Biological Assessment / Biological Evaluation

Prepared for

Black Hills Resilient Landscapes Project
Environmental Impact Statement

Black Hills National Forest
2017

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I. INTRODUCTION

The purpose of this biological evaluation is to analyze and determine the likely effects of the Black Hills Resilient Landscapes (BHRL) project alternatives on federally listed plant species (endangered, threatened, and proposed) and Forest Service sensitive species (2672.11 – Exhibit 01; Plants).

This Biological Evaluation (BE) conforms to legal requirements set forth under section 7 of the Endangered Species Act (ESA) (19 U.S.C. 1536 (c), 50 CFR 402.12 (f) and 402.14). Section 7(a) (1) of the ESA requires federal agencies to use their authorities to further the conservation of listed species. Section 7(a) (2) requires that federal agencies ensure any action they authorize, fund, or carry out is not likely to jeopardize the existence of federally listed species, or destroy or adversely modify designated critical habitat.

Forest Service policy requires that a review of programs and activities, through a biological evaluation (BE), be conducted to determine their potential effect on threatened and endangered species, species proposed for listing, and sensitive species (FSM 2670.3). Under the ESA, a biological assessment (BA) must be prepared for federal actions that are "major construction activities" to evaluate the potential effects of the proposal on listed or proposed species. The contents of the BA are at the discretion of the federal agency, and will depend on the nature of the federal action (50 CFR 402.12(f)). A BE may be used to satisfy the ESA requirement to prepare a biological assessment. Preparation of a Biological Evaluation as part of the NEPA process ensures that TEPS species receive full consideration in the decision-making process. This document tiers directly to the Black Hills National Forest Land and Resource Management Plan (Forest Plan, as amended) and incorporates the analysis conducted for the BA/BE prepared for the Phase II Amendment (USDA Forest Service 2005).

This BA/BE evaluates management activities of all action alternatives and associated mitigation measures as set forth in the Black Hills Resilient Landscapes Project Draft Environmental Impact Statement. Any actions in addition to or outside the scope of these activities will require further analysis and documentation.

II. DESCRIPTION OF THE PROPOSAL

Purpose and Need

The Black Hills National Forest is proposing action to move landscape-level vegetation conditions in the project area toward Forest Plan objectives in order to increase ecosystem resilience to insect infestation and other natural disturbances, contribute to public safety and the local economy, and reduce risk of wildfire to landscapes and communities. Due to epidemic levels of mountain pine beetle activity in the project area over the past decade, the Forest has moved away from vegetation objectives identified in the Forest Plan. The epidemic now appears to be slowing in most parts of the Forest, and the Black Hills Resilient Landscapes Project intends to re-align Forest conditions with Forest Plan objectives.

The Black Hills Resilient Landscapes Project considers a proposed action (Alternative A) and a no action alternative (Alternative B).

Project Area Description
The project area includes National Forest System lands that are managed by the Black Hills National Forest within the areas designated by the Secretary of Agriculture under the amended Healthy Forests Restoration Act (HFRA, 16 U.S.C. 6591), excluding Inventoried Roadless Areas and certain management areas. The project area includes approximately 1,098,000 acres of NFS lands.

The project area includes the following management areas (MAs):
Table 1: Management Areas

MA	Emphasis	Acres*	Proposed activities
3.31	Backcountry motorized recreation	6,870	Fuels/hazard trees
3.32	Backcountry non-motorized recreation	8,948	Fuels/hazard trees
3.7	Late succession landscapes	18,484	Fuels/hazard trees
4.1	Limited motorized use and forest products	41,374	All
5.1	Resource production	558,520	All
5.1A	Southern Hills forest and grassland	27,845	Fuels/hazard trees
5.2A	Fort Meade VA Hospital watershed	3,299	Fuels/hazard trees
5.4	Big game winter range	388,950	All
5.43	Big game and resource production	10,083	All
5.6	Forest products, recreation, and big game	34,043	All
*MA acres in project area	Total	1,098,425	

Proposed Action (Alternative A)
The Forest Service is proposing to conduct the following land management activities in the project area, beginning in approximately 2018 and continuing for about 10 years.

Fuel Reduction and Prescribed Fire
To increase ecosystem resilience and reduce wildfire hazard to landscapes and communities, the proposal includes mechanical fuel treatments (up to 7,000 acres per year), prescribed fire (up to 10,000 acres per year), and hazard tree removal. Total acres implemented annually would depend on budget constraints and, for prescribed burning, weather conditions.

Enhancement of Hardwoods and Grasslands
The project would cut encroaching pine from areas of hardwoods and grasslands. Pine and spruce removal from aspen stands would take place on up to 2,400 acres. On up to 30,900 acres of pine stands, pine and spruce would be removed from aspen inclusions. Regeneration of declining aspen stands would occur on up to 4,000 acres. Pine removal from oak stands would take place on up to 5,400 acres. Pine would be cut from encroached grasslands on up to 14,200 acres.

Pine Structural Stage Modification
The following activities would occur in MAs 4.1, 5.1, 5.4, 5.43, and 5.6.

Table 2: Structural stage totals – All relevant management areas combined

SS	Objective		Existing		Deviation from obj.
	Acres	Percent	Acres	Percent	
1	44,522	5%	78,306	9%	+33,785
2	44,522	5%	54,102	6%	+9,581
3A	89,043	10%	65,712	7%	-23,331
3B	133,565	15%	42,273	5%	-91,292
3C	44,522	5%	23,934	3%	-20,588
4A	222,608	25%	423,388	48%	+200,781
4B	222,608	25%	145,641	16%	-76,967
4C	44,522	5%	53,088	6%	+8,567
5	44,522	5%	3,987	<1%	-40,536
Total	890,430	100%	890,430	100%	

Overstory removal or uneven-age management would occur on up to 187,000 acres of SS 4A stands. These treatments would decrease 4A and increase younger structural stages, which are generally below Forest Plan objectives. Pre-commercial and/or POL thin would occur on up to 25,000 acres per year to increase SS 3A and 3B and to promote growth toward 4B.

Patch cuts would occur on up to 1,300 acres in MA 4.1 and 600 acres in MA 5.6. This treatment would produce SS 1, which is below Forest Plan objectives in these MAs. Tree planting would occur on up to 5,000 acres per year in large burned areas in the southern Black Hills. Without planting, reforestation of these areas may require decades of growing.

Mechanical site preparation would occur in open, mature pine stands on up to 4,000 acres in the western Black Hills where thick sod hinders establishment of pine seedlings. This action would expose soil, creating conditions favorable for establishment of pine.

Summary Table

Maximum activity acres and miles are displayed below. The amount implemented may be less.

Table 3: Treatment Summary

Fuel and hazard tree treatments	
Mechanical and manual fuel treatments *(shaded fuel break construction; thin, pile, and burn fuels; scatter, shred, or chip fuels; cut, lop, and scatter fuels); includes up to 4,000 acres of shaded fuel breaks with commercial removal*	70,000 acres (7,000 acres per year)
Prescribed fire *(broadcast; piles)*	100,000 acres (10,000 acres per year)
Hazard tree treatments *(cut; push; explosives; other)*	As needed and funded
Hardwood and grassland enhancement	
Removal of pine/spruce from aspen stands	2,400 acres
Regeneration of aspen stands	4,000 acres
Removal of pine/spruce from aspen inclusions (possibly commercial)	22,500 acres
Removal of pine/spruce from aspen inclusions (non-commercial)	8,400 acres

Removal of encroaching pine from oak stands	5,400 acres
Removal of encroaching pine from grasslands	14,200 acres
Pine structural stage modification	
Overstory removal and uneven-age individual tree selection *By management area:* *MA 4.1: Approximately 8,970 acres* *MA 5.1: Approximately 129,890 acres* *MA 5.4: Approximately 41,210 acres* *MA 5.43: Approximately 250 acres* *MA 5.6: Approximately 6,790 acres*	187,000 acres
Precommercial and/or POL thin	250,000 acres (25,000 acres per year)
Patch cut *By management area:* *MA 4.1: 1,300 acres* *MA 5.6: 600 acres*	1,900 acres
Tree planting *(MAs 5.1, 5.4, and 5.43)*	5,000 acres
Mechanical site preparation	4,000 acres
Connected actions	
Road construction – Specified	17 miles (expected: 7-10 miles)
Road construction – Temporary	39 miles (expected: 20-30 miles)
Temporary roads on existing templates	182 miles (expected: 120-150 miles)
Road conversion (unclassified to system)	20 miles

No Action Alternative (Alternative B)
The National Environmental Policy Act (NEPA) requires the study of the No Action Alternative and it will be used as a basis for comparing the effects of the proposed action.

The No Action Alternative assumes that no implementation of any elements of the action alternative will take place within the project area. This alternative represents no attempt to actively respond to the purpose and need for action or the issues, concerns, or comments identified during scoping. There would be no effort to modify existing vegetation and related fuels conditions in the project area. Vegetation structure would change over time through natural growth and mortality and events such as wildfires, storms, insects, and disease. None of the actions associated with the project would occur.

Actions such as ongoing and planned Forest protection efforts, fire suppression, noxious weed treatment, and recurring road maintenance on system roads would continue as directed by the Forest Plan. Vegetation management would not take place unless authorized by other decisions (see cumulative effects).

Affected Environment
The BHNF is situated within the Middle Rockies ecoregion, surrounded on all sides by the Great Plains ecoregion (Omernik & Griffith 2014). Referred to as an *Island in the Plains*, the Black Hills encompass an area of 5,121 square miles (approximately three million acres). The varied topography, geology, and climate result in a corresponding variety in plant communities, including such diverse elements as ponderosa pine (*Pinus ponderosa*) forests typical of the western mountains, grasslands typical of the Great Plains, and white spruce (*Picea glauca*)

forests typical of the boreal north. Midwest hardwood types are represented by stands dominated by oak, ash, and elm. Approximately 30 percent of the plant taxa in the Black Hills have their primary ranges to the west, though Midwestern, eastern, and northern associated taxa are also significantly represented in the local flora (McIntosh 1931).

The Black Hills Community Inventory by the Nature Conservancy's Midwest Conservation Science Center and the Midwestern Resources Center was the first systematic classification to describe the vegetation of the Black Hills by adopting the standardized National Vegetation Classification (Marriott et al. 1999, Marriott and Faber-Langendoen 2000). Although further refinement of the Black Hills Community Inventory is needed, approximately 70 native plant communities have been described in the Black Hills.

Because the potential treatment areas for the Black Hills Resilient Landscapes (BHRL) Project span across much of the Forest, the Black Hills National Forest in its entirety is considered the affected environment for this discussion.

The majority of plant species considered rare in the Black Hills are best described as boreal disjuncts (species that became isolated in the cooler, moister forest and riparian areas of the Black Hills as glaciers retreated and the Great Plains environment became established). The next closest populations of these species to the populations located in the Black Hills are generally found in Canada and the northeastern United States.

No Botanical Areas or Research Natural Areas are included in the Black Hills Resilient Landscapes Project Area. However, Botanical Areas and Research Natural Areas are located adjacent to the project area boundary and have potential to be impacted by the proposed treatments. Potential impacts to these special designation areas are addressed in the Black Hills Resilient Landscapes Project Botany Report (contained in the project record).

There are eight sites (comprising approximately 550 acres) identified as montane grasslands which are recommended for conservation in the Survey and Mapping of Black Hills Montane Grasslands report (Marriott 2012). Approximately 440 of the 550 acres recommended for conservation are co-located with areas identified for treatment in the Black Hills Resilient Landscapes Project. Treatments proposed in these areas include commercial timber harvest, non-commercial thinning and pine removal from grasslands and aspen/oak stands, and fuels reduction. Potential impacts to these special designation areas are addressed in the Black Hills Resilient Landscapes Project Botany Report (contained in the project record).

III. THREATENED, ENDANGERED, AND PROPOSED SPECIES CONSIDERED AND ANALYZED

Consultations To Date

The U.S. Fish and Wildlife Service (USFWS) lists for Threatened and Endangered species were accessed on December 7, 2017 for the states of South Dakota and Wyoming. As of this date, there is one federally listed *Threatened* plant species (Leedy's roseroot) known to occur in one county within the Black Hills National Forest (USDI Fish & Wildlife Service 2015, 2017a, 2017b, 2017c, 2017d, 2017e). The *Threatened* plant species occurs in a county included in the

project area. There are no documented occurrences of the species within the project area, and habitat suitable for supporting Leedy's roseroot is not likely to occur beyond the currently occupied area. Habitat consists of moist and shaded granitic cliffs at an elevation of approximately 7,000 feet.

Leedy's roseroot (*Rhodiola integrifolia* subsp. *leedyi*) is the sole *Threatened* plant species known to occur in the Black Hills National Forest. It is documented from a single site in Pennington County, SD. The known population of Leedy's roseroot is located in the Black Elk Wilderness (Management Area 1.1A) which is not included in the project area. Leedy's roseroot occurrences and/or suitable habitat are not located within or in the vicinity of the project area, resulting in no effects (direct, indirect, or cumulative) to the species. A determination of "no effect" (FSM 2671.44) to the *Threatened* species has been confirmed.

Another *Threatened* species, Ute lady's tresses (*Spiranthes diluvialis*), is identified as having potential to occur in the Black Hills in Wyoming (USDI Fish & Wildlife Service 2015). The species is associated with alluvial banks, point bars, floodplains, or ox-bows along perennial streams. Numerous surveys for botanical resources have been conducted in the project area and no occurrences of Ute lady's tresses have been observed (USDA Forest Service 2016). Project area habitat is considered marginally suitable for the species (i.e. no alluvial banks, point bars, floodplains, or ox-bows associated with perennial streams (USDI Fish & Wildlife Service 2015)). Ute lady's tresses occurrences and/or suitable habitat are not located within or in the vicinity of the project area, resulting in no effects (direct, indirect, or cumulative) to the species. A determination of "no effect" (FSM 2671.44) to the *Threatened* species has been confirmed.

Threatened, endangered, and proposed plant species which could potentially occur on the Black Hills National Forest were identified and addressed through informal consultation with the South Dakota and Wyoming Field Offices of USFWS during the Phase II Amendment development (USDA Forest Service 2005).

Candidate species have sufficient information on their biological status and threats to warrant a proposal to list as endangered or threatened, but development of a listing regulation is precluded by other higher priority listing activities. Species which are candidates for listing under the Endangered Species Act (ESA) are automatically placed on the Region 2 Forester's sensitive species list. The analysis and determination of effects for candidate species are included as part of the Biological Evaluation for sensitive species. No current candidate plant species are known to occur on the Black Hills National Forest (USDI Fish & Wildlife 2014). No further analysis is required for species not known or suspected to occur in the project area.

It is my determination that implementation of either of the two alternatives as described will not affect any threatened or endangered plant species or designated critical habitat.

IV. SPECIES INFORMATION

The sensitive species list for the Rocky Mountain Region was published as a Regional Supplement (2600-2017-1) effective July 13, 2017. The list of sensitive species was verified by visiting the Region 2 Threatened, Endangered and Sensitive Species Program website (USDA

Forest Service 2017).

There are 14 plant species on the Forest Service Region 2 sensitive species list that are known or suspected to occur, or for which suitable habitat is suspected to occur, on the Black Hills National Forest. These species are shown in Table 4. There are 2 plant species designated *Threatened* by the US Fish & Wildlife Service which are either known to occur or for which the species' area of influence extends onto the Black Hills National Forest. These species are shown in Table 5.

TABLE 4: REGION 2 SENSITVE PLANT SPECIES						
Common Name	**Scientific Name**	**Black Hills Habitat**	**Species Known To Occur in Project Area[1]**	**Suitable Habitat Present in Project Area**	**Rationale for Further Analysis**	**Analyzed Further[3]**
Prairie moonwort	*Botrychium campestre*	Black Hills sites occur on limestone substrates and are primarily in open grassland habitats with high to moderate forb diversity. Little bluestem (*Schizachyrium scoparium*) occurs at several of the sites. Black Hills occurrences range in elevation from approximately 3,850 to 6,700 ft.	Yes	Yes	Species and suitable habitat located within project area. Occurrences and/or habitat have potential to be impacted by proposed activities.	Yes
Narrowleaf grapefern	*Botrychium lineare*	Black Hills sites occur on limestone substrates in open grassland habitats (both high elevation montane grasslands and lower elevation little bluestem dominated habitats), on old (estimated 15-25 years) native surface roadbeds and in openings along perennial streams. Elsewhere in its range, this species has often been documented in areas of road disturbances and other human and natural disturbances. Black Hills occurrences range in elevation from approximately 4,200 (in Wind Cave national Park) to 6,700 ft.	Yes	Yes	Species and suitable habitat located within project area. Occurrences and/or habitat have potential to be impacted by proposed activities.	Yes
Foxtail sedge	*Carex alopecoidea*	In the Black Hills, foxtail sedge is currently known from two general areas: The Cement Ridge area along the South Dakota–Wyoming border, and the Bear Lodge Mountains of Wyoming. Foxtail sedge is primarily found along open, perennial streams, often with old beaver dams or ponds. Occurrences have also been found in spruce dominated riparian areas and in drainages with dense shrub cover. Plants are primarily documented in the transitional areas between saturated soils and the more mesic upland areas. Black Hills occurrences range in elevation from approximately 3,800 to 5,900 ft..	Yes	Yes	Species and suitable habitat located within project area. Occurrences and/or habitat have potential to be impacted by proposed activities.	Yes
Mountain lady's slipper	*Cypripedium montanum*	Mountain lady's slipper is known from a single population in the Black Hills, located on a shady, sheltered mid-slope under white spruce (*Picea glauca*) on an east-facing slope at an elevation of approximately 5,500 ft.	No	Yes	Suitable habitat located within project area has potential to be impacted by proposed activities.	Yes
Yellow lady's slipper	*Cypripedium parviflorum*	Habitat in the Black Hills includes stream banks under both white spruce (*Picea glauca*) and deciduous overstories, moist cliffs (usually north-facing), and moist areas/seeps under white spruce or mixed conifer forest. Occasionally, it is found on upper mesic forest slopes. Black Hills occurrences range in elevation from approximately 3,500 to 6,500 ft.	Yes	Yes	Species and suitable habitat located within project area. Occurrences and/or habitat have potential to be impacted by proposed activities.	Yes
Giant helleborine	*Epipactis gigantea*	In the Black Hills, giant helleborine is known only from Cascade Springs in Fall River County, South Dakota at approximately 3,400 ft. It is likely dependent upon the constant moisture and warmth provided by the springs. No other warm springs are known on Forest Service administered	No	No	There are no warm springs within the Project Area and the influence zone for the known population is outside of the Project Area.	No

TABLE 4: REGION 2 SENSITVE PLANT SPECIES						
Common Name	**Scientific Name**	**Black Hills Habitat**	**Species Known To Occur in Project Area[1]**	**Suitable Habitat Present in Project Area**	**Rationale for Further Analysis**	**Analyzed Further[3]**
		land in the Black Hills.				
Trailing clubmoss	*Lycopodium complanatum*	Black Hills occurrences are located in the northern portion of the forest on shaded, north-facing, white spruce dominated slopes often with paper birch (*Betula papyrifera*) or quaking aspen (*Populus tremuloides*). Black Hills occurrences range in elevation from approximately 4,900 to 6,350 ft.	Yes	Yes	Species and suitable habitat located within project area. Occurrences and/or habitat have potential to be impacted by proposed activities.	Yes
Large round-leaf orchid	*Platanthera orbiculata*	Black Hills occurrences are found primarily on shady, north-facing slopes in paper birch/hardwood or white spruce forests on moist, rich, humus soil. Black Hills occurrences range in elevation from approximately 4,300 to 6,200 ft.	Yes	Yes	Species and suitable habitat located within project area. Occurrences and/or habitat have potential to be impacted by proposed activities.	Yes
Sage willow	*Salix candida*	In the Black Hills, sage willow is limited to one natural verified extant occurrence west of Deerfield (McIntosh Fen, 6,000 ft.). In addition there is a historical collection for the general area "from Loring Siding to Minnekahta" (unknown if on BKF or private land) and an experimental site planted on the Mystic district in 2007. 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 natural occurrence is wet meadow/fen.	Yes	Yes	Species and suitable habitat located within project area. Occurrences and/or habitat have potential to be impacted by proposed activities.	Yes
Autumn willow	*Salix serissima*	Black Hills occurrences are documented from the central to north-central Black Hills in fens and wet meadows often dominated by *Carex* spp. and other *Salix* spp. It appears to occur in the same unique hydrologic conditions as *Salix candida*. Black Hills occurrences range in elevation from approximately 5,600 to 6,000 ft.	Yes	Yes	Species and suitable habitat located within project area. Occurrences and/or habitat have potential to be impacted by proposed activities.	Yes
Bloodroot	*Sanguinaria canadensis*	In the Black Hills, bloodroot occupies floodplains, forested terraces, drainage bottoms, and north-facing footslopes in open, rich hardwood plant communities. It is currently known only from the northeast portion of the Black Hills, from the east side of Spearfish Canyon to west of Tilford. Black Hills occurrences range in elevation from approximately 3,900 to 5,000 ft.	Yes	Yes	Species and suitable habitat located within project area. Occurrences and/or habitat have potential to be impacted by proposed activities.	Yes
Narrowleaf peatmoss	*Sphagnum angustifolium*	Narrowleaf peatmoss has recently been confirmed in one central Black Hills fen site on BKF land. Information on local distribution and habitat is limited. This plant is widely distributed throughout northern North America and is	Yes	Yes	Species and suitable habitat located within project area. Occurrences and/or habitat have potential to be impacted by proposed activities.	Yes

TABLE 4: REGION 2 SENSITVE PLANT SPECIES						
Common Name	**Scientific Name**	**Black Hills Habitat**	**Species Known To Occur in Project Area[1]**	**Suitable Habitat Present in Project Area**	**Rationale for Further Analysis**	**Analyzed Further[3]**
		restricted to fens, open mires, sedge fens and muskeg habitats throughout its range (McQueen & Andrus 2007). In Region 2 Narrowleaf peatmoss is not known outside of fen habitats.				
Highbush cranberry	*Viburnum opulus* var. *americanum*	In the Black Hills, highbush cranberry occurs at mid-elevations in wet, shaded habitats along streams, springs and canyon bottoms. The majority of documented Black Hills occurrences are in drainage bottoms or low slopes with moist soil conditions and partial shade. Sites are primarily associated with paper birch/ironwood (*Ostrya virginiana)* and paper birch/hazelnut (*Corylus cornuta)* communities, with or without white spruce or quaking aspen. A few sites are in ponderosa pine/bur oak (*Pinus ponderosa/Quercus macrocarpa)* communities. Paper birch is present at almost all currently known sites. Black Hills occurrences range in elevation from approximately 3,800 to 5,700 ft.	Yes	Yes	Species and suitable habitat located within project area. Occurrences and/or habitat have potential to be impacted by proposed activities.	Yes
Great-spurred violet	*Viola selkirkii*	Black Hills occurrences are known from BKF lands, Custer State Park and Mt. Rushmore National Monument and are restricted to a concentrated area (ca. 36 square miles) of the central core on igneous or metamorphic bedrock. Microhabitats are often moist, cold air drainages, in shaded to open areas, and often in the vicinity of granitic rock outcrops. White spruce is usually the dominant overstory with a variable understory. Currently known occurrences on BKF lands are located within the Black Elk Wilderness and/or the Norbeck Wildlife Preserve. One site extends outside of Black Elk Wilderness. Black Hills occurrences range in elevation from approximately 5,200 to 7,000 ft.	Yes	Yes	Species and suitable habitat located within project area. Occurrences and/or habitat have potential to be impacted by proposed activities.	Yes

TABLE 5: Federally Listed Threatened Plant Species						
Common Name	**Scientific Name**	**Black Hills Habitat**	**Species Known To Occur in Project Area[1]**	**Suitable Habitat Present in Project Area**	**Rationale for Further Analysis**	**Analyzed Further[3]**
Leedy's roseroot	*Rhodiola integrifolia* subsp. *leedyi*	Black Hills population is located in the vicinity of Black Elk Peak at an elevation of approximately 7,000 feet. Individuals are found on moist north-facing granite cliff habitat.	No	No	Project area is outside of known geographic range and does not contain moist granitic cliffs at	No

TABLE 5: Federally Listed Threatened Plant Species						
Common Name	**Scientific Name**	**Black Hills Habitat**	**Species Known To Occur in Project Area[1]**	**Suitable Habitat Present in Project Area**	**Rationale for Further Analysis**	**Analyzed Further[3]**
					comparable elevations.	
Hooded lady's tresses	*Spiranthes diluvialis*	There are no known populations of Hooded lady's tresses in the Black Hills, despite extensive focused surveys. It is associated with alluvial banks, point bars, floodplains, and ox-bows within close proximity to perennial streams at elevations less than 7,000 feet. The nearest confirmed population is located in Niobrara County, Wyoming.	No	No	No known populations or suitable habitat are present in the Project Area.	No

[1]Species presence known or suspected in or immediately adjacent to the project area.

[2]Suitable habitat present in or immediately adjacent to the project area.

[3]Species not known or suspected to be present and with no suitable habitat present in the project area are not further evaluated because they would not be affected by project activities.

No further analysis is required for species not known or suspected to occur in the project area, and for which no suitable habitat is present. Tables 4 and 5 above document the rationale for excluding a species from further analysis. Determinations for all other species are documented below in the Determinations section.

Analysis was conducted on the effects of the proposed action on Region 2 sensitive species known to occur, or for which potentially suitable habitat occurs, in the Black Hills Resilient Landscapes project area. This analysis considers management activities of the action alternative (Alternative A) and associated mitigation measures as set forth in the Black Hills Resilient Landscapes Project Environmental Impact Statement.

The following analysis is derived from surveys, professional knowledge, and the best available science. An effects analysis has been completed for species (and associated habitats) which have potential to be impacted by the proposed project. Twelve Region 2 sensitive plant species are known to occur within the project area, and one additional species is not documented within the project area but has potential for suitable habitat presence. Effects have been analyzed for known Region 2 sensitive plant populations and corresponding suitable habitat, as well as occurrences which may be present but have not been detected during survey. Extensive species accounts were prepared for the Black Hills National Forest Land and Resource Management Plant (Phase II Amendment) Final Environmental Impact Statement (USDA Forest Service 2005). This document tiers to the FEIS and information included in the following species accounts is partially derived from it. Due to the size of the project area, complexity of analysis, and the short time allotted in which to conduct analysis, the site specificity for analysis purposes was defined at the stand size. If Region 2 sensitive plant species occur within a potential treatment area, or stand, actions are assumed to directly impact the species present.

Prairie Moonwort *(Botrychium campestre)*

Habitat: Prairie moonwort is considered a grassland species, associated with sandy grassland habitats in prairies, dunes, railroad sidings, and fields over limestone. All known Black Hills prairie moonwort occurrences are found on limestone substrate and are associated with varying levels of previous disturbance (USDA Forest Service 2014). Limestone substrates are found in a band circling the granitic central core of the central part of the Black Hills (USDA Soil Conservation Service 1990).

Species Distribution, Status, and Trend: Prairie moonwort is a North American endemic that ranges from the Canadian provinces of Alberta, Ontario, and Saskatchewan to Montana, Wyoming, Colorado, Nebraska, Iowa, Minnesota, North Dakota, South Dakota, Michigan, Wisconsin, and New York. It is considered an uncommon species with a patchy widespread distribution, but is likely more widespread and abundant across its range than is recorded. There are twenty-six known occurrences of prairie moonwort on the Black Hills National Forest, with several additional occurrences from lands adjacent to National Forest (USDA Forest Service 2014). The twenty-six Black Hills National Forest occurrences span a wide range with the northern-most occurrence found in the Sundance Trails area (Bearlodge RD) and the southern-most occurrence found southwest of Hot Springs (Hell Canyon RD). All Black Hills occurrences have been confirmed through genetic analysis by Dr. Don Farrar of Iowa State University.

Prairie moonwort is currently assigned a rank of S1, critically imperiled, in Wyoming (Heidel 2012a, Heidel 2012b). South Dakota has designated the rank of S2S3, imperiled because of rarity or only found locally (SDGFP 2016). Global rank is G3G4, apparently secure, with locally abundant, disjunct populations (NatureServe 2015).

Four of the core prairie moonwort sites have been established for annual monitoring. According to the 2013 / 2014 monitoring report, the known populations of prairie moonwort are generally stable with no changes in the disturbance regime. However, some populations had decreased in number most likely due to changes in the local nutrient regime, including correlations to drought conditions experienced in 2012 (USDA Forest Service 2014). Moonwort species do not produce above ground parts every year and may remain alive but dormant in the soil for years (Johnson-Groh 1998). The production of above ground parts is believed to respond to weather of the previous spring and summer (Farrar 2006). Although observed numbers of plants were lower at some of the sites visited in 2013 and 2014 compared to previous years, a trend cannot be confirmed until more monitoring has occurred, particularly in years not following a drought (USDA Forest Service 2014).

Project Review: Three stands identified in Alternative A for potential commercial treatment are co-located with prairie moonwort sites. One of the three sites co-occurs with narrowleaf grapefern and highbush cranberry, and another site co-occurs with narrowleaf grapefern. Approximately eight other prairie moonwort sites are located adjacent to, or within close proximity of, potential commercial treatment areas. Prairie moonwort sites are also co-located with areas identified as grasslands, where encroaching pine could potentially be removed, and areas identified for potential fuel reduction and prescribed fire. The project area includes grasslands over limestone substrate, which are elements of identified suitable habitat for prairie moonwort. Since specific habitat relationships for this species are not well understood and the species can be difficult to detect, a conservative approach assumes that potentially suitable habitat does support other undocumented individuals within the project area, which could be impacted by actions associated with Alternative A.

Narrowleaf Grapefern *(Botrychium lineare)*

Habitat: Narrowleaf grapefern is associated with a wide variety of ecological conditions making it difficult to describe suitable habitat. Generally it is found in areas of open canopy over calcareous soils with a history of disturbance. All known Black Hills narrowleaf grapefern populations occur on limestone substrate in open grassland habitats (USDA Forest Service 2014, USDA Forest Service 2016). Limestone substrates are found in a band circling the granitic central core in the central part of the Black Hills (USDA Soil Conservation Service 1990).

Species Distribution, Status, and Trend: Narrowleaf grapefern ranges from across Canada south into the western half of the United States, extending east to Minnesota. In Region 2, narrowleaf grapefern is known from Colorado, Wyoming, and South Dakota. It is considered an uncommon species with a patchy widespread distribution, but is likely more widespread and abundant across its range than is recorded. There are fifteen known occurrences of narrowleaf grapefern on the Black Hills National Forest with one additional occurrence from Wind Cave National Park lands adjacent to National Forest (USDA Forest Service 2014, USDA Forest Service 2016). The fifteen Black Hills National Forest occurrences are on the west side of the

forest spanning from the northern-most occurrence in the vicinity of Sand Creek to the southern-most located southwest of Pringle (Hell Canyon RD).

Narrowleaf grapefern is currently ranked S1, critically imperiled, in both Wyoming and South Dakota (Heidel 2012a, Heidel2012b, SDFGP 2016) and has a global rank of G2G3, imperiled. It had been a candidate for Federal listing, but was officially removed from the candidate list by the U.S. Fish and Wildlife Service (USDI Fish & Wildlife 2007).

Sites visited in 2013 and 2014 reported apparently stable populations with some disturbance and presence of invasive species. Fewer individuals were observed at one site (Boles Canyon) than in previous years, but further monitoring is necessary to make any trend determinations (USDA Forest Service 2014).

Project Review: Two narrowleaf grapefern sites are co-located with stands identified in Alternative A for potential commercial treatment. One of these sites co-occurs with prairie moonwort, and the other site co-occurs with highbush cranberry. Six additional narrowleaf grapefern sites are located adjacent to, or within close proximity of, potential treatment areas. Narrowleaf grapefern sites are also co-located with areas identified as grasslands, where encroaching pine could potentially be removed, and areas identified for potential fuel reduction and prescribed fire. The project area includes grasslands occurring over limestone substrate, which are elements of identified suitable habitat for narrowleaf grapefern. Since habitat relationships for this species are not well understood and the species can be difficult to detect, a conservative approach assumes that potentially suitable habitat does support other undocumented individuals within the project area, which could be impacted by actions associated with Alternative A.

Foxtail Sedge *(Carex alopecoidea)*

Habitat: Foxtail sedge is generally located in open areas along perennial streams, often with old beaver dams or ponds. It is usually associated with calcareous substrates (Standley 2002). Occurrences are primarily documented in the transitional areas between saturated soils and more mesic uplands, but can be associated with many different wetland, riparian, and upland communities. This habitat is found throughout the project area, but is concentrated in the northern part of the Forest (USDA Forest Service 2014, USDA Forest Service 2016).

Species Distribution, Status, and Trend: Foxtail sedge is widely distributed from eastern to central Canada, the Northeastern United States through the Great Lakes region, south to Tennessee, and west to Wyoming. In the Black Hills, foxtail sedge is currently known from two general areas, the Cement Ridge area along the South Dakota – Wyoming border, and in the Bear Lodge Mountains in Wyoming. There are thirty-four occurrences of foxtail sedge known to occur on the Black Hills National Forest between the Bearlodge and Northern Hills Ranger Districts (USDA Forest Service 2014).

Foxtail sedge is currently ranked as S2, imperiled, in Wyoming (Heidel 2012a, Heidel 2012b) and S2S3, imperiled to vulnerable, in South Dakota (SDGFP 2016). It currently holds a global rank of G5, secure (NatureServe 2015).

Foxtail sedge sites visited in 2013 and 2014 appear stable and have persisted, though nearly all sites displayed varying levels of livestock impacts and invasive plant presence. Modified grazing practices and additional fencing have been implemented at several sites to address previous years' livestock concerns. None of the 2013 or 2014 visited sites displayed impacts from timber management activities (USDA Forest Service 2014).

Project Review: Approximately six foxtail sedge sites are co-located with areas identified in Alternative A for potential commercial treatment. No other Region 2 sensitive plant species co-occur with foxtail sedge at these sites. Approximately ten additional foxtail sedge sites are located adjacent to, or within close proximity of, potential treatment areas. Sites co-located with potential treatment areas generally consist of a portion of the documented occurrences overlapping with the stand, not any entire sites. Other potential treatment areas are identified in the vicinity of riparian areas, wetlands, and meadows, which would present the possibility of impacts to foxtail sedge suitable habitat. Foxtail sedge sites are also co-located with areas identified as grasslands, mixed pine and aspen, and mixed aspen and oak; all areas with potential to receive treatments removing pine. Other areas of suitable habitat for foxtail sedge, and possibly undocumented individuals, may occur within the project area and have potential to be impacted by actions associated with Alternative A.

Mountain Lady's Slipper *(Cypripedium montanum)*

Habitat: Across its range, mountain lady's slipper is known to occur in a wide variety of habitats including mesic to dry coniferous and deciduous forests, openings, and thickets (Sheviak 2002). In the Black Hills the species is documented on a shaded east-facing slope dominated by a fairly dense white spruce overstory with moist to mesic-moist soil conditions. This habitat is found throughout the project area, with highest concentrations in the northern part of the Forest (USDA Forest Service 2014, USDA Forest Service 2016).

Species Distribution, Status, and Trend: Mountain lady's slipper occurs in the northwestern United States (including Alaska) from Oregon south to California, east to Montana, Wyoming, and South Dakota, and in Canada from British Columbia to Saskatchewan. It is known from a single site in the Black Hills, on the south end of Spearfish Canyon in the northern part of the Forest. Approximately twenty individuals are recorded from the site (USDA Forest Service 2014).

Mountain lady's slipper is currently unranked in South Dakota (SDGFP 2016), and ranked S1, critically imperiled, in Wyoming (Heidel 2012a, Heidel 2012b). It holds a global rank of G4, apparently secure (NatureServe 2015).

The mountain lady's slipper population was documented in 2012, with baseline data collected in 2013. The site is revisited annually to develop population trends, but trend data has not yet been established. The population appears stable. Potential concerns at the mountain lady's slipper site include observed wildlife trailing in close proximity to individuals and invasive plant species in the vicinity of occurrences. No impacts have been observed from livestock activity, recreational use, or timber management. With all known occurrences on the forest located at one site, the population is susceptible to a single event removing the species from the Planning Area (USDA Forest Service 2014).

Project Review: The single known occurrence of mountain lady's slipper in the Black Hills is located on the southern end of Spearfish Canyon, Management Area 4.2A. This management area is not included in the project area boundary, resulting in no impacts to the site from actions associated with the project. Despite no other occurrences recorded of mountain lady's slipper during multiple surveys (some focused solely on the species), suitable habitat for the species is present in other areas where potential treatments are identified in Alternative A. Suitable habitat and possibly undocumented individuals have potential to be impacted by actions associated with Alternative A, including commercial treatments, hardwood enhancement, and fuel treatments.

Yellow Lady's Slipper *(Cypripedium parviflorum)*

Habitat: Currently known locations in the Black Hills indicate this species is generally associated with mesic conditions on limestone rock outcrop areas, often on north-facing slopes, and on mesic to saturated soils in and adjacent to riparian areas and drainages. Yellow lady's slipper is often associated with hardwoods, conifer-deciduous communties, deciduous communities, and confier communities (mostly white spruce, *Picea glauca*). Limestone substrates are found in a band circling the granitic central core in the central Black Hills (USDA Soil Conservation Service 1990) and the conifer-deciduous community on limestone is largely located in the northern part of the limestone band. Yellow lady's slipper has also been found outside of this habitat type in the Black Hills, so suitable habitat for the species could occur outside of this described geographic area (USDA Forest Service 2014, USDA Forest Service 2016).

Species Distribution, Status, and Trend: Primarily circumboreal in distribution, yellow lady's slipper ranges from Canada south into most of the United States, and is known to occur in all states within Region 2. There are at least fifty known occurrences of yellow lady's slipper on the Black Hills National Forest (USDA Forest Service 2014). Occurrences are located on three of the Black Hills National Forest Ranger Districts (Bearlodge, Northern Hills, and Mystic).

Yellow lady's slipper is currently ranked S2, imperiled, in Wyoming (Heidel 2012a, Heidel 2012b) and S3S4, vulnerable to apparently secure, in South Dakota (SDGFP 2016). It has a global rank of G5, secure (NatureServe 2015).

Nine yellow lady's slipper sites were visited during the 2013 / 2014 monitoring period. Due to limited years of monitoring, trend information is not available for six of the sites. Observations report each of the populations as persisting and showing little impact from management activities. No impacts from livestock grazing, timber management, or road construction and maintenance were reported from sites visited between 2013-2014. Invasive plant species were reported within the vicinity of occurrences at eight of the nine sites visited. The species is considered stable and persisting on the Forest (USDA Forest Service 2014).

Project Review: Approximately eight yellow lady's slipper sites are co-located with areas identified in Alternative A for potential commercial treatment. One site co-occurs with bloodroot, and another site with highbush cranberry. Approximately 15 additional yellow lady's slipper sites are located adjacent to, or within close proximity of, potential treatment areas. Yellow lady's slipper sites are also co-located with areas identified as grasslands, and mixed

aspen and oak; areas with potential to receive treatments removing pine. Several yellow lady's slipper sites are located within areas identified for potential fuel treatments and prescribed burning. Other areas of suitable habitat for yellow lady's slipper, and possibly undocumented individuals, may occur within the project area and have potential to be impacted by actions associated with Alternative A.

Trailing Clubmoss *(Lycopodium complanatum)*
Habitat: In the Black Hills, trailing clubmoss is restricted to moist microhabitats within boreal plant communities in ravines, steep drainages, steep slopes within white spruce stands, and on moist streamside benches from 5,000 to 6,340 feet. Documented occurrences are associated with a canopy of white spruce, paper birch (*Betula papyrifera*), and ponderosa pine. Suitable habitat for trailing clubmoss is concentrated in the northern part of the Forest (USDA Forest Service 2014, USDA Forest Service 2016).

Species Distribution, Status, and Trend: Trailing clubmoss is circumboreal and common across northern latitudes but disjunct or sparse at the southern limits of the species' distribution, such as in the Black Hills. In the Black Hills, trailing clubmoss is disjunct from the nearest occurrences in the Rocky Mountains. There are ten known occurrences of trailing clubmoss on the Black Hills National Forest (USDA Forest Service 2014). Occurrences are located on Bearlodge and Northern Hills Ranger Districts.

Trailing clubmoss is currently unranked in Wyoming (Heidel 2012a, Heidel 2012b), and ranked S2, imperiled, in South Dakota (SDGFP 2016). It has a global rank of G5, secure (NatureServe 2015).

Trailing clubmoss sites visited during the 2013 / 2014 monitoring period are persisting and appear stable, similar in size and extent to previous years' observations. Evidence of livestock trailing and non-native or invasive plants were present in the vicinity of 2013/2014 monitor sites. Impacts from these disturbances were not observed directly affecting individual trailing clubmoss plants, though they were identified as appearing to be the most significant potential threats to the species (USDA Forest Service 2014).

Project Review: There are no trailing clubmoss sites co-located with areas identified in Alternative A for potential commercial treatment. Approximately 5 sites are located adjacent to, or within close proximity of, potential treatment areas. Two trailing clubmoss sites are co-located with areas identified for potential fuel treatments, and other sites are near areas of grasslands, and mixed aspen and oak; areas with potential to receive treatments removing pine. Other areas of suitable habitat for trailing clubmoss, and possibly undocumented individuals, may occur within the project area and have potential to be impacted by actions associated with Alternative A.

Large Round-Leaf Orchid *(Platanthera orbiculata)*
Habitat: Large round-leaved orchids are found in dense to partially open canopy with filtered light, dense understory vegetation, and damp, humic soil with a thick litter layer. Elevated soil moisture appears to be a key component of its habitat. It occupies boreal hardwood habitats associated with paper birch/hazelnut/white spruce forest. Suitable habitat for large round-leaved

orchid is concentrated in the northern part of the Forest (USDA Forest Service 2014, USDA Forest Service 2016).

Species Distribution, Status, and Trend: Large round-leaved orchids are found in boreal regions of North America including Canada, the Appalachians, Great Lakes region, and the Black Hills. There are more than thirty known occurrences of large round-leaf orchid documented on the Black Hills National Forest. Black Hills occurrences are found in cool, mesic areas of the Black Hills on the Bearlodge, Northern Hills, and Hell Canyon Ranger Districts (USDA Forest Service 2014).

Large round-leaf orchid is currently ranked S1, critically imperiled, in Wyoming (Heidel 2012a, Heidel 2012b) and S3, vulnerable, in South Dakota (SDGFP 2016). It has a global rank of G5, secure (NatureServe 2015).

Twenty-four large round-leaf orchid sites were visited during the 2013 / 2014 monitoring report period. Occurrence observations from the monitored sites included increased numbers, apparantly stable populations, and noticeable decline in observed individuals. Sites displaying decrease in number of individuals generally provided little indication as to a cause, other than assumptions on effects of drought and, in some cases, direct and indirect impacts from mountain pine beetle activity. Impacts associated with livestock activity and presence of non-native or invasive plant species were noted from several sites. These types of impacts, along with long-term drought and dramatic climate changes, are regarded as presenting the greatest threats to large round-leaf orchids and their habitat. Overall, populations have persisted, with a few of the smaller populations appearing to be in decline. Large round-leaf orchid populations are reported to be secure on Black Hills National Forest based on the large number of occurrences distributed across three geographically separate areas (USDA Forest Service 2014).

Project Review: Four large round-leaf orchid sites are co-located with areas identified in Alternative A for potential commercial treatment. Approximately eleven additional large round-leaf orchid sites are located adjacent to, or within close proximity of, potential treatment areas. Large round-leaf orchid sites are also co-located with areas identified as mixed pine and aspen, and mixed aspen and oak; areas with potential to receive treatments removing pine. Several sites are located within areas identified for potential fuel treatments. Other areas of suitable habitat for large round-leaf orchid, and possibly undocumented individuals, may occur within the project area and have potential to be impacted by actions associated with Alternative A.

Sage Willow *(Salix candida)*

Habitat: Sage willow is generally found in 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. It is a wetland obligate species and is commonly associated with wet meadows and fens (Argus 2010). Suitable habitat for sage willow is concentrated in the northern part of the Mystic Ranger District and southern part of the Northern Hills Ranger District (USDA Forest Service 2014, USDA Forest Service 2016).

Species Distribution, Status, and Trend: Sage willow occurs across Canada, the northern continental United States, and Alaska. It is considered secure throughout its range, but locally

rare in some areas. There are two known sites of sage willow in the Black Hills, located at McIntosh Fen and an experimental transplant near Heely Creek, both on the Mystic Ranger District (USDA Forest Service 2014).

Sage willow is currently ranked S2, imperiled, in Wyoming (Heidel 2012a, Heidel 2012b) and S1, critically imperiled, in South Dakota (SDGFP 2016). It has a global rank of G5, secure (NatureServe 2015).

Sage willow in the Black Hills has been negatively affected in past years by stem boring insects, disease, and drought. Non-native or invasive plants are documented from the vicinity of both sage willow sites. The 2013 / 2014 monitoring report describes the populations as stable, with evidence of mortality observed both years. Mortality is more commonly noted during drought years and/or the year following drought, with disease and insect activity likely correlated and increasing in drier conditions (USDA Forest Service 2014).

Project Review: The sage willow occurrence at McIntosh Fen is not located within the project area boundary, though areas identified in Alternative A for potential commercial treatment are located on both sides of the drainage surrounding the occurrence. The other sage willow site, Heely Creek, is near to areas identified for potential commercial treatment. It is also located within an area identified as grassland, with potential for pine removal treatments. Other areas of suitable habitat for sage willow, and possibly undocumented individuals, may occur within the project area and have potential to be impacted by actions associated with Alternative A.

Autumn Willow *(Salix serissima)*

Habitat: Like sage willow, autumn willow is found in rich calcareous fen habitats with high mineral content, along stream banks near fens, and in wet meadows with high concentrations of calcium and minerals. Suitable habitat for sage willow is concentrated in the northern part of the Mystic District and southern portion of the Northern Hills District (USDA Forest Service 2014, USDA Forest Service 2016).

Species Distribution, Status, and Trend: Autumn willow occurs across Canada and the northern continental United States. There are five natural known sites of autumn willow on the Black Hills National Forest, located on the Mystic and Northern Hills Ranger Districts. A sixth site near Heely Creek contains experimental plantings of autumn willow (USDA Forest Service 2014).

Autumn willow is currently ranked S1, critically imperiled, in both Wyoming and South Dakota (Heidel 2012a, Heidel 2012b, SDGFP 2016). It has a global rank of G5, secure (NatureServe 2015).

The 2013 / 2014 monitoring report identified all six autumn willow sites as persisting and stable. Drought and impacts from stem boring insects are reported to present the greatest threats to the species on the Black Hills National Forest, both of which have affected observed vigor of individuals in various years since monitoring began. Non-native and invasive plant species were observed within the vicinity of all but one autumn willow site (USDA Forest Service 2014).

Project Review: There are no autumn willow sites co-located with areas identified in Alternative A for potential commercial treatment. Four sites are located adjacent to, or within close proximity of, potential treatment areas. Autumn willow sites are co-located with areas identified for potential fuel treatments and grasslands, and near areas identified as mixed aspen and oak; areas with potential to receive treatments removing pine. Other areas of suitable habitat for autumn willow, and possibly undocumented individuals, may occur within the project area and have potential to be impacted by actions associated with Alternative A.

Bloodroot *(Sanguinaria canadensis)*
Habitat: Bloodroot generally occurs in floodplains, forested terraces, drainage bottoms, and north-facing foot slopes in open, rich hardwood plant communities. Suitable habitat for bloodroot is concentrated in the northern portion of the Forest (USDA Forest Service 2014, USDA Forest Service 2016).

Species Distribution, Status, and Trend: Bloodroot occurs in moist forests from Nova Scotia to Florida and west to Manitoba and Kansas, with the Black Hills supporting the western-most, outlying population. There are over twenty known occurrences of bloodroot on the Black Hills National Forest located in the northeast portion of the Forest, on the Northern Hills Ranger District (USDA Forest Service 2014).

Bloodroot is currently unranked in Wyoming (Heidel 2012a, Heidel 2012b) and ranked S4?, apparently secure, in South Dakota (SDGFP 2016). The global rank is G5, globally secure (NatureServe 2015).

Monitoring over the 2013 / 2014 period resulted in twelve bloodroot site visists. Observations from sites noted similar conditions to previous years and the population on the Black Hills is reported to be persisting and apparently stable. Based on monitoring observations, threats to bloodroot include presence of non-native or invasive plants and impacts from livestock trailing. Competition with non-native and invasive plants is reported to be the greatest threat to bloodroot, resulting in a general decline in suitability of habitat at several sites (USDA Forest Service 2014).

Project Review: Three bloodroot sites are co-located with areas identified in Alternative A for potential commercial treatment, one of which co-occurs with highbush cranberry. Approximately eight additional bloodroot sites are located adjacent to, or within close proximity of, potential treatment areas. Bloodroot sites are also co-located with areas identified as mixed aspen and oak, and near areas of mixed pine and aspen; areas with potential to receive treatments removing pine. Several sites are located within areas identified for potential fuel treatments. Other areas of suitable habitat for bloodroot, and possibly undocumented individuals, may occur within the project area and have potential to be impacted by actions associated with Alternative A.

Narrowleaf Peatmoss *(Sphagnum angustifolium)*
Habitat: Rangewide, narrowleaf peatmoss is known to occur in a wide range of habitats, from bogs to rich (high pH) fens (McQueen & Andrus 2007). Suitable habitat for narrowleaf peatmoss in the Black Hills is not yet fully understood and described; therefore it is assumed that any rich fens or areas with known populations of other *Sphagnum spp.* have potential to support

narrowleaf peatmoss. These habitats are concentrated along the contact between the limestone and central core, as well as wetlands in the northern part of the Forest (USDA Forest Service 2014, USDA Forest Service 2016).

Species Distribution, Status, and Trend: Narrowleaf peatmoss is found across North America from Alaska and the Yukon to Nova Scotia, with its southern extent from California to North Carolina. On the Black Hills National Forest, narrowleaf peatmoss has only been positively identified from one site, in the Rochford Cemetary Fen (RCU_001) on the Mystic Ranger District (USDA Forest Service 2014).

Narrowleaf peatmoss is currently unranked in Wyoming (Heidel 2012a, Heidel 2012b) and South Dakota (SDGFP 2016). The global rank is G5, globally secure (NatureServe 2015).

The 2013 / 2014 monitoring report noted similar conditions to previous years' observations at the single known narrowleaf peatmoss site (USDA Forest Service 2014). Non-native or invasive plant species observed at the site included Canada thistle (*Cirsium arvense*) and common mullein (*Verbascum thapsus*). No livestock impacts were reported from the site during the most recent monitoring period. The site is reported to be apparently stable, but highly susceptible to impacts associated with road maintenance and improvements.

Project Review: The single known narrowleaf peatmoss site is located adjacent to areas identified in Alternative A for potential commercial treatment. It is co-located with an area identified as grassland, where pine removal could potentially occur, and within an area identified for potential fuel treatments. Other areas of suitable habitat for narrowleaf peatmoss, and possibly undocumented individuals, may occur within the project area and have potential to be impacted by actions associated with Alternative A.

Highbush Cranberry *(Viburnum opulus* var. *americanum)*
Habitat: Highbush cranberry is generally found in wet, shaded habitats along streams, springs, and canyon bottoms. Suitable habitat for highbush cranberry is concentrated in the northern part of the Forest (USDA Forest Service 2014, USDA Forest Service 2016).

Species Distribution, Status, and Trend: Highbush cranberry is found in Canada from British Columbia to New Brunswick, and south to Idaho across to West Virginia (Nellessen 2006). There are more than sixty known occurrences of highbush cranberry on the Black Hills National Forest, all on the Bearlodge and Northern Hills Ranger Districts (USDA Forest Service 2014).

Highbush cranberry is currently ranked S2, imperiled, in Wyoming (Heidel 2012a, Heidel 2012b) and unranked in South Dakota (SDGFP 2016). The global rank is G5T5, the variety is globally secure (NatureServe 2015).

The 2013 / 2014 monitoring report describes the monitored populations as stable, noting some ungulate herbivory on individual shrubs. Non-native or invasive plant species competition and impacts from livestock use appear to be the largest threats to highbush cranberry on the Black Hills National Forest (USDA Forest Service 2014).

Project Review: Four highbush cranberry sites are co-located with areas identified in Alternative A for potential commercial treatment. One site co-occurs with narrowleaf grapefern, and another site co-occurs with bloodroot. Approximately ten additional highbush cranberry sites are located adjacent to, or within close proximity of, potential treatment areas. Highbush cranberry sites are co-located with areas identified as mixed aspen and oak; areas with potential to receive treatments removing pine. Several sites are located within areas identified for potential fuel treatments. Other areas of suitable habitat for highbush cranberry, and possibly undocumented individuals, may occur within the project area and have potential to be impacted by actions associated with Alternative A.

Great-Spurred Violet *(Viola selkirkii)*

Habitat: Great spurred violet is usually found in cold, moist, shaded microhabitats associated with vegetated granitic rock outcrops or white spruce forest with a highly variable understory. Suitable habitat for great spurred violet is concentrated in the high elevation granites of the east-central part of the Forest (USDA Forest Service 2014, USDA Forest Service 2016).

Species Distribution, Status, and Trend: Great spurred violet is a circumboreal species found in Canada, northern United States, Eurasia, and Japan. On the Black Hills National Forest, currently known occurrences are located within the Black Elk Wilderness or Norbeck Wildlife Preserve, with one site extending south outside of the Norbeck boundary. There are nineteen known sites of great spurred violet on the Black Hills National Forest, all on the Hell Canyon Ranger District. Additional occurrences are known from Custer State Park and Mt. Rushmore National Memorial (USDA Forest Service 2014).

Great spurred violet is currently unranked in Wyoming (Heidel 2012a, Heidel 2012b) and ranked S2S3, imperiled to vulnerable, in South Dakota (SDGFP 2016). The global rank is G5?, globally secure (NatureServe 2015).

The 2013 / 2014 monitoring report describes the six sites visited in 2013 and the four sites in 2014 as persisting and apparently stable (USDA Forest Service 2014). Due to the limited actions permitted in the Black Elk Wilderness and Norbeck Wildlife Preserve, occurrences of great spurred violet are not considered to be at risk from management activities. Public use of these areas, along with periodic flooding, climate change, wildfire, and presence of non-native or invasive plants could potentially threaten the future persistence of the species on the Forest.

Project Review: One great spurred violet site extends into the project area and is located adjacent to an area identified in Alternative A for potential commercial treatment. The site is also located near an area identified for potential fuel treatments. Other areas of suitable habitat for great spurred violet, and possibly undocumented individuals, may occur within the project area and have potential to be impacted by actions associated with Alternative A.

Suitable Sensitive Plant Habitat

Although a majority of treatment areas identified in the Black Hills Resilient Landscapes Project are primarily ponderosa pine forests, treatments are also proposed in areas containing spruce, hardwoods, and grasslands. Associated activities, including road construction and maintenance, log decking, and debris piles, have potential to occur outside of identified treatment areas. The

Design Criteria for the Black Hills Resilient Landscapes Project include a requirement to consult with a qualified (0430 series) botanist for review of any activities occurring beyond treatment areas if the activities will impact suitable sensitive plant habitat. Following is a general description of suitable sensitive plant habitat.

White Spruce Habitat

The Black Hills has one of the southern-most populations of white spruce (*Picea glauca*) in the United States. White spruce is the most shade-tolerant of the Black Hills tree species, enabling regeneration and growth under closed canopy conditions. The cool, moist environments of white spruce stands provide habitat diversity in an otherwise ponderosa pine dominated landscape. Several Region 2 sensitive plant species are associated with white spruce communities.

Hardwood Habitat Including Paper Birch and Bur Oak

Paper birch/Hazelnut (*Betula papyrifera/Corylus cornuta*) Forest occurs in drainage bottoms with and without streams and on northerly slopes. In the northern Black Hills where precipitation is higher and temperatures are cooler, Paper birch/Hazelnut Forest extends to lower elevations. Stands of this type are found in mesic habitats such as shaded, narrow gulches and north-facing slopes. Paper birch/Hazelnut Forest often transitions into Bur oak/Ironwood (*Quercus macrocarpa/Ostrya virginiana*) Forest in Black Hills drainages at lower elevations. A number of boreal disjunct plant species, including some Region 2 sensitive plant species, occur in stands of cool, moist Paper birch/Hazelnut Forest and Bur oak/Ironwood Forest.

Riparian Habitat Including Wetlands and Fens

Riparian areas are lands which interface between water and drier uplands. They are an ecologically diverse habitat and provide bank stability, sediment filtering, streamside shading, and nutrient input into streams and lakes. Riparian areas are generally located along perennial and intermittent streams. Approximately 2,108 miles of intermittent and perennial streams occur on Black Hills National Forest lands (BHRL Watershed Report 2017).

More than half of the Region 2 sensitive plant species in the Black Hills are associated with wetland and/or riparian areas. Consequently, management protective of general riparian and wetland habitat and processes is an important component of protection for native plant species and communities, including Region 2 sensitive plant species. Inventory completed by the US Fish and Wildlife Service has documented approximately 3,981 acres of wetlands occurring on Black Hills National Forest lands (USDI Fish and Wildlife Service 1995).

Fens

In Region 2, a fen is defined as an ancient wetland with continuous organic soil accumulation of 16 inches or more, with perennial support from ground water, and consistent saturation throughout the year (Austin 2005). They are classified as groundwater dependent ecosystems and are an important element of biological diversity due to their water-holding capability, unique characteristics and species assemblages, and support of several globally rare plant and invertebrate species. Fens occur where settings provide a highly specific balance between climatic conditions, bedrock lithology, constant ground water flow, and where natural barriers contribute to maintaining saturated conditions (Bedford & Godwin 2003). In the Black Hills, peat develops primarily from mosses (particularly *Sphagnum spp.*), the roots of sedges, and to a

lesser extent from grasses.

The Forest Service Handbook 2509.25 directs managers to avoid any loss of rare wetlands such as fens and springs because these areas cannot be replaced in-kind. Many fens in Region 2 are known to be 6,000 to 10,000 years old, and often support sensitive plant species. Due to the slow rate of peat accumulation and specificity of ecological requirements, fens are difficult to reclaim and deemed essentially irreplaceable (USDA Forest Service 2011). Black Hills National Forest is in the process of performing fen resource inventory as part of the national effort to catalogue Groundwater Dependent Ecosystems. Approximately 25 fens are believed to have been verified on the Black Hills National Forest, largely occurring on the Mystic Ranger District but also located on Northern Hills and Hell Canyon Ranger Districts (USDA Forest Service 2010). Other areas have been identified as potential fens and have yet to be surveyed to confirm or deny the classification.

The Regional Watershed Conservation Practices (WCP) Handbook contains standards used when conducting activities in riparian, water influence zones, and wetlands as does the Forest Plan (Standards 1306 and 3106).

Meadows

A meadow is a tract of grassland or a low area near a river. Meadows can be considered riparian habitat, but not all riparian habitat is classified as a meadow. Meadows occur across the Forest at various elevations. A unique type of meadow endemic to the Black Hills is the Montane Grassland, ranked G1S1 ("critically imperiled" on a global and local basis) in South Dakota and Wyoming. Protections and potential impacts to Black Hills Montane Grasslands are discussed in the Black Hills Resilient Landscapes Project Botany Report. Several Region 2 sensitive plant species, including, but not limited to, prairie moonwort, narrowleaf grapefern, foxtail sedge, sage willow, and autumn willow occur in meadow habitats.

Guideline 4111 in the Forest Plan recommends slash piles scheduled for burning to be located outside of meadows that contribute to the Waters of the United States and that a buffer should be established to keep sediment, ash, and debris out of these channels.

V. EFFECTS OF THE ALTERNATIVES

For the purpose of this analysis, cumulative effects are bound in space by the Forest boundary since this is the area affected by Forest Service management decisions and which contains actions proposed by the project. Cumulative effects are bound in time by twenty years (ten years prior and ten years into the future), from the time of BHRL project implementation. This time frame encompasses the impacts related to the most recent planning efforts and the foreseeable impact of the Black Hills Resilient Landscapes Project.

Past, present, and foreseeable vegetation projects include timber sales which have occurred over the past ten years, those currently in progress, and those which are in the planning phase across all districts of the Forest. The Forest contains 133 grazing allotments located with the project area (BHRL Project Range Report).

There was no field reconnaissance or survey performed specifically for this project, though all botanical survey data available on the Black Hills National Forest were considered. Forest-wide survey specifically for Region 2 sensitive plant species and Black Hills National Forest species of local concern (SOLC) has occurred since 2001. Since this time, the list of Region 2 sensitive species has been revised several times and some current listed species may not have been considered in earlier surveys. The most recent list was effective as of July 13, 2017 (USDA Forest Service 2017). The information collected during botanical surveys has provided information on distribution and habitat associations for targeted species and has contributed to the effects analysis of the project alternatives. The focus of botanical surveys includes identifying and mapping community types and determining the probability of an area for supporting sensitive plant species, in addition to locating and recording sensitive plant species occurrences. Botanical surveys often occur in forested habitats, but also cover other habitats with high potential to support sensitive plant species, including riparian areas, wetlands, and meadows. Areas identified for focus during surveys have been determined by a combination of aerial imagery, topographic maps, local knowledge, and professional judgement during field reconnaissance. Less intensive surveys are also conducted in habitats with lower potential for supporting sensitive species. All botanical survey data is stored in the Black Hills National Forest plants database (USDA Forest Service 2016). Impacts and risks to sensitive plant species on the Forest were evaluated using the best available science and data.

The majority of forested landscapes on BHNF have received survey for botanical resources, either through contracted survey, Forest Service botanist survey, or field review in support of projects occurring across all Forest districts. It is recognized that Region 2 sensitive plants are not always observed when present, even in areas where botanical survey has occurred. In some cases, plants may not be in an identifiable growth stage, they may be in dormancy, or may be difficult to see among surrounding vegetation.

Assumption for Analysis

- All figures are approximate
- Actual acres/miles implemented would depend on weather, priorities, funding, and other factors
- Mapped stand boundary locations are approximate. Stand structure determinations are preliminary. Stand delineation and structure are subject to corrections based on field review.
- Areas that have not been surveyed for botanical resources are occupied (as directed in FSM_R2_2670_2017-1)

Design Criteria for Botanical Resources

Table 3: Design Criteria for Botanical Resources

All Activities	All activity areas would be reviewed to determine presence and location of botanical resources prior to contract or permit issuance.
	Any Region 2 sensitive plant species or plant species of local concern located after contract or permit issuance will be appropriately managed by active coordination between permittee, contractor or purchaser, Forest Service line officer, project administrator, and botanist. (Standard 3115)
	Riparian areas or wetlands where populations of Region 2 sensitive plants are located would be avoided during surface disturbing activities (Standard 3106).

	Surface disturbing activities, such as skid trails, landings, road construction, etc., would be avoided in meadows, wetlands, and riparian areas (suitable rare plant habitat, Standard 1306). If, during implementation, activities such as these cannot be located outside of meadows, a qualified (0430 series) botanist would be contacted prior to implementation to determine if special requirements are warranted to protect site integrity.
	For areas outside of designated treatment areas, surface disturbing activities including, but not limited to skid trail designation, landing creation, pile construction, road construction or reconstruction/conversion, would be evaluated for risk to rare plants and their habitat by a qualified (0430 series) botanist prior to implementation.
	Rehabilitation of pile sites would include site preparation and seeding to return the sites to productivity and control the spread of noxious weeds.
	No wheeled or tracked equipment would be allowed within 100 feet of fens.
	Temporary roads, skid trails, landings, or piles would not be located within 100 feet of fens.
	Treatment within fens would be limited to hand felling of trees and would require assessment by a qualified (0430 series) botanist prior to implementation. All woody material (chips, piles, cut and chunk, logs, etc.) would be removed from the fen area with as little impact to the fen as possible (i.e. hand carrying out via a single trail/disturbance).
	Treatments within or adjacent to Black Hills Montane Grasslands will require assessment by qualified (0430 series) botanist prior to implementation.
	When logging in previously disturbed stands, existing skid trails and landings would be used whenever possible.
	Treatment would not occur within Research Natural Areas.
	Treatment would not occur within Botanical Areas.
Road Construction / Maintenance	New road construction would require consultation with a qualified (0430 series) botanist prior to implementation.
	No road construction or reconstruction/conversion would be allowed if proposed site is located over 40% slope and up- or downslope of a known rare plant population in order to avoid the effects of mass movement.
	Neither magnesium chloride nor calcium chloride would be used for dust abatement within 500 feet of fens or known rare plant sites.
	New road construction would not occur within 100 feet of fens.
Herbicide Spraying	Areas of exposed soil associated with Mechanical Site Preparation would be monitored and treated as needed to prevent spread of noxious weeds.
	Spraying treatments would not occur within 200 feet of fens.
Hardwood / Grassland Enhancement	Proposed treatment areas would be reviewed for rare plants and/or suitable habitat prior to contract or permit issuance.
Pine Structural Stage Modification	Mechanical site preparation would not occur within 100 feet of fens or known rare plant sites.
	Cable logging in areas known to contain rare plants would only occur when there is a foot of snow on the ground to avoid soil disturbance and impacts to rare plants.

Analysis of Effects of the Proposed Action (Alternative A)

Direct and Indirect Effects: Twelve Region 2 sensitive plant species were located in the area designated for treatment in Alternative A (action alternative), and one other species was determined to have suitable habitat within designated treatment areas (Table 4). Habitats most likely to support the species analyzed for in this project include moist and shaded white spruce-dominated slopes, moist to mesic hardwood stands, drainages with spruce and/or hardwoods, grasslands, and riparian areas. Some species are known to occur beyond these areas, but generally as outlier individuals.

Fuel Reduction and Prescribed Fire
Locations identified for potential fuel reduction and/or prescribed fire to occur include portions of most of the types of habitat with higher suitability for supporting Region 2 sensitive plants. Areas identified as aspen, oak, pine/aspen mix, aspen/oak mix, and grasslands for the BHRL project analysis equal around 250,000 acres in the project area. Fuel treatments could occur across approximately 1/3 (82,000 acres) of these communities. Identification and extent of hardwoods, grasslands, and fuels GIS files are preliminary and approximate, but this provides some estimates on the acres of these habitats potentially subject to fuel treatments.

Actions associated with fuel treatments involve thinning tree densities (generally ponderosa pine) and assorted methods of addressing the produced woody material, including piling, lop and scatter, and shredding or chipping. Objectives may be achieved manually (by hand) or through the use of mechanized equipment. Mechanical fuel treatments, prescribed fire, and hazard tree removal as proposed in Alternative A would increase ecosystem resilience and reduce the potential for landscape-level wildfires. Fuel treatments have the potential to negatively impact Region 2 sensitive plants by direct contact with fire or indirectly by increased exposure to sediment and ash via runoff. The effects of these impacts are largely determined by the frequency, intensity, and season of the fire, along with climatic patterns to include moisture availability and any other pre-fire stressors to vegetation. Areas supporting Region 2 sensitive plants in the Black Hills are often associated with drainage bottoms, north-facing slopes, and spruce and/or hardwood overstories; typically areas with a higher soil moisture content where lower intensity burning would be expected. Lower intensity fire related impacts to vegetation are considered short-term, present from the time burning occurs until approximately the following growing season. However, higher intensity burns have the potential to affect below-ground biomass and alter species composition, including a possibility of Region 2 sensitive plant mortality. Aside from short-term negative impacts, prescribed fire can provide long-term benefits for understory vegetation, including Region 2 sensitive plants. Long-term benefits may become apparent within several months of treatment implementation, by removal of non-native and/or invasive plant species, reduction in surrounding competetion for resources, and removal of decadent growth-inhibiting grass and other vegetation. These benefits persist until the ecosystems again reach pre-implementation conditions, a time-frame which can be highly variable and driven by many factors (Neary et al. 1999). Fuel treatments help maintain a healthy amount of fuels on landscapes, reducing the risk of catastrophic wildfires. With heavier fuel loads, fire tends to smolder and move more slowly through affected areas, resulting in greater vegetative mortality than lower intensity fires (Neary et al. 1999). Fuel treatments provide the benefits of nutrient cycling, removal of decadent growth, and natural disturbance through a

managed process. So, although proposed fuel treatments could impact individual Region 2 sensitive plants and their habitat, the negative effects are determined to be short-term (generally one season), with more long-term benefits (5-15 years) becoming apparent soon after treatments occur.

Enhancement of Hardwoods and Grasslands
The project would cut encroaching pine from areas of hardwoods and grasslands to enhance these areas. Region 2 sensitive species with higher potential to occur in hardwoods and grasslands include prairie moonwort, narrowleaf grapefern, foxtail sedge, yellow lady's slipper, large round-leaf orchid, sage willow, autumn willow, bloodroot, and highbush cranberry. The other four species analyzed for this project have lower potential to occur in these areas, though presence remains a possibility.

The action of removing pine and spruce from hardwood stands is capable of providing a benefit of retaining these stands as more suitable sensitive plant habitat. The impacts to sensitive plant species associated with the action depend on the method used to achieve the result. Hand falling pine and/or spruce in these areas would cause the least amount of disturbance, still presenting the possibility of sensitive plants being crushed by falling trees or covered by dropped trees and debris.

Mechanical treatments to remove pine and/or spruce from hardwoods would result in more extensive impacts to the understory vegetation from wheeled or tracked heavy equipment passing through, as well as soil compaction and exposure of bare soil. These impacts have the potential to lower the suitability of the habitat for sensitive plants by altering the understory/forb community during the process of enhancing the overstory. Areas where pine and/or spruce are removed from the overstory will result in more sunlight reaching the understory, potentially creating a change in micro-habitats by increasing temperature and evapotranspiration. Impacts to mycorrhizal fungi in the soil could impact sensitive species dependent upon relationships with these organisms.

An increase in sunlight and exposure of bare soil creates favorable conditions for non-native and/or invasive plant species migration to new areas. These species have potential to out-compete native and sensitive plant species for resources and can alter species composition in areas to a point where it is no longer considered suitable sensitive plant habitat.

Removal of encroaching pine from grasslands would provide the benefit of retaining a site as a grassland, offering more habitat suitable for supporting certain sensitive plants. Impacts of the action to sensitive plants are similar to those discussed above (for hardwood enhancement), and would depend upon the method by which the result is achieved. Potential impacts from the action include crushing sensitive plant occurrences, covering sensitive plants with debris, and introduction or spread of non-native or invasive plant species.

Pine Structural Stage Modification
Actions included with pine structural stage modification include overstory removal, precommercial and/or POL thinning, patch cuts, tree planting, and mechanical site preparation. In general, pine forests are not considered highly suitable for supporting Region 2 sensitive

plants in the Black Hills. Some species are known to occupy pine stands, usually consisting of individuals on the periphery of the core occurrences located nearby within an inclusion of more suitable habitat (white spruce, aspen/birch, etc.). These inclusions of spruce and hardwoods within pine stands have potential to be impacted by activities occurring in surrounding or adjacent areas.

Heavy equipment associated with mechanical treatments can directly impact understory plants by crushing or uprooting, or by compacting soil or otherwise altering the forest floor. The equipment can also loosen and diplace soil, which can then collect in drainages and other low-lying areas suitable for supporting Region 2 sensitive plant species. Microsite hydrology and fungal communities can be affected by heavy equipment to a point where Region 2 sensitive species (such as prairie moonwort, narrowleaf grapefern, yellow lady's slipper, mountain lady's slipper, and large round-leaf orchid) could be inhibited from establishing.

Mechanical site preparation to promote the establishment of pine seedlings would result in exposing bare soil on up to 4,000 acres in open, mature pine stands. Although the action creates conditions favorable for pine establishment, it also provides opportunity for establishment and spread of non-native and/or invasive plant species. Once established in the mechanically prepared areas, these species have potential to spread into other nearby areas of suitable sensitive plant habitat.

Other potential indirect effects result from greater use of existing roads for hauling, resulting in an increase in erosion and dust pollution. Sensitive plant individuals that are not documented which occur along roads could experience reduced photosynthetic capacity due to a coating of dust on the leaves. Also, removal of timber may open access to areas previously protected from impacts by livestock and illegal off-road vehicle use. New use in areas increases not only the potential for unauthorized collecting, trampling, and other losses of individuals, but also increases the susceptibility of non-native or invasive plant species invasion.

Connected Actions

Supporting actions associated with proposed action include road construction (Specified: up to 17 miles, Temporary: up to 39 miles), reconstruction and/or maintenance for use of temporary roads on existing templates, road conversion (from unclassified to system designation), and creation of skid trails and slash piles. Roads and skid trails have the potential to alter ground surface by crushing and/or uprooting vegetation, compacting or otherwise altering soil, exposing bare soil, and introducing non-native and/or invasive plant species to an area. New road construction is not proposed within 500 feet of any known Region 2 sensitive plant occurrences. Use of existing Unclassified roads could occur within 500 feet of 4 sites supporting Region 2 sensitive plants (foxtail sedge, large round-leaf orchid, bloodroot, highbush cranberry), and one temporary road is proposed within 500 feet of another site (trailing clubmoss).

A potential beneficial indirect effect of the proposed action is the introduction of disturbance, such as use of temporary roads and skid trails. These disturbed areas, if decommissioned, treated for invasive species, and left undisturbed for a decade could become suitable habitat for Region 2 sensitive species such as narrowleaf grapefern and prairie moonwort, as these species are associated with historically disturbed areas.

Slash piles are often situated outside of pine stands, in open areas, or on the periphery of grasslands/meadows. Multiple passings to these areas by heavy equipment can compact soil and devegetate pathways. Piles have the potential to be placed upon Region 2 sensitive plant species, most notably prairie moonwort and narrowleaf grapefern. Undocumented individuals of these species have the potential to be buried by debris. Piling of unused forest materials results in alteration of the site below via increased temperatures, blocking of sunlight and other resources, and general surface disturbance. Piles planned for burning result in high temperatures below and surrounding piles, and further surface disturbance. Although an approved seed mix is distributed across the affected area, non-native and/or invasive plant species commonly colonize these areas after burning (Haskins & Gehring 2004).

Dust Abatement

Use of dust abatement (water, magnesium chloride, calcium chloride, etc.) causes a decrease in airborne dust. Airborne dust can adhere to photosynthetic surfaces ultimately causing a decrease in the ability of an individual plant to grow. The addition of salt to dust abatement treatments allows the treatment to be effective for a longer period of time; however, high concentrations of ions in the soil matrix caused by the addition of magnesium chloride or calcium chloride can decrease plant growth and survival (Goodrich et al. 2009). These ions usually move down slope from treated roads, but impacts can be observed up slope and relate to application rate (Goodrich et al. 2008, Piatt and Krause 1974). The distance from treated road surface causing impacts to vegetation would increase with an increase in the surface area to which the treatment was applied, the application rate, and average precipitation (Goodrich et al. 2008, Goodrich et al. 2009). On average, chloride ions can move down slope from the site of application approximately six meters and magnesium can move three meters from application site regardless of the soil type (Goodrich et al. 2009).

Aspen (*Populus tremuloides*) growing down slope from application sites could show necrosis of leaf margins, crown damage, and mortality depending on the application rate and surface area treated upslope from the tree (Goodrich et al. 2009). In coniferous tree species, high concentrations of ions in needle tissue can cause an increase in susceptibility to agents such as fungus, insects, and mechanical damage caused by frost and snow (Goodrich et al. 2009). In grasses, germination generally decreases with increased concentration of magnesium ions present in the soil (Ryan et al. 1975).

Impacts to Habitat

Design Criteria require that consultation with a qualified, professional series botanist occur prior to ground disturbance in suitable sensitive plant habitat. The intent is that this consultation would minimize impacts to the habitat and any occurrences of Region 2 sensitive plant species located in the potential habitat. If impacts of ground disturbance on suitable habitat cannot be avoided, the possible impacts to the habitat itself are discussed below. Impacts to Region 2 sensitive species are discussed separately.

White Spruce

Impacts to white spruce stands should be minimal because the treatment areas target ponderosa pine stands, hardwoods, and grasslands, although white spruce may be targeted for removal from

hardwood stands. Impacts to white spruce stands outside of treatment areas could occur if landings, log decks, roads, or debris piles need to be constructed in order to facilitate timber harvest. Ponderosa pine could potentially be removed from white spruce stands that are found within larger ponderosa stands. If either of these potential impacts to white spruce stands occurs, impacts to the habitat include removal of white spruce and damage to standing white spruce, including damage to root structures, during felling and removal of ponderosa pine. Road construction in white spruce habitat could alter the local hydrology, create a vector for non-native or invasive plant introduction, and create a source of erosion. In addition to the impacts discussed in the Dust Abatement section, use of chemicals can cause needle burn or mortality of white spruce along the road, particularly down slope and the risk increases with area treated, application rate and frequency, and distance from the treated surface (Goodrich et al. 2009). Changes in the overstory of white spruce stands would cause changes to the under and midstory, which in turn impact the habitat which certain Region 2 sensitive species require to survive.

Hardwood Habitat Including Paper Birch, Aspen, and Bur Oak
Impacts to hardwood habitats are discussed in the above section *Enhancement of Hardwoods and Grasslands.* Beyond what is noted there, impacts to this habitat include damage to standing hardwoods, including damage to root structures, during felling and removal of ponderosa pine. Changes in the overstory of hardwood stands would cause changes to the under and midstory, which in turn impact the habitat which certain Region 2 sensitive species plant SOLC require to survive.

Riparian Habitat Including Wetlands and Fens
Plant species in wetlands, riparian areas, and seeps could be impacted by changes in hydrology and water quality. Roads that currently exist in the water influence zone of wetlands can cause increased erosion, which can modify stream bank geometry and cause an increase in overland flow. Increases in overland flow will have the net effect of maximizing runoff and minimizing infiltration. While the increased runoff results in overall greater water yield, the storm water is delivered relatively quickly through surface processes rather than through sustained subsurface flows, which are often critical to wetland hydrology (Moore et al. 2006). Impacts to fens specifically are discussed in the Black Hills Resilient Landscapes Project Botany Report.

While direct impacts to riparian habitat are possible, moist soils and riparian areas are protected during timber harvest and new road-building on National Forest land under Best Management Practices and Forest Service Manual 2509.25. In addition to the impacts discussed in the Dust Abatement section, use of these chemicals can cause leaf necrosis or mortality of forbs and grasses along the road (Ryan et al. 1975), particularly down slope and the risk increases with area treated, application rate and frequency, and distance from the treated surface (Goodrich et al. 2009). Design Criteria prohibit the use of these chemicals within 500 feet of fens, which will decrease the impact on these wetlands.

Meadows
Impacts to meadows are discussed in the above section *Enhancement of Hardwoods and Grasslands.* In general, landings, log decks, roads, or debris piles have potential to impact meadows and Region 2 sensitive species within the habitat. Impacts to suitable plant habitat if these activities occur within meadows include loss of habitat, alteration of local hydrology, and

introduction of non-native or invasive plant species. If ponderosa pine trees are removed from meadows, equipment used during harvest could crush or uproot vegetation as well as cause varying degrees of soil compaction. Road construction, conversion, or maintenance in meadows could crush, bury, remove, or uproot vegetation. Roads can also create erosion channels that further impact soil structure and moisture, both of which are qualities that make meadows habitat for some Region 2 sensitive plants. In addition to the impacts discussed in the Dust Abatement section, use of these chemicals can cause leaf necrosis or mortality of forbs and grasses along the road (Ryan et al. 1975), particularly down slope and the risk increases with area treated, application rate and frequency, and distance from the treated surface (Goodrich et al. 2009). Changes in meadow habitat could alter the habitat quality such that certain Region 2 sensitive species and plant SOLC would no longer be able to survive.

Cumulative Effects: Past, current, and reasonably foreseeable actions within the Black Hills Resilient Landscapes Project Area are discussed in this section.

Activities such as vegetation management, fuels management, livestock grazing, recreational activities, and other management activities have occurred and will continue on the Forest. These activities will likely occur on private land as well. All may affect Region 2 sensitive plant species through direct mortality, habitat alteration, or spread of invasive species.

The annual impact to botanical resources on the Forest from timber harvest activities would remain comparable to previous years. Cumulative effects to botanical resources have the potential to increase with all new or recurring actions on the Forest, with effects ranging from null or minimal to significant. Stands are identified for treatment across the Black Hills National Forest in Management Areas identified in Table 1 (Management Areas). Most notably for botanical resources, treatments will not occur in Botanical Areas, Research Natural Areas, or Wilderness Areas, locations of higher density Region 2 sensitive plant occurrences and suitable habitat.

Actions associated with mechanical site preparation have the potential to increase the presence of non-native and/or invasive plants in the western portion of the Black Hills. Establishment of invasive species across the proposed acreage (up to 4,000 acres) may result in these species spreading to other areas where they would not have otherwise been as likely to reach. Non-native and/or invasive plant species are capable of outcompeting native vegetation for resources and often are known to produce high quantities of seed which can be easily (and widely) dispersed with general requirements for propagation. The spread of non-native and/or invasive plant species can result in the alteration of plant communities and reduction in suitability of sensitive plant habitat.

Management of national and state parks adjacent to the Forest is assumed to have a similar effect on Region 2 sensitive plant populations. Other federal, state, and private lands offer suitable habitat for Region 2 sensitive plant species. Only sage willow, autumn willow, and narrowleaf peatmoss have not been confirmed from other federal, state, and/or private lands adjacent to Black Hills National Forest.

Privately owned lands within the Black Hills Ecoregion may also provide suitable habitat, but resource management by companies and private citizens depends on a number of factors (e.g., desired goals, market prices, development potential) making it difficult to predict future trends in private habitat diversity and quality. Suitable habitat for Region 2 sensitive plants may occur on private lands across the Black Hills. Further urban development in the Black Hills will likely continue to affect habitat, including white spruce communities and paper birch/hazelnut forest, thereby increasing the importance of stands on Forest Service lands.

Analysis of Effects for the No Action Alternative (Alternative B)

Direct and Indirect: Under Alternative B (no action) there would be no direct effects to botanical resources since implementation of elements of the proposed action would not occur. Ongoing forest management and recurring road maintenance on system roads would continue as directed by the Forest Plan. Timber harvest project areas generated by each District would continue as planned, as would analysis of future planned timber projects.

Alternative B would maintain Region 2 sensitive plants and suitable habitat and protect biodiversity by not implementing actions with potential to impact these resources, though over time the forest would experience an increase in ponderosa pine, including further encroachment into stands of hardwoods, riparian areas, and grasslands. Structural stage objectives outlined in the Forest Plan may be addressed through other management, but not likely to the extent as proposed with the BHRL project.

Cumulative: If no action is taken, it is unlikely that Forest structural stage conditions will become aligned with the goals outlined in the Forest Plan. Managing for specific structural stage conditions had not been a primary focus during the mountain pine beetle epidemic. Cumulative impacts associated with no action include retention of large areas of monotypic stands which could become susceptible to mountain pine beetle epidemic in the future. Alternative B would also result in a decrease in landscape diversity, reduced health of hardwood stands, and a decrease in areas of grasslands unless these items were addressed through another management action.

VI. DETERMINATIONS OF EFFECT AND RATIONALE

The determination of effects on Region 2 sensitive plant species in the BA/BE were made as a result of the information gathered in the pre-field review, field reconnaissance, survey results, and effects analysis for the action alternative. The determinations were based on effects of proposed activities on known populations and impacts to populations that could occur in areas that are unsurveyed for all Region 2 sensitive plant species. The determination language is set forth in Forest Service Manual 2670.

Determinations consider the extent of each plant species' distribution on the Forest and within the project area. Species may be limited in documented occurrences, located within a restricted range, have highly specific habitat requirements, or have a significant percentage of known sites located within, or within close proximity to, areas identified for potential treatment in Alternative A.

Objectives, standards, and guidelines have been identified in the Forest Plan Phase II to conserve Region 2 sensitive species located on the Black Hills National Forest. This project will follow the objectives, standards, and guidelines applicable to those species and habitats found in the Black Hills Resilient Landscapes Project Area.

Most Region 2 sensitive plant species and plant species of local concern on the Black Hills National Forest are globally secure, with the exception of prairie moonwort and narrowleaf grapefern (NatureServe 2015). This, in combination with the rangewide presence of these species, can be interpreted to mean that if all of the occurrences of these species on the Forest were extirpated, the species would most likely survive and most likely not cause a trend to Federal listing.

Design criteria are described at the beginning of the Effects of the Alternatives section and are integral to the effects determination. Any deviation from these criteria will require further analysis and a revised effects determination. Some mitigation measures not included here are Forest Service standard operating procedures. Other mitigation measures not included here are additional Forest Plan Standards and Guidelines (including those relating to water, soils, riparian areas, travel and transportation, noxious weeds, and livestock grazing). Project implementation will incorporate all Forest Plan Standards and Guidelines.

The **expected** determinations of effects for each species are contingent upon, to varying degrees, implementation of the design criteria and mitigation. With mitigation measures fully implemented, 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 to federal listing or a loss of species viability range-wide"*** is made for the following Region 2 sensitive plant species for the proposed action:

Prairie moonwort	*Botrychium campestre*
Narrowleaf grapefern	*Botrychium lineare*
Foxtail sedge	*Carex alopecoidea*
Mountain lady's slipper	*Cypripedium montanum*
Yellow lady's slipper	*Cypripedium parviflorum*
Trailing clubmoss	*Lycopodium complanatum*
Large round-leaf orchid	*Platanthera orbiculata*
Sage willow	*Salix candida*
Autumn willow	*Salix serissima*
Bloodroot	*Sanguinaria canadensis*
Narrowleaf peatmoss	*Sphagnum angustifolium*
Highbush cranberry	*Viburnum opulus* var. *americanum*
Great-spurred violet	*Viola selkirkii*

Table 4 summarizes determinations for all analyzed Region 2 sensitive plant species for both alternatives identified in the BHRL project.

Table 4: Determination Summary by Alternative for Analyzed Species

Species	**Alternative A (proposed action)**	**Alternative B (no action)**
Prairie moonwort	MAII[3]	NI[1]
Narrowleaf grapefern	MAII	NI
Foxtail sedge	MAII	NI
Mountain lady's slipper	MAII	NI
Yellow lady's slipper	MAII	NI
Trailing clubmoss	MAII	NI
Large round-leaf orchid	MAII	NI
Sage willow	MAII	NI
Autumn willow	MAII	NI
Bloodroot	MAII	NI
Narrowleaf peatmoss	MAII	NI
Highbush cranberry	MAII	NI
Great-spurred violet	MAII	NI

1 - No Impact
2 - Beneficial Impact
3 - 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.
4 - Likely to result in a loss of viability in the Planning Area, or in a trend toward federal listing.

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