres), prescribed broadcast burning (4,013 acres), and noxious weed control as needed. Proposed roadwork includes construction of approximately 6.2 miles of road, reconstruction of 70.7 miles of road, and decommissioning of 0.5 mile of NFS road and 25 miles of unauthorized roads. Reconstruction includes both road improvement (adding gravel, repairing rolling dips, etc.) and road realignment (moving the road template).

Alternative 3: Alternative 3 is based on the proposed action. It was developed to take advantage

of additional treatment opportunities and to create uneven-age stand structure. It proposes 6,768 acres of even-aged commercial timber harvest and 857 acres of uneven-aged commercial timber harvest. Other activities include precommercial thinning (2,901 acres), removing pine from meadows (1,178 acres) and aspen (1,000 acres), mechanical fuel reduction (342 acres), prescribed broadcast burning (3,630 acres), reburning of recent prescribed burn areas (“maintenance” burning, 2,820 acres), and noxious weed control as needed. Proposed roadwork includes construction of approximately 5.2 miles of road, reconstruction of 78 miles of road, and decommissioning of 0.5 mile of NFS road and 26 miles of unauthorized roads. Notes under Alternative 2 regarding road construction and reconstruction also apply to Alternative 3.

Alternative 4: Alternative 4 was developed to move towards uneven-age stand structure on a greater area while reducing fire hazard by retaining more stands of well-spaced large trees and decreasing near-ground fuels. This alternative proposes 5,276 acres of even-aged commercial timber harvest and 1,758 acres of uneven-aged commercial timber harvest. Other activities include precommercial thinning (2,311 acres), removing pine from meadows (1,178 acres) and aspen (1,000 acres), mechanical fuel reduction (342 acres), prescribed broadcast burning (1,661 acres, including 204 acres of maintenance burning), understory mulching (1,259 acres), and noxious weed control as needed. Proposed roadwork includes construction of approximately 5.2 miles of road, reconstruction of 77 miles of road, and decommissioning of 0.5 mile of NFS road and 26 miles of unauthorized roads. Notes under Alternative 2 regarding road construction and reconstruction also apply to Alternative 4.

For a more detailed description of alternatives, refer to the Moskee Project Environmental Assessment. Table 4 provides a summary comparison of activities proposed under the three action alternatives analyzed in detail.

Table 4. Proposed Activities

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Commercial treatments (acres)				
Thin to 50 BA	0	1,288	1,195	1,195
Thin to 60 BA	0	1,984	1,948	1,047
Overstory removal	0	125	240	0
Overstory removal/seedcut	0	1,032	1,507	1,156
Seedcut	0	652	685	685
Seedcut/overstory removal	0	306	1,010	1,010
Group selection				
Groups	0	0	286	586
Thin between groups	0	0	571	1,172
Non-commercial treatments (acres)				
Precommercial thin	0	1,464	2,757	2,166
Mechanical fuel reduction	0	342	342	342
Understory mulch	0	0	0	1,259
Prescribed broadcast burn	0	3,911	3,528	1,457
Reburn recently burned areas	0	0	2,820	204
Remove pine from group selections	0	0	286	586
Pine removal from meadows/riparian	0	0	1,178	1,178
Pine removal from aspen stands	0	0	1,000	1,000
Off-road motorized travel closure area	0	5,161	5,161	5,161
Roads (miles)				
Construction	0	6.0	5.0	5.0
Reconstruction	0	67.8	75.1	74.1
Preuse maintenance	0	6.0	5.7	5.7
Decommission	0	24.8	25.9	25.9
Convert road to snowmobile trail*	0	0.1	0.7	0.7

*These unclassified roads are already part of the snowmobile trail system. This project would officially convert them to trails.

PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

Various activities have already occurred, are occurring, or will occur in the future within the project area. Past activities have contributed to the current condition of resources as described above. Ongoing and future activities may contribute to effects to resources that would also be affected by the proposed project.

Past Actions

Coyote Timber Sale, cutting units completed 1999-2006:

- Commercial thinning to 80 square feet of basal area per acre: 46 acres
- Shelterwood seedcut: 436 acres
- Overstory removal: 103 acres
- Pine removal from hardwoods: 48 acres

Wish Timber Sale, cutting units completed 2001-2006:

- Overstory removal: 13 acres
- Hardwood restoration: 18 acres
- Shelterwood seedcut: 57 acres

Fires:

- Adams Prescribed Burns (2002-2005): 700 acres
- Baldman Prescribed Burns (2002-2005): 2,100 acres
- Cement Wildfire (July 2005): 61 acres
- Grand Wildfire (July 2002): 9 acres (T50N, R61W, section 20)
- Moskee Wildfire (1936): 7,174 acres
- Stanton Wildfire (July 2002): 22 acres (T49, R60W, section 28)
- Stanton Draw Wildfire (1963): 80 acres (T49N, R60W, section 36)
- Windmill Wildfire (August 1988): 8 acres (T49N, R61W, section 31)

Present Actions

Precommercial thinning to be completed in 2007: 312 acres

Coyote Timber Sale, cutting units to be completed by 2009:

- Commercial thinning to 80 square feet of basal area per acre: 288 acres
- Shelterwood seedcut: 692 acres
- Overstory removal: 138 acres
- Pine removal from hardwoods: 37 acres

Wish Timber Sale, cutting units to be completed by 2009:

- Overstory removal: 17 acres

Foreseeable Actions

Group selection is proposed on 857 acres under Alternative 3 and 1,758 acres under Alternative 4. This treatment would begin the process of creating uneven-age stand structure. A third of the acreage would be regenerated now in three- to five-acre patches. During the next harvest entry (15-20 years in the future), another third of the acreage would be treated with group selections. After the third entry, the stands would have developed uneven-age structure.

Riflepit Timber Sale (to the east of the project area), cutting units to be completed by 2009:

- Hardwood restoration: 585 acres
- Commercial thinning: 574 acres
- Shelterwood preparation cut: 417 acres
- Shelterwood seedcut: 76 acres
- Overstory removal: 74 acres

- Meadow enhancement: 25 acres
- Pine encroachment: 62 acres

Moskee Land Exchange:

This proposal to acquire privately held lands in exchange for NFS lands is in the development stages as of this writing. No decisions have been made. The National Forest System would acquire approximately 340 acres of private land within the project area in exchange for approximately 336 NFS acres within project area. The proposed exchange includes additional acres outside the project area.

Coyote Post-sale Activities:

- Precommercial thinning: 116 acres
- Products other than logs (POL) thinning: 817 acres
- Noxious weed treatment

Wish Post-sale Activities:

- Precommercial thinning: 30 acres
- Aspen regeneration: 18 acres

EFFECTS ANALYSIS

The following assessment is based upon surveys, professional knowledge, published literature, and consultation with peers. An effects analysis was completed for those species that could be impacted by the proposed project. No R2 Sensitive plant species are known to occur in the Moskee project area. Seven R2 Sensitive plant species may have suitable habitat within the project area (see Table 2). The R2 Sensitive plant species with suitable habitat but no known occurrences in the project area are addressed first, followed by a combined analysis for *Botrychium campestre* and *Botrychium lineare*, for which there are no known occurrences but possible suitable habitat within the project area.

R2 Sensitive Species with Suitable Habitat but No Known Occurrences (excluding *Botrychium campestre* and *Botrychium lineare*, analyzed below)

In the Black Hills, the primary habitat for the five species listed below is riparian communities and/or moist forested communities, usually with a birch or spruce component (See Table 2 for more specific habitat requirements). Although the Moskee project area has suitable habitat for the species listed below, none of them were found within the project boundary during surveys. The focus of surveys conducted during the 2004 field season was on locating individual target species as well as identifying suitable habitat. It is estimated that less than 3% of the project area is suitable habitat for the R2 Sensitive plant species listed below. Refer to Table 3 for the habitat category assigned to each species for analysis purposes.

<i>Botrychium multifidum</i>	Leathery grapefern
<i>Carex alopecoidea</i>	Fox-tail sedge
<i>Cypripedium parviflorum</i>	Yellow lady’s slipper
<i>Platanthera orbiculata</i>	Large round-leaved orchid
<i>Viburnum opulus</i> var. <i>americanum</i>	Highbush cranberry

***Botrychium multifidum* (Leathery Grapefern)**

Botrychium multifidum is currently assigned a rank of S2 (imperiled) in Wyoming and S1 (critically imperiled) in South Dakota. Global ranking is G5, indicating that the species is considered to be secure across its range (NatureServe 2007).

Species Distribution: *Botrychium multifidum* is nearly circumboreal in distribution, being found across North America, Europe, and northwest Asia. It is widespread across Canada from

Newfoundland to British Columbia, and in the northern United States from New England west to Washington and Oregon, north into Alaska and south into California, Nevada, Utah, New Mexico, and Arizona (USFS 2005d).

Habitat: In the Black Hills, *Botrychium multifidum* generally occurs in mesic sites next to riparian areas dominated by white spruce or mixed spruce-pine along small, perennial streams in more or less open areas, and in or near old stream channels where water is no longer flowing on a permanent basis but that may still receive scouring disturbance by occasional flooding events. Black Hills locations are in the Norbeck Wildlife Preserve and Black Elk Wilderness. One exception is a single site in the Bear Lodge Mountains. This site is located in a steep, narrow drainage with birch/hazelnut community on sandstone. Plants are found on moss-covered sandstone boulders and streambank berms near occasional pools of water. In the Black Hills, plants are associated with mossy mats, frequently with the moss *Climacium*. Individuals of leathery grapefern have been found in duff under spruce, in grassy margins along streams, on sand/gravel bars along streams, and in mesic soils near hiking trails. The known elevation range in the Black Hills is from 4,620-6,400 feet (USFS 2005d, 2007).

***Carex alopecoidea* (Foxtail Sedge)**

Carex alopecoidea is currently assigned a rank of S2 (imperiled) in Wyoming and South Dakota. Global ranking is G5, indicating that the species is considered to be secure across its range (NatureServe 2007).

Species Distribution: *Carex alopecoidea* is widely distributed from eastern to central Canada, the northeastern United States, the Great Lakes region south to Tennessee, and west to North Dakota and the Black Hills of South Dakota and Wyoming (USFS 2005d). There are 29 documented sites on the Black Hills National Forest (USFS 2005d).

Habitat: The majority of Black Hills occurrences are along the upper headwaters of low-gradient perennial streams, with the majority of the occurrences associated with old beaver dams and ponds (little or no ongoing beaver activity) where flooding and disturbance have created wet to moist meadow conditions. Black Hills *Carex alopecoidea* sites are most often open, with little to no canopy cover, and are located at elevations between 3,840 and 6,400 feet. Occasionally a few individuals extend into areas scattered with willows, hawthorn, hazelnut, or spruce. In the Black Hills, *Carex alopecoidea* occurs primarily in the transitional areas between saturated soils and adjacent mesic uplands, and individuals are often found on the downstream side of old beaver dams. Individuals at the lowest known elevation site in the Black Hills grow within the saturated riparian zone (USFS 2005d, 2007).

***Cypripedium parviflorum* (Yellow Lady's Slipper)**

Cypripedium parviflorum is currently “not ranked/under review” (SNR/SU) in Wyoming and assigned a rank of S3 (vulnerable) in South Dakota. Global ranking is G5, indicating that the species is considered to be secure across its range (NatureServe 2007).

Species Distribution: In North America, *Cypripedium parviflorum* occurs from Alaska to Newfoundland, south to Washington, Arizona, New Mexico, Kansas, Mississippi, and Georgia. Only five states have no documented occurrences of *Cypripedium parviflorum*, including Hawaii, Nevada, Texas, Louisiana, and Florida (USDA Forest Service 2005d). Occurrences are located on three of the four Black Hills National Forest ranger districts (Bearlodge, Northern Hills, and Mystic) and are widely dispersed across 21 sixth-level watersheds. According to monitoring reports, there are over 60 sites (USFS 2006).

Habitat: In the Black Hills, *Cypripedium parviflorum* habitat generally includes stream banks under spruce and deciduous overstories, north-facing limestone rock outcrop areas, and moist

areas/seeps under spruce or mixed conifer forest.

***Platanthera orbiculata* (Large Round-leaved Orchid)**

Platanthera orbiculata is currently assigned a rank of (S1), critically imperiled in Wyoming and (S2), imperiled in South Dakota. Global ranking is G5, indicating that the species is considered to be secure across its range (NatureServe 2007).

Species Distribution: *Platanthera orbiculata* is endemic to the boreal regions of northern North America from Newfoundland to southern Alaska, with a more southern distribution in the eastern United States into the Appalachians and Great Lakes. *Platanthera orbiculata* exists as sparse, intermittent occurrences throughout its range. In the Black Hills, occurrences are disjunct and found in remnant boreal/hardwood forest in the Bear Lodge Mountains, the northwestern limestone plateau, and Black Elk Wilderness. There is a conservative estimate of over 700 individuals on the Forest. Although most occurrences are small and sparsely distributed, the species is more abundant and widely distributed on the Forest than was previously believed (USFS 2005d).

Habitat: *Platanthera orbiculata* is known from 31 sites in three geographically separated regions in the Black Hills, each within a different geological type: Bear Lodge Mountains; northwestern Black Hills (contains the largest cluster of sites); and Black Elk Wilderness. Scattered occurrences are located on sheltered, north-facing, forested slopes in damp humus-rich soil at elevations of 4,350 to 6,150 feet. This species is often associated with dense understory vegetation in mid to late-successional paper birch/hazelnut forest, often with an overstory component of white spruce. Historically in the Black Hills, periodic fires likely maintained the successional paper birch/hazelnut forests where *Platanthera orbiculata* occurs. Within appropriate habitat, the sparse and patchy distribution of this species may be due to its specialized interactions with mycorrhizal fungi, insect pollinators, and other micro-habitat conditions (USFS 2005d, 2007).

***Viburnum opulus* var. *americanum* (Highbush Cranberry)**

Viburnum opulus var. *americanum* is assigned a rank of S1 (critically imperiled) in Wyoming and currently not ranked/under review (SNR/UR) in South Dakota. Global ranking is G5T5, indicating that the species is considered to be secure across its entire range (NatureServe 2007).

Species Distribution: *Viburnum opulus* var. *americanum* is a widespread species with disjunct occurrences in the Black Hills in South Dakota and Wyoming. It is widely distributed across north-central North America: in Canada from Newfoundland to southern British Columbia, and in the United States from Maine to Washington, extending southward to Kentucky, Missouri, and Nebraska (USFS 2005d). *Viburnum opulus* var. *americanum* is primarily located in the northern Black Hills and Bear Lodge Mountains and is reported from more than 30 occurrences on NFS lands. Occurrences are widely dispersed across the Forest and are located in Crook, Lawrence, Meade, and Pennington counties. Sites are distributed over a wide elevation range (3,800 to 5,700 feet) and exist in 10 sixth-level watersheds (USFS 2005d).

Habitat: This species is widespread in the Black Hills, occurring from the central to northeastern to northwestern portions. On NFS lands, *Viburnum opulus* var. *americanum* is primarily associated with moist but well-drained sites and grows in dense shrub thickets and deciduous woodlands with tree canopy covers ranging from zero to 90%. The majority of reports document the species as associated with dry to moist soil conditions, often in and adjacent to upper-watershed ephemeral draws and on gentle to steep wooded hillslopes, with most of the shrubs occurring on northern aspects (USFS 2005d).

Alternative 1 (No Action)

Direct and Indirect Effects

Moist forested and riparian meadow communities:

No new management activities would occur. Ongoing activities such as recreation, fire suppression, and road maintenance would continue. Management activities analyzed under other environmental documents would continue to occur. Alternative 1 does not address the potential for uncharacteristically intense wildfire behavior, nor does it modify stand density to reduce risk of insect outbreaks, produce commercial timber, or provide for diverse wildlife habitat. Fuel loads would remain at their current levels and would be expected to increase over the next decade, adding to the potential for intense wildfire behavior. Pine would continue to encroach on meadows and aspen stands. Motorized recreation on and off roads could damage Sensitive plant habitat or introduce noxious weeds. If stand-replacing disturbance events occur and reduce pine cover on north aspects, aspen and birch forest and associated plant habitat could expand.

Cumulative Effects

Moist forested and riparian meadow communities:

The cumulative effects analysis area for the five R2 Sensitive plant species analyzed in this section is suitable plant habitat within the project area as described under the “FIELD RECONNAISSANCE & SURVEY INFORMATION” section, and includes moist forested and riparian meadow communities.

Soil disturbance, introduction of invasive species, and changes in microsite moisture and hydrologic regimes can negatively affect Sensitive plant species and their habitats. Moist forested and riparian areas in the Black Hills have been changed by historical management practices such as livestock grazing, road construction, fire suppression, recreation, mining, water diversion, and near-extirpation of beaver. These activities have decreased suitability of many of these habitats for Sensitive plant species.

Continued fire suppression without vegetation treatment would be expected to add to the effects of past fire suppression (higher fuel loading and increased fire hazard). This may increase the wildfire susceptibility of stands adjacent to Sensitive plant habitat. These conditions could increase effects of wildfire on Sensitive plant habitat, which would otherwise be expected to act as a fuel break.

Alternative 1 would also add to the effects of fire suppression by allowing pine to continue encroaching on riparian meadows. An increased pine component in riparian meadows would be expected to cause a decline in the suitability of this habitat to support Sensitive plant species such as *Carex alopecoidea*.

Continued motorized recreation on and off roads would be expected to add incrementally to effects of past and ongoing use by increasing disturbance of soil and vegetation.

The potential Moskee land exchange could result in acquisition of open meadows with historic beaver dams and the potential to be managed for improvement of riparian habitat.

Alternative 1 - Determination

Implementation of Alternative 1 would be expected to result in minimal direct or indirect effects on Sensitive plant species or their habitats in the next decade. In the longer term, risks are associated with the cumulative effects noted above. Therefore, implementation of Alternative 1 “May adversely impact individuals, but [is] not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing” for the five R2 Sensitive plant species analyzed in this section.

Alternatives 2, 3, and 4 (Action Alternatives)

Analysis of effects on suitable habitat for the five species listed above is discussed here for all action alternatives (2, 3, and 4). The alternatives differ in objectives, emphasis areas, and acres to be treated (see Table 4) and would result in different magnitudes of potential effects; however, the types of effects would be similar. For this reason, all three action alternatives are analyzed together, followed by a discussion on the differences among the alternatives in magnitude of effects. The alternatives are described in “SUMMARY OF ALTERNATIVES”, above, and Chapter 2 of the Environmental Assessment.

Alternatives 2, 3, and 4 – Direct Effects:

Moist forested communities and riparian meadow communities:

Mechanical vegetation treatments (commercial thin, overstory removal, shelterwood seedcut, group selection, precommercial thin, mechanical fuel reduction, and understory mulch) would not occur in suitable plant habitat. While the risk is low, the possibility exists for a small amount of overlap between mechanical treatments and suitable Sensitive plant habitat. The risk is further reduced due to the limited amount of the project area identified as suitable habitat (3%) and the focus of all proposed mechanical treatments on removing pine. In general, suitable Sensitive plant habitat is either devoid of pine or pine is present in very limited amounts, so mechanical treatments are prescribed in habitats not suitable for these Sensitive plant species. While the risk is very low, mechanical treatments may result in direct effects to suitable habitat and/or to individuals if unknown suitable habitat is present in treated areas. Direct effects could include trampling or flattening of habitat and individual plants. Ground disturbance is likely to occur during mechanical treatment due to use of heavy machinery. While direct impacts to habitat would be possible in areas where treatments overlap suitable habitat (there may not be any), recommended measures would limit the extent (see page 20). In addition, moist soils and riparian areas are protected during timber harvest and road construction on NFS lands under Forest Service Manual 2509.25 (Watershed Conservation Practices Handbook). Therefore, while direct impacts to Sensitive plant habitat are possible, the magnitude of direct effects resulting from mechanical treatments is expected to be minimal due to the following:

1. The risk of overlap with high potential suitable habitat is low or non-existent.
2. Overlap, if it occurred, would represent a small fraction of the total estimated 3% of the project area identified as suitable habitat.
3. The project area has been thoroughly surveyed for R2 Sensitive plant species and habitat.
4. Additional measures are recommended to further reduce the risk of potential negative effects.

Non-mechanical removal of pine from meadows and aspen stands would occur under Alternatives 3 and 4. Some overlap occurs between the areas proposed for treatment and suitable Sensitive plant habitat. These treatments are expected to improve Sensitive plant habitat within a decade but may result in short-term direct impacts due to small amounts of ground disturbance. Possible direct effects include trampling by workers or felling of pine trees onto plant occurrences (if any exist). The magnitude of effects due to these treatments would be the same for Alternatives 3 and 4 since the treatments and acres are identical.

There is a small amount of potential overlap between prescribed burns and suitable habitat under Alternatives 2 (less than 5 acres) and 3 (less than 20 acres). No overlap exists in Alternative 4. Under Alternatives 2 and 3, prescribed fire may result in direct impacts, including crushing or burning, on habitat and/or individual plants if there are unknown occurrences. Light ground disturbance is likely to occur in burn units due to fire and workers entering the area. While direct impacts to habitat are likely to occur in areas where burns overlap suitable habitat, the risk is low due to the small amount of overlap and that measures are in place (see page 20) to limit the extent.

No road construction is proposed in suitable Sensitive plant habitat. There is a limited risk of overlap between suitable Sensitive plant habitat and roads proposed for reconstruction under all action alternatives. Direct effects may include uprooting, trampling, compacting, burying, or otherwise disturbing Sensitive plants and/or habitats.

Alternatives 2, 3, and 4 – Indirect Effects

Moist forested communities and riparian meadow communities:

Commercial thin, overstory removal, shelterwood seedcut, group selection, precommercial thin, mechanical fuel reduction, and understory mulching would not occur in suitable Sensitive plant habitat. While the risk is low, the possibility exists for a small amount of overlap between these treatments and suitable Sensitive plant habitat. The risk is further reduced due to the limited amount of the project area identified as suitable habitat (3%) and the focus of all proposed mechanical treatments on removing pine. In general, suitable Sensitive plant habitat is either devoid of pine or pine is present in very limited amounts, so mechanical treatments are prescribed in habitats not suitable for these Sensitive plant species. While the risk is low, mechanical treatments may result in indirect effects on suitable habitat and/or individuals if unknown suitable habitat is present in treated areas.

A beneficial indirect effect of these actions would be a reduction in the fire hazard through mechanical treatments and prescribed fire. Ecotones between suitable plant habitat and pine stands (as well as the adjacent pine stands themselves) may have a strong influence on the health of suitable plant habitat, particularly relative to fuel loads and crown fire hazard. Heavy fuel loading may contribute to widespread, high-severity wildfires that could negatively affect moist forested communities and riparian communities which, under other conditions, would be expected to act as fuel breaks. Reducing fuels in the project area via mechanical treatments and prescribed burns could, in the case of a wildfire, cause crown fires to drop to the ground before burning into suitable habitat. This would reduce the likelihood of severe impacts on moist forested communities. Prescribed burning and selective thinning of adjacent conifer stands could maintain a mosaic of seral stages, increase available moisture, and decrease the potential for widespread crown fires (Hornbeck et al. 2003). Resulting patches of paper birch and other moist communities may act as natural fuel breaks. As a forest type, paper birch stands are one of the least flammable. These stands typically have a canopy with high moisture content and a lush understory. Crown fires in coniferous stands often stop at the boundary of large paper birch stands or become slow-moving ground fires (Uchytel 1991).

Under all action alternatives, a possible negative indirect effect would be the spread and/or creation of new weed infestations resulting from ground disturbance associated with mechanical and fire treatments. Noxious weeds may out-compete desired plant species, and herbicides used to help control weeds can have negative effects on desirable plants. Adherence to Forest Plan standards and guidelines and the Black Hills National Forest Noxious Weed Management Plan would help reduce indirect effects on habitat due to the spread of weeds.

Alternatives 3 and 4 propose 2,178 acres of non-mechanical removal of pine from meadows and aspen stands. Some overlap occurs between areas proposed for treatment and suitable Sensitive plant habitat. These treatments are expected to improve Sensitive plant habitat over the next decade but may result in short-term indirect effects due to minor ground disturbance. Pine removal would be expected to improve the suitability of this habitat to support Sensitive plant species (such as *Carex alopecoidea*) that prefer open riparian meadow conditions. While negative indirect effects, such as weed encroachment and felled trees changing microhabitat conditions, may occur, the risk is low due to the small amount of overlap and the non-mechanical nature of the treatments. The magnitude of indirect effects (both negative and positive) is the same under Alternatives 3 and 4 since the treatments and the acres are identical.

Proposed road construction would not occur in suitable habitat under any alternative but would occur within approximately 150 feet of this habitat in one location. Approximately 0.7 mile of road reconstruction in three separate locations would overlap suitable habitat under all action alternatives. Indirect effects on suitable habitat would be probable due to the proximity of road construction to areas of suitable habitat and the overlap of reconstruction with suitable habitat. Roads act as corridors for the dispersal for invasive weeds, which are one of the greatest risks to R2 Sensitive plant species. This is true particularly for Sensitive plants found in riparian areas and wetlands due to the concentration of a variety of management activities and uses that occur in these habitats (USFS 1999).

Noxious weeds may out-compete desired plant species, and herbicides used to help control weeds can also have negative effects on Sensitive plants. Since proposed new construction is in close proximity and reconstruction of roads is located within areas of suitable plant habitat, there is risk of indirect effects on suitable habitat under Alternatives 2, 3, and 4. Adherence to Forest Plan standards and guidelines and the Black Hills National Forest Noxious Weed Management Plan would help reduce indirect effects on habitat due to the spread of weeds.

A beneficial indirect effect under Alternatives 2, 3, or 4 would be expected to result from decommissioning of roads. Reducing disturbances caused by motorized travel in these areas has the potential to improve plant habitat by allowing vegetation to reestablish and by increasing shade and moisture levels as a result of increased canopy cover. Decommissioning roads would have a beneficial effect on all plant communities and “eventually, obliterated roads would be expected to function like undisturbed areas” (USFS 1997).

Alternatives 2, 3, and 4 – Cumulative Effects

Moist forested communities and riparian meadow communities:

The cumulative effects analysis area for the five R2 Sensitive plant species analyzed in this section is suitable plant habitat within the project area as described under the “FIELD RECONNAISSANCE & SURVEY INFORMATION” section, and includes moist forested and riparian meadow communities.

Soil disturbance, introduction of invasive species, and changes in microsite moisture and hydrologic regimes can negatively affect Sensitive plant species and their habitats. Moist forested and riparian areas in the Black Hills have been changed by historical management practices such as livestock grazing, road construction, fire suppression, recreation, mining, water diversion, and near-extirpation of beaver. These activities have decreased suitability of many of these habitats for Sensitive plant species.

Mechanized treatments, prescribed fire, and road construction and improvement proposed under all action alternatives may add to effects of past, present, and foreseeable activities on Sensitive plant habitat by increasing the potential for noxious weed infestation. Cumulative effects may also occur if there are unknown occurrences of Sensitive plants in treated/affected areas. The risk of these cumulative effects would be reduced by design criteria requiring prompt revegetation of disturbed areas, treatment of new weed infestations, the fact that thorough Sensitive plant/habitat surveys have been completed, and exclusion of most activities from known Sensitive plant habitat.

Fire suppression would continue under all action alternatives, but proposed treatments would act against the effects of this practice by reducing fuel loading and decreasing fire hazard. This would be expected to decrease the wildfire susceptibility of stands adjacent to Sensitive plant habitat, reducing effects of wildfire on plant habitat and allowing it to act as a fuel break.

The potential Moskee land exchange could result in acquisition of open meadows with historic

beaver dams and potential to be managed for improvement of riparian habitat.

Alternatives 3 and 4 would act against the effects of fire suppression by reducing pine encroachment in riparian meadows. An decreased pine component in riparian meadows would be expected to increase suitability of this habitat for Sensitive plant species such as *Carex alopecoidea*. These treatments may add temporarily to effects of other activities as a result of minor ground disturbance.

Decommissioning of unclassified roads and closure of MA 4.1 to off-road motorized use would be expected to act against effects of roading and motorized vehicle use by decreasing disturbance of soil and vegetation.

Comparison of Magnitude of Effects of Alternatives 2, 3, and 4

The number of acres proposed for mechanical vegetation management treatments, including commercial thin, overstory removal, shelterwood seedcut, group selection, precommercial thin, mechanical fuel reduction, and understory mulch is 5,955 under Alternative 2, 7,784 under Alternative 3, and 8,452 under Alternative 4. Potential overlap with suitable Sensitive plant habitat exists in all three action alternatives. Alternative 2 proposes 30% fewer acres of mechanical treatment than Alternative 4. Alternative 3 proposes 8% less than Alternative 4. The magnitude of potential effects, both positive and negative, from mechanical vegetation management treatments would be expected to be greatest under Alternatives 4, with Alternative 3 close behind and Alternative 2 substantially less.

Prescribed burning treatments also vary between alternatives. Alternative 3 proposes the greatest number of acres (6,450) for burning. Alternative 2 proposes 4,013 acres of prescribed burning, and Alternative 4 proposes 1,661 acres. The magnitude of effects, both positive and negative, from burning treatments would be expected to be greatest under Alternative 3 followed by Alternatives 2 and finally 4.

Miles of proposed road construction and reconstruction are very similar for all three action alternatives. Alternative 2 proposes 6.0 miles of road construction and 67.8 miles of reconstruction. Alternative 3 proposes 5.0 miles of construction and 75.1 miles of reconstruction. Alternative 4 proposes 5.0 miles of construction and 74.1 miles of reconstruction. The magnitude of negative indirect effects due to building new roads and reconstructing existing roads would be expected to be very similar for all three action alternatives. The number of miles proposed for decommissioning is essentially the same under Alternatives 2 (26.0 miles), 3 (26.5 miles), and 4 (26.5 miles). Beneficial indirect effects from road decommissioning would be expected to be very similar for all three action alternatives.

Risks

The risk of implementing Alternative 2, 3, or 4 is low because areas of suitable habitat in the project area were identified and surveyed and no Sensitive plants were found. In addition, mechanical vegetation treatments are not proposed in areas characterized as suitable Sensitive plant species habitat under any alternative. Risk is further reduced because protective measures associated with Forest Service Handbook 2509.25 (Watershed Conservation Practices) apply.

Alternatives 2, 3, and 4 – Determination

Although implementation of Alternative 2, 3, or 4 may have negative effects, these effects are expected to be balanced or outweighed by beneficial effects in the project area such as the reduction in the wildfire hazard and risk of mountain pine beetle infestation. This approach of managing to restore and preserve habitat despite potential negative effects (weed infestation, loss of plant or wildlife individuals, or initial changes to habitat) is supported by the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration (FWS/NOAA 2002).

Considering the risk and the potential for indirect and cumulative effects, a determination of “May adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing” is made for the five R2 Sensitive plant species listed above upon implementation of Alternative 2, 3, or 4.

EFFECTS ANALYSIS FOR *BOTRYCHIUM CAMPESTRE* AND *BOTRYCHIUM LINEARE*: TWO R2 SENSITIVE PLANT SPECIES WITH SUITABLE HABITAT IN THE PROJECT AREA BUT NO KNOWN OCCURRENCES

Suitable habitat exists in the Moskee project area for both *Botrychium campestre* (prairie moonwort) and *Botrychium lineare* (narrowleaf grapefern). Neither species is known to be present in the project area.

***Botrychium campestre* (Prairie Moonwort)**

Species Distribution: *Botrychium campestre* is a North American endemic that ranges from the Canadian provinces of Alberta, Ontario, and Saskatchewan to Colorado, Iowa, Michigan, Minnesota, Montana, Nebraska, New York, North Dakota, South Dakota, Wisconsin, and Wyoming. It is considered an uncommon species with a very patchy, widespread distribution. *Botrychium campestre* is a grassland species originally described from the loess prairies of Iowa and dune habitats around the Great Lakes. It reaches the southern edge of its range in Region 2 and is known from only a few scattered sites within the region (USFS 2005d).

In the Black Hills, there are currently 5 confirmed sites on NFS lands. Additional sites exist on private lands and at Wind Cave National Park. No known occurrences are present in the Moskee project area.

Members of the genus *Botrychium* (moonworts) can be difficult to identify to species level. Morphology is variable within species, and differences between species can be subtle. Research being completed by Dr. Donald Farrar of Iowa State University is revealing genetic similarity between *B. campestre* and *B. lineare*. Dr. Farrar plans to continue analysis to resolve whether the taxa warrant taxonomic separation.

Habitat: Rangewide, *B. campestre* is extremely inconspicuous. It is considered a grassland species associated with sandy grassland habitats in prairies, dunes, railroad sidings, and fields over limestone (USFS 2005d). Black Hills sites are found on limestone in open grassland habitats, usually with high forb diversity and often with a high percentage of bare and rocky soils. Little bluestem (*Schizachyrium scoparium*) and western snowberry (*Symphoricarpos occidentalis*) occur at the majority of sites.

***Botrychium lineare* (Narrowleaf Grapefern)**

Species Distribution: Historical and current occurrences of *Botrychium lineare* have been documented in Idaho, Oregon, Montana, California, Washington, and Colorado, and in Quebec and New Brunswick, Canada. The species is also now documented from Utah, Wyoming, Alaska, and the Yukon Territory, and additional occurrences have been found in Glacier National Park, Montana (USFS 2005d).

Habitat: Typically, moonworts are long-lived (i.e. 10-15 years), colonizing plants that may require disturbed sites to become established. This is consistent with the *B. lineare* occurrence conditions from the Black Hills, since individuals are documented to occur on an old native-surface roadbed with low levels of ongoing disturbance (USFS 2005d).

Typical habitat descriptions for *B. lineare* are problematic because sites are so different across its range (Beatty et al. 2003). This species may be a habitat generalist, since habitat across the range 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 and natural (USFS 2005d).

Baseline inventory documentation of the *B. lineare* occurrences on the Black Hills shows habitat similarities to as well as differences from occurrences elsewhere. In the Black Hills, confirmed occurrences on NFS lands are located on the Bearlodge and the Hell Canyon Ranger Districts. All sites are in open conditions on limestone geologic material. Two sites have been confirmed on native-surface roadbeds last disturbed approximately 15-25 years ago. A third site is located adjacent to a gravel roadbed in open grassland. The fourth site, located on a north-facing hillside, is not associated with a road. Elsewhere in its range, this species has often been documented in areas of roads and other human and natural disturbances.

Botrychia depend on mycorrhizal fungi in the soil for water and nutrient uptake. Because mycorrhizal function depends on adequate soil moisture, mycorrhizae are probably the most important limiting factor for *Botrychium* establishment (Anderson and Cariveau 2003).

Risks

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

Determination

The following determination is assigned to *Botrychium campestre* and *Botrychium lineare*. The rationale that follows the determination applies to both species.

Because there is limited available information for both species in the Black Hills and in the Rocky Mountain Region, it is difficult to assess whether the activities associated with the Moskee project would have no effect, a potential adverse effect, or a potential beneficial effect on *B. campestre* and *B. lineare*. 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” is made for all alternatives for these species. The rationale for this determination is based upon the following:

1. Verified occurrences of *B. campestre* and *B. lineare* are located more than 10 miles from the Moskee project area. The occurrences of both species south of Beulah, Wyoming are located approximately 10 miles from the project area. None of these occurrences would be disturbed by the activities proposed under the Moskee project. While the full extent of the distribution of *B. campestre* and *B. lineare* in the Black Hills is unknown, the appearance of above-ground sporophytes at the known sites is indicative of viable populations with extensive supporting underground biomass (including mycorrhizae). Therefore, while loss of individuals may occur in unknown sites (if any) in the Moskee project area, the viable populations at the known occurrence sites outside the project area would not be affected by the project.
2. Baseline monitoring data for *B. campestre* and the *B. lineare* occurrences in the Black Hills document that the species are able to colonize areas of past disturbance and are persisting at the monitored sites with limited ongoing disturbances (USFS 2005d).
3. Under Alternatives 2, 3, and 4, forest canopy cover would decrease in some portions of the project area. The conditions could benefit *B. campestre* and/or *B. lineare*. Although specific data are lacking on the Black Hills National Forest, the earlier successional conditions that occur with opening the overstory canopy could benefit

site colonization by these wind-dispersed, spore-producing species, if the associated mycorrhizal species and other microsite conditions are present (USFS 2005d).

4. If there are unknown occurrences of these species in the project area, implementation of Alternative 2, 3, or 4 could facilitate expansion. Proposed actions could alter site conditions to those that may be favorable for expansion and/or colonization by *Botrychium* spores (i.e., earlier successional conditions, including shrub shade reduction, disturbed site conditions, and changes in plant competition patterns), as long as associated mycorrhizae and other microsite conditions are present.
5. Under Alternatives 2, 3, and 4, log skidding that results in ground disturbance could impact unknown *Botrychium* individuals, if any exist in the project area. Conversely, skidding may create conditions suitable for colonization by *B. campestre* or *B. lineare* (USFS 2005d).
6. Although uncertainty exists, weed competition and herbicide application are considered to be potential risks to *Botrychium* spp. If herbicide spraying occurred at a *B. campestre* or *B. lineare* site when aboveground plant portions are present, the individual plants could react to the herbicide and a negative effect to those individuals would likely be realized. There would, however, likely be enough belowground spores, gametes, juveniles, etc., so that not all of any one occurrence would be affected by herbicide treatment (Farrar pers. comm.). In addition, if a *B. campestre* and/or *B. lineare* occurrence does exist at a herbicide application site, the individuals would be expected to benefit from reduced weed competition (USFS 2005d).
7. Despite the fact that aboveground stems may be negatively affected, beneficial short- and long-term effects may be realized by prescribed burning proposed under Alternatives 2, 3, and 4. A fast-moving fire may remove aboveground stem portions but would not be expected to affect belowground individuals or parts. Burning may release more nutrients to the soil that may immediately benefit the mycorrhizae and *Botrychium* species, and prescribed fire may provide the disturbance needed for site colonization. An intense fire (wild or prescribed) with high-severity effects such as deep soil heating could negatively affect both the belowground and aboveground portions of *B. campestre* and *B. lineare* individuals. Fuel reduction in adjacent upland conifer stands would be expected to decrease the likelihood of crown fires reaching occurrences of R2 Sensitive plant species such as *B. campestre* and *B. lineare* (USFS 2005d).
8. Complete distribution, abundance, microhabitat needs, and disturbance regime optimal for persistence of *B. campestre* and *B. lineare* are unknown. This lack of information makes it difficult to predict the cumulative effects to these species under any of the Moskee project alternatives. Past, present, and foreseeable actions (as well as natural disturbances) likely have had and could be expected to continue to have both beneficial or negative effects on some of these individuals or entire occurrences, while at the same time contributing to site conditions suitable for colonization by these species or helping to conserve or maintain existing habitat (USFS 2005d).

Refer to Appendix C of the FEIS for the Phase 2 Amendment to the Forest Plan (USFS 2005d) and to the Supplemental Information report on *Botrychium campestre* for the Biological Evaluation for the Phase 2 Amendment to the Forest Plan (USFS 2005e) for more information on *B. campestre* and *B. lineare* and for a more in-depth rationale for the above determination.

RECOMMENDED MEASURES

1. For all action alternatives (2, 3, and 4): To reduce the potential for negative effects on Sensitive plants and habitat for Sensitive plant species, most suitable habitat would be protected from disturbance during proposed activities. Suitable habitat is specified in the Moskee Project Analysis File (E009). The large majority of suitable habitat is excluded from proposed mechanical treatment units. However, mechanical disturbance may occur adjacent to defined treatment units due to landing and skid trail placement. These areas would be placed away from suitable plant habitat. If they are needed near suitable habitat, they would be designated after consultation with a botanist.
2. Regarding all action alternatives (2, 3, and 4): For proposed activity areas that overlap suitable plant habitat, a botanist would be consulted and available during layout of the units and roads to ensure that habitat is protected from an unacceptable level of damaging ground disturbance during implementation. Skid trails would not be used to remove pine from birch-dominated communities. Pine would be removed from birch-dominated communities if it can be accomplished without damaging the birch community.
3. Prescribed fire control lines would not be placed in or near suitable plant habitat. If the need arises, a botanist would be consulted and negative effects to suitable habitat and the surrounding area minimized.

SUMMARY OF DETERMINATION OF EFFECTS

Table 5. Summary of Determination of Effects

Scientific Name/ Common Name	Determination			
	Alt. 1	Alt. 2	Alt. 3	Alt. 4
<i>Botrychium campestre</i> Prairie moonwort	MAII*	MAII*	MAII*	MAII*
<i>Botrychium lineare</i> Narrowleaf grapefern	MAII*	MAII*	MAII*	MAII*
<i>Botrychium multifidum</i> Leathery grapefern	MAII*	MAII*	MAII*	MAII*
<i>Carex alopecoidea</i> Foxtail sedge	MAII*	MAII*	MAII*	MAII*
<i>Cypripedium parviflorum</i> Yellow lady's slipper	MAII*	MAII*	MAII*	MAII*
<i>Platanthera orbiculata</i> Large round-leaved orchid	MAII*	MAII*	MAII*	MAII*
<i>Viburnum opulus</i> var. <i>americanum</i> Highbush cranberry	MAII*	MAII*	MAII*	MAII*

* "MAII" indicates the entire FSM wording of "May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing."

See Appendix C of the FEIS for the Phase 2 Amendment to the Forest Plan (USFS 2005d) for additional information on R2 Sensitive plant species.

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GLOSSARY

High-probability habitat for most Sensitive plant species includes, but is not limited to: sites with additional moisture and/or shade such as shady lower slopes and bottoms adjacent to and including riparian areas; creeks and drainages (especially north-trending); springs, boggy areas and seeps; northwest- to northeast-facing slopes; sites dominated by moisture-loving hardwoods (such as birch, ironwood, or hazelnut) or dominated by spruce, rock outcrops, or native grass meadows.

High-quality plant habitats are those areas of suitable habitat where there appears to be the greatest chance of finding target species. They usually are areas with little to no disturbance from logging (skid trails, landings), livestock use (trailing, browsing), or mining. Most have minimal weed infestations. For most Sensitive plant species, high-quality sites have additional moisture present, a result of high canopy cover when in forested stands and also riparian areas, springs, or seeps. There are some target plant species whose high quality habitat is defined differently.

Hillshade is a command in ESRI ArcInfo and ArcView GIS that creates a grid with the shaded relief effect based on the altitude and aspect of the light source, including any shadows that may be present. The “compute hillshade” command is used to determine the hypothetical illumination of a surface as part of an analysis step or for graphical display. For analysis, “compute hillshade” can be used to determine the length of time and intensity of the sun in a given location. For our purposes, hillshade estimates high-probability Sensitive plant habitat based on the amount of shade and therefore moisture. Moisture seems to be the major factor driving the presence of most Sensitive plant species in the northern Black Hills. Hillshade should be used with other information sources such as aerial photographs, topographic maps, and field reconnaissance. Hillshade may overestimate and/or underestimate high-probability acres, and it may overlook unique microsites.

Low-probability plant habitats are those lacking characteristics desirable for the occurrence of Sensitive plant species. Low-probability plant habitat is fairly consistent throughout the Black Hills National Forest and consists of drier sites such as upland pine and dry meadows with non-native plant species.

Region 2 Sensitive species: Those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by:

- a. Significant current or predicted downward trends in population numbers or density.
- b. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (Forest Service Manual 2670.5, 19).

Suitable habitat is habitat that meets the requirements of a species. Different species have different requirements and not all requirements may be understood at this time. Examples of different possible requirements include vegetation composition, edaphic characteristics, moisture content, landscape structure, and the presence of mycorrhizal associations. Habitat may be suitable but unoccupied, and it may exhibit varying degrees of quality. There is likely a spectrum of suitability that varies over time.

Survey Types:

Field Check – The surveyor gives the area a quick “once-over” but does not walk completely through the project area. A field check examines approximately 2-10% of a project area.

Cursory – The surveyor gives the area a quick “once-over” by walking through the project area. After a cursory survey, approximately 11-24% of the project area has been examined.

General – The surveyor gives the area a closer look by walking through the project area and perimeter or by walking more than once through the area. After a general survey, approximately 25-49% of the project area has been examined.

Intuitive Controlled – The surveyor has given the area a closer look by conducting a complete reconnaissance through a specific part of the project after walking through the project area and perimeter or by walking more than once through the area. An intuitive-controlled survey examines approximately 50-74% of the project area.

Complete – The surveyor has examined the entire area.