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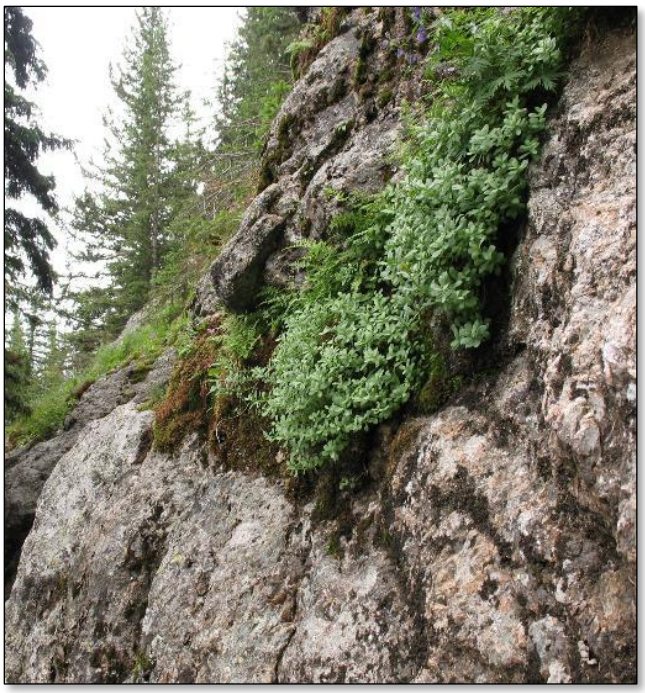
Black Hills National Forest

Draft Forest Assessment:

At-Risk Species Status



American three-toed woodpecker and Leedy's Roseroot growing on rock (right), Black Hills National Forest.

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Chapter 1. Introduction

The Black Hills National Forest (BHNF) is on the South Dakota/Wyoming state line and surrounds the Black Hills Mountain Range. The BHNF supports a variety of habitat types that extend from the shortgrass prairie zone to a high of 7,244 feet on the summit of Black Elk Peak. Twenty-two ecosystems were identified on the BHNF and analyzed in three assessments: Terrestrial Ecosystems; Non-Forested Terrestrial Ecosystems; and Aquatic, Riparian and Groundwater Dependent Ecosystems. These ecosystems support over 300 wildlife and fish species that occur on the BHNF. The diversity of ecological conditions provides habitats essential for maintaining populations for a diverse array of native plant, animal, and fish species.

The BHNF is unique in its diversity of ecosystems and associated habitat types influenced by the unique nature of the 1.25 million acres of forested hills surrounded by (and isolated by) the prairies of the northern great plains. The ecosystem diversity provides habitat for large populations of mule deer and Rocky Mountain elk, which in turn attract a large number of hunters annually to Wyoming and South Dakota. This influx of people provides a large economic benefit to businesses and communities in and around the BHNF.

Assessment 5 Development Process

In developing a Forest Plan Revision, the Forest Service planning rule requires the Forest Service to assess the Black Hills National Forest's At-Risk species and to identify the subset of species of conservation concern (SCC) for the plan area. The purpose of assessing at-risk species is to help develop forest plans that maintain the diversity of plant and animal communities and provide for the persistence of native species in the plan area. Most species will be maintained by plan components that provide for broad ecosystem integrity and ecosystem diversity. Some at-risk species may need more specific plan components to provide for their persistence on the BHNF.

Forest Service Handbook direction for Identifying and Assessing At-risk Species is found at 1909.12, Chapter 10, Section 12.5 – Identifying and Assessing At-risk Species. We used the following approach:

1. Staff at the BHNF National Forests and the Forest Service Region 2 office (RO) used the direction at FSH 1909.10 to develop an "initial" list of at-risk species on the BHNF. The list of at-risk species includes:

    - Species federally recognized under the Endangered Species Act as endangered, threatened, proposed or candidates (FSH 1909.12_10 sec. 12.51). Federally listed species appropriate to consider in the planning process were identified with the U.S. Fish & Wildlife Service.
    - Potential species of conservation concern (SCC). The existing Regional Forester's sensitive species list provided the starting point for the list of potential species of conservation concern to consider. This was supplemented by species that "must" be considered (those with NatureServe or Wyoming/South Dakota Natural Heritage Program (NHP) rankings G/T1 or G/T2), and species that "should" be considered; those with NatureServe/NHP rankings G/T3, S1, or S2, as well as species identified from various other sources (sources for this assessment included the Bison Database, Intermountain Herbarium Consortium, Bird Conservancy of the Rockies, Xerces Society, and staff reports). This assessment also considers species with an S3 ranking on NatureServe or NHP. Generally, NatureServe and CNHP concurred on both state and global status rankings. In cases where they did not, we deferred to the more "imperiled" score.
    - Much of this information is geospatially referenced, allowing staff to determine which of these species were found within the BHNF boundary. The requirements and criteria for considering a species as a potential SCC are specified in FSH 1909.10 section 12.52.

2. For each of the at-risk species that are known to occur on the BHNF, we completed a "species overview" based on details in FSH 1909.12. This overview is designed to capture the best available science information following current manual and handbook direction. These overviews highlight key elements of life history, distribution, risk factors and ecological conditions necessary for recovery, conservation and viability of at-risk species. Species overviews include key information gaps and uncertainties.
3. Resource specialists, including BHNF National Forests district wildlife biologists, Forest staff and RO staff, reviewed and refined species overviews.
4. For at-risk species, we used the species overviews to populate a species spreadsheet that includes the ecosystem/s and ecological conditions required by each species, and risk factors that influence recovery, conservation, and viability. In developing the ecological conditions database, we captured information directly as it is reported in the scientific literature rather than develop an *a priori* list of ecological conditions and risk factors. As we populated the database, we aggregated information into common terminology across species as appropriate. Using these species overviews to populate the species spreadsheet captures the ecosystems, key ecological conditions, and risk factors for each species.
5. We used the following steps to assess the current status of potential at-risk species and likely future trends on the forest.
    A. Working with species from the "initial" list of at-risk species, we correlated ecosystems and ecosystem conditions and features with those described in the *Terrestrial Ecosystems, Non-Forested Terrestrial Ecosystems* and *Aquatic, Riparian and Groundwater Dependent Ecosystems assessments*.
    B. We used ecosystem trends identified from step 6A and documented risk factors to identify the list of potential SCC for the BHNF, and to identify which species to potentially not carry forward as SCC.
    C. We identified the ecosystem conditions and features in the Species Overviews that were not described in the *Terrestrial Ecosystems* and *Aquatic and Riparian Ecosystems assessments*. These information gaps may be carried forward for future research and/or monitoring to better inform management of SCC species.
    D. Individual species overviews are available as supporting information.

Summary Public Input

Note to reviewers: This section is a placeholder for text that may be added after public meetings.

Use of Best Available Science

Sources of data for this assessment include various published and unpublished reports and data. Key sources include:

- Information compiled as part of the Rocky Mountain Region's Species Conservation Project (http://www.fs.usda.gov/detail/r2/landmanagement/?cid=stelprdb5177128)
- Peer-reviewed literature and other scientific reports
- Information on species occurrence, distribution and abundance provided by the Natural Heritage Programs of South Dakota and Wyoming.
- NatureServe (http://www.natureserve.org/)

- BHNF NF species occurrence records as documented in the Forest Service Natural Resource Manager NRIS Wildlife database.
- The Intermountain Herbarium Consortium (http://www.intermountainbiota.org/portal/index.php)
- Bird Conservancy of the Rockies (http://www.birdconservancy.org/)

Information Gaps

The following habitats, feature and conditions are not addressed or are not fully addressed in the BHNF ecosystem assessments, so less is known about the conditions of these resources on the Forests:

- Caves and mines
- Rock outcrops, cliffs, and talus slopes are mentioned in the Terrestrial Ecosystem Assessment, but there is no in-depth assessment.
- Substrates – shale, limestone, calcareous, etc.

In general, the process used to identify potential SCC appears to result in a greater emphasis on plants and insects than previous efforts to designate species for conservation-focused attention, such as the Regional Forester's Sensitive Species list. More information regarding rare plant species, as well as plant species required by insects for nectar or to host caterpillars, may be warranted.

Pollinator decline is an increasingly severe issue. The causes are still under debate, the impact is still being determined, but the general trend is apparent. Domestic honeybees get much of the attention, but native bee species such as the western bumblebee (*Bombus occidentalis*) are also impacted as are butterflies, moths, and other pollinator insect species. There is little to no active population or habitat monitoring of these species.

Scale of Analysis Area

For most species, the scale of assessment is the plan area. For select wide-ranging species, the scale of assessment may be larger than the plan area. For the determination of whether or not a given species should be considered as an SCC, assessment must be limited to the plan area. With respect to federally listed threatened and endangered species, as well as proposed and candidate species, the assessment may include species not present immediately within the plan area, such as endangered Black-footed ferret. They are not within the plan area, but the plan may impact the potential for range expansion.

Federally Recognized Species

Species analyzed in the Assessment as Threatened, Endangered, Proposed, and Candidate (TEPC) are determined partly by the U.S. Fish and Wildlife Service, through application of the Information and Planning for Consultation (IPaC) system (currently a web-based application, U.S. Fish and Wildlife Service, 2016). This can include species that are not known to occur in the plan area, but which may be affected by management of the plan area (such as Colorado River fish species). IPaC may also identify TEPC species that have potential to be reintroduced or to recolonize the plan area if those species were formerly present in the plan area. In addition, any plant or animal species known to be present on the forest that are listed as TEPC by the FWS through its implementation of the Endangered Species Act (ESA) and announced through Federal Register notices must also be analyzed, whether or not their presence in the plan area is highlighted in IPaC.

The following TEPC species are currently or formerly known to occur in the plan area or may be impacted by management of the BHNF (table 1).

Table 1. Threatened, endangered, or candidate species

Species	ESA Status	Occurrence data
Black-footed ferret *Mustela nigripes*	Endangered	One occurrence on Bear Lodge Ranger District. Nearby reintroduction sites on National Park Service managed lands adjacent to BHNF
Northern Long-eared bat *Myotis septentrionalis*	Threatened	106 known records on several ranger districts
Monarch butterfly *Danaus plexippus*	Candidate	Six records from the plan area (Hell Canyon and Mystic Ranger Districts)
Leedy's Roseroot *Rhodiola integrifolia* ssp. *Leedyi*	Threatened	One known occurrence in the Plan Area

Information regarding the TEPC species for the plan area is presented in Appendix 1, *Threatened, Endangered, Proposed, and Candidate species ecosystems and habitat characteristics*. For those TEPC species documented as present on the BHNF, they were grouped with information regarding other at-risk species to compile the "Key Ecosystem Characteristics" in the following section.

Chapter 2. At-Risk Species

In the 2012 Planning Rules "At-Risk" includes species that are listed by the U.S. Fish and Wildlife Service as Threatened, Endangered, Proposed of Candidate (TEPC) as well as Species of Conservation Concern (SCC).

The decision of which Endangered Species Act Threatened, Endangered, Proposed, and Candidate (TEPC) species to analyze was made by the U.S. Fish and Wildlife Service and communicated to the USFS via the Information for Planning and Consultation (IPaC) web-based application.

The determination of which species are Species of Conservation Concern on the BHNF was made by the Forest Service prior to the development of this assessment. As outlined in the "Assessment 5 Development Process" section of Chapter 1, potential species were identified and analyzed based on criteria from the 2012 Planning Rule.

This was done via Species Overviews developed for each species that met the "must" or "should" consider criteria from the Planning rule, as well as other species included based upon professional judgement of USFS staff. Criteria from Planning Rule Section 12.52d 3(f) were used to determine which species would be designated Species of Conservation Concern.

Those criteria include:

1. Significant threats, caused by stressors on and off the plan area, to populations or the ecological conditions they depend upon (habitat). These threats include climate change.
2. Declining trends in populations or habitat in the plan area.
3. Restricted ranges (with corresponding narrow endemics, disjunct populations, or species at the edge of their range).
4. Low population numbers or restricted ecological conditions (habitat) within the plan area.

Based upon information compiled in the species overviews and analyzed under the criteria in the 2012 Planning Rule section 12.52d 3(f) the following species are likely to be designated as Species of Conservation Concern in the Black Hills National Forest Plan.

Plants

- Sleepy needlegrass (*Achnatherum robustum*)
- Southern Maidenhair Fern (*Adiantum capillus-veneris*)
- Groundnut (*Apios americana*)
- Frenchman's Bluff grapefern (*Botrychium gallicomontanum*)
- Michigan moonwort (*Botrychium michiganense*)
- Leathery grapfern (*Botrychium multifidum*)
- Pale botrychium (*Botrychium pallidum*)
- Acute brachythecium moss (*Brachythecium acutum*)
- Swamp thread moss *(Bryum uliginosum*)
- Pointed tip mariposa lily (*Calochortus apiculatus*)
- Fairy slipper (*Calypso bulbosa*)
- Marsh bellflower (*Campanula aparinoides*)
- Foxtail sedge (*Carex alopecoidea*)
- Slenderbeak sedge (*Carex athrostachya*)
- Southwestern showy sedge (*Carex bella*)
- Brownish sedge (*Carex brunnescens*)
- Silvery sedge (*Carex canescens*)
- Low northern sedge (*Carex concinna*)
- Emory's sedge (*Carex emoryi*)
- limestone meadow sedge (*Carex granularis*)
- Greater bladder sedge (*Carex intumescens*)
- Eastern star sedge (*Carex radiata*)
- Blunt broom sedge (*Carex tribuloides*)
- Sheathed sedge (*Carex vaginata*)
- Broadleaf enchanter's nightshade (*Circaea canadensis* var. *canadensis*)
- Mountain lady's slipper (*Cypripedium montanum*)
- Lesser yellow lady's slipper (*Cypripedium parviflorum*)
- California oatgrass (*Danthonia californica*)
- Tufted hairgrass (*Deschampsia cespitosa*)
- slimleaf panicgrass: Slim-leaf Witchgrass (*Dichanthelium linearifolium*)
- dicranella moss; Spur-necked Forklet Moss (*Dicranella cerviculata*)
- Schreber's dicranella moss; Schreber's Forklet Moss (*Dicranella schreberiana*)
- shortleaf dicranum moss; Shortleaf Broom Moss (*Dicranum brevifolium*)
- Ontario dicranum moss; Ontario Broom Moss (*Dicranum ontariense*)
- Longleaf hook moss (*Drepanocladus longifolius*)
- Spinulose woodfern; Spinulose Shield fern (*Dryopteris carthusiana*)
- Ovate spikerush (*Eleocharis ovata*)
- Beaked spikerush (*Eleocharis rostellata*)
- Diverseglume wildrye; Interrupted Wild Rye (*Elymus diversiglumis*)
- Stream orchid; Giant Helleborine (*Epipactis gigantea*)

- dwarf scouring rush (*Equisetum scirpoides*)
- Variegated scouring rush; Variegated Horsetail (*Equisetum variegatum*)
- Hooker's sandwort (*Eremogone hookeri* var. *pinetorum*)
- Tall cottongrass; Narrowleaf Cotton-grass (*Eriophorum angustifolium*)
- Showy prairie gentian (*Eustoma exaltatum* ssp. *russellianum*)
- Downy Gentian (*Gentiana puberulenta*)
- Slender cudweed (*Gnaphalium exilifolium*)
- Large pod pinweed; Narrowleaf Pinweed (*Lechea intermedia* var. *intermedia*)
- Wolf lichen (*Letharia vulpine*)
- Broad lipped twayblade (*Listera convallarioides*)
- Small flowered woodrush (*Luzula parviflora*)
- Stiff clubmoss; Bristly Clubmoss (*Lycopodium annotinum*)
- Ground cedar; trailing clubmoss (*Lycopodium complanatum*)
- Northern bugleweed (*Lycopus uniflorus***)**
- Five stamen miterwort; Five-point Bishop's-cap (*Mitella pentandra*)
- Alpine notchleaf moss; paraleucobryum moss (*Paraleucobryum enerve*)
- Marsh grass of Parnassus (*Parnassia palustris*)
- Arrowleaf sweet coltsfoot; (*Petasites frigidus* var. *sagittatus*)
- Little fountain apple moss; philonotis moss (*Philonotis fontana* var. *pumila*)
- Lodgepole pine (*Pinus contorta*)
- Limber pine; Rocky Mountain white pine (*Pinus flexilis*)
- Greater featherwort (*Plagiochila asplenioides*)
- Scentbottle; Tall White Bog Orchid (*Platanthera dilatate*)
- Lesser roundleaved orchid; Dessert-plate Orchid (*Platanthera orbiculate*)
- Jensen's polytrichum moss (*Polytrichum jensenii*)
- Platte River cinquefoil (*Potentilla plattensis*)
- Purple rattlesnake root; Glaucous Rattlesnake-root; Glaucous White Lettuce (*Prenanthes racemose*)
- Drops-of-gold; Hooker's Mandarin; Hooker's Fairy bells (*Prosartes hookeri*)
- Intense light and dark lichen; Western Antler Lichen (*Pseudevernia intensa*)
- White veined wintergreen; White-veined Pyrola (*Pyrola picta*)
- Cartilage lichen; Fan Ramalina; Burning Bush Lichen (*Ramalina sinensis*)
- Felted leafy moss; Felt Round Moss (*Rhizomnium pseudopunctatum*)
- Sageleaf willow; Hoary Willow (*Salix candida*)
- Greenleaf willow (*Salix lasiandra* var. *caudata*)
- Shining willow (*Salix lucida*)
- Autumn willow (*Salix serissima*)
- Bloodroot (*Sanguinaria canadensis*)
- Nodding saxifrage (*Saxifraga cernua*)
- Alberta saxifrage; Western Saxifrage (*Saxifraga occidentalis*)
- Woolgrass; Cottongrass Bulrush (*Scirpus cyperinus*)
- Northern selaginella; Ledge Spikemoss; Rock Spikemoss (*Selaginella rupestris*)

- Sphagnum; narrowleaf peatmoss (*Sphagnum angustifolium*)
- Sphagnum; Northern Peatmoss (*Sphagnum capillifolium*)
- Sphagnum; Flat-top Bogmoss; Flat-topped Sphagnum Moss (*Sphagnum fallax*)
- Sphagnum; Brown Peatmoss (*Sphagnum fuscum*)
- Sheathed pondweed; ig-sheathed Pondweed (*Stuckenia vaginata*)
- Hairy Naval lichen (*Umbilicaria hirsuta*)
- Cranberry; Large Cranberry (*Vaccinium macrocarpon*)
- Thinleaf huckleberry; Square-twigged Huckleberry; Square-twig Blueberry (*Vaccinium membranaceum*)
- Squashberry; Highbush Cranberry (*Viburnum edule*)
- American cranberrybush; mooseberry; Guelder-rose Viburnum (*Viburnum opulus* var. *americanum*)
- Small white violet; Macloskey's Violet (*Viola macloskeyi*)
- White violet; Kidneyleaf White Violet (*Viola renifolia*)
- Selkirk's violet; great-spurred violet (*Viola selkirkii*)
- Warnstorfia moss; Spring Hook Moss (*Warnstorfia pseudostraminea*)

Animals

- Black-billed hummingbird (*Archilochus alexandri*)
- American dipper (*Cinclus mexicanus*)
- Black-billed cuckoo (*Coccyzus erythropthalmus*)
- American kestrel (*Falco sparerius*)
- Black-backed Woodpecker (*Picoides arcticus*)
- American three-toed woodpecker (*Picoides dorsalis*)
- Brewer’s sparrow (*Spizella breweri*)
- Finescale dace (*Chrosomus neogaeus*)

The USFS Planning Rule handbook suggests that the following criteria be used to determine the status of each At-Risk species present on the forest. This is not “status” in the sense of determining whether or not a given species is At-Risk (SCC or TEPC) but is rather the status/condition of species that have already been determined to be At-Risk.

1. Describe current distribution of each at-risk species in the plan area.
2. Identify ecological conditions in the plan area necessary to meet the requirements of 36 CFR 219.9(b) for each at-risk species (sec. 12.53 of this Handbook) and at-risk species grouping (sec. 12.54 of this Handbook). These are the ecological conditions to be considered for at-risk species in the assessment.
3. Ecological conditions assessed by the assessment of key ecosystem characteristics.
4. Identify ecological conditions in the plan area necessary to meet the requirements of 36 CFR 219.9(b) for each at-risk species that were not addressed by the assessment of key ecosystem characteristics as follows:
    a. Describe the current and likely future status of the ecological conditions necessary to meet the requirements of 36 CFR 219.9(b) for each at-risk species, assuming management continues under the current plan.

b. Compare the species' current and likely future status described in paragraph 4a for each at-risk species to the ecological conditions of the natural range of variation, or an alternative ecological reference model (sec. 12.14b of this Handbook).

c. Assess human-related stressors (for example, roads, human disturbance and displacement, dams) and whether they can be managed under Forest Service authorities.

d. Identify other threats or limiting factors (for example, naturally small and isolated populations, climate change) and whether they can be managed under Forest Service authority.

5. Describe the current and projected overall status of the ecological conditions necessary to meet the requirements of 36 CFR 219.9(b) for at-risk species considering the combined ecological conditions addressed through the assessment of key ecosystem characteristics and, if needed, for specific at-risk species or groupings.

6. For those ecological conditions not currently meeting or expected to meet the requirements of 36 CFR 219.9(b) for at-risk species, describe the potential outcome of the at-risk species status and identify the key risk factors, taking into account factors such as time (for example, short-term, long-term, planning period, generations of species), affected life history requirement (for example, loss of part of foraging habitat, loss of all spawning habitat), or affected population dynamic (for example, loss of recolonization routes).

7. Identify those key risk factors influencing the ecological conditions not expected to meet the requirements of 36 CFR 219.9(b) for at-risk species that are or can be influenced by Forest Service management of the plan area.

8. Describe any differences in likely future status of groups of individuals in the plan area that are known to be or highly suspected to be reproductively isolated and separate from the rest of the individuals of at-risk species.

9. Summarize the overall status of each at-risk species or species group (sec. 12.54 of this Handbook) with explanations of which key risk factors weighed most heavily in determining status. Describe the effect of key risk factors on species in simple terms such as the level of resulting vulnerability and the trend in that vulnerability. State the conclusions of the vulnerability status process for each species in a way that is helpful in identifying the need for change and in developing plan components that provide the ecological conditions necessary to sustain the species. The Interdisciplinary Team may support conclusions using the "Issue-Rule-Analysis/Application-Conclusion" model (IRAC) as described in FSH 1909.12, chapter 20, section 21.42. Document the resulting information and status evaluation in the planning record.

Table 2. Status of each at-risk species for each of these criteria

Common Name	Scientific Name	Distribution on the Black Hills
Threatened, Endangered, and Candidate Species		
Black-footed ferret	*Mustela nigripes*	One occurrence on Bear Lodge Ranger District. Nearby reintroduction sites on National Park Service managed lands adjacent to BHNF, including Wind Cave National Park, Badlands National Park, and other nearby reintroduction sites.
Northern Long-eared bat	*Myotis septentrionalis*	106 known records on several ranger districts
Monarch butterfly	*Danaus plexippus*	Six records from the plan area (Hell Canyon and Mystic Ranger Districts)
Leedy's Roseroot	*Rhodiola integrifolia* ssp. *Leedyi*	One known occurrence in the Plan Area
Animal Species of Conservation Concern		
Black-chinned Hummingbird	*Archilochus alexandri*	Historic distribution of the Black-chinned Woodpecker has been limited to the southern edge of the Beartooth mountains in the Black Hills National Forest. Extremely rare, 1 known occurrence in the Black Hills NF (USDA USFS 2021).
American dipper	*Cinclus mexicans*	Distribution in the Black Hills is mainly restricted to spearfish canyon and the canyon's tributaries. However small numbers have been located in other drainages in the Black Hills National Forest.
Black-billed cuckoo)	*Coccyzus erythropthalmus*	Historic Distribution in the Black Hills NF is limited to the riparian areas of the Beartooth Mountains and Sand Creek area in Wyoming. There are five records of occurrences in the Black Hills National Foresty
American Kestrel	*Falco sparerius*	Found throughout edge habitats within the plan area
Black-backed Woodpecker	*Picoides arcticus*	158 known occurences in the Black Hills NF since 1958
American three-toed woodpecker	*Picoides dorsalis*	The Lawrence and Pennington County border, north to Spearfish Creek
Brewer's sparrow	*Spizella breweri*	The sagebrush shrublands of the Bear Lodge Mountains and the Northeastern corner of the Black Hills in Wyoming
Finescale dace	*Chrosomus neogaeus*	Historically, the Finescale Dace has been known to inhabit Spotted Tail Creek, Trent Canyon, Richardson Creek, NFK Cow Creek, Hemler Reservior and Geis Reservior in the Black Hills National Forest.
Plant Species of Conservation Concern		

Common Name	Scientific Name	Distribution on the Black Hills
Sleepygrass	*Achnatherum robustum*	Single occurrence on Cascade Creek of S B Hills (SDNHP 2018a). A few historic specimens from Black Hills but none on BKF (Mayer 2021); one 2003 specimen record on BKF Fanny Boles RNA Custer Co (CDVPMP 2021); 9 database occurrences scattered throughout the Black Hills and Bear Lodge Mountains (USDA USFS 2021a); listed in Dorn 2021a.
Southern Maidenhair Fern	*Adiantum capillus-veneris*	In the Black Hills, it is only known to occur on calcareous substrates along Cascade Creek from J.H. Keith Cascade Falls and J.H Keith Cascade Springs Picnic Areas in Fall River County, South Dakota and ranges in elevation from 3,250 to 3,450 feet (USDA USFS 2018m). In the Black Hills, southern maidenhair fern and stream orchid occur in scattered colonies at Cascade Springs, a series of six artesian warm springs, and downstream along Cascade Creek in Fall River County, South Dakota. Large populations of these species occur in recreational sites along Cascade Creek that are managed by the Black Hills National Forest. the Black Hills population represents one of the northernmost occurrences of the plant anywhere in its range (Paris 1993 as cited in Hornbeck et al. 2003e).
Groundnut	*Apios americana*	The species is known to occur in the Black Elk Wilderness (SEINet 2021).
Frenchman's Bluff grapefern	*Botrychium gallicomontanum*	The species can be found in the Limestone grasslands of the Black Hills National Forest (SDNHP 2018a).
Michigan moonwort	*Botrychium michiganense*	In Wyoming, it is known to occur known from the Black Hills to the Big Horn Mountains (Crook, Sheridan and Weston counties) (SDNHP 2018a).
leathery grapefern	*Botrychium multifidum*	Seven of the eight documented occurrences on Black Hills National Forest land are within the Norbeck Wildlife Preserve (on HC) in a concentrated area (ca. 16 square miles) of the central core on igneous or metamorphic bedrock. One occurrence is in the Bearlodge Mountains (WY) in a narrow, sandstone drainage under a paper birch/hazelnut (Betula papyrifera/Corylus cornuta) forest community type. Black Hills occurrences range in elevation from 4,620 to 6,440 feet (USDA USFS 2018m). Black Elk Peak area of the B Hills (Rare Plant of SD 2021).
pale botrychium	*Botrychium pallidum*	Notably, there have been 6 occurrences in the Black Hills of South Dakota (identity confirmed by isozyme analysis, D. Farrar). There have been seven known occurrences in the Black Hills National Forest in Wyoming (WYNDD 2021a).
acute brachythecium moss	*Brachythecium acutum*	Known from BKF Smith Gulch Fen (located on MY)(and possibly other locations)(Kosovich-Anderson 2017).
swamp thread moss	*Bryum uliginosum*	One BKF specimen record (1986, Janssens) (BH_Mosses_GIS)
pointed tip mariposa lily	*Calochortus apiculatus*	In Wyoming, known only from the Black Hills (Crook County) (WYNDD 2021a). Single known location on BKF (BL) (USDA USFS 2021).
fairy slipper	*Calypso bulbosa*	Spruce forests of the high elevation black hills (Rare Plants SD 2021)
marsh bellflower	*Campanula aparinoides*	It is known to occur in the Black Hills portion of the Black Hills National Forest in Wyoming (Crook County).

Common Name	Scientific Name	Distribution on the Black Hills
foxtail sedge	*Carex alopecoidea*	In the Black Hills C. alopecoidea is known from two general areas: the northwestern Black Hills along the South Dakota–Wyoming border, and the Bear Lodge Mountains of Wyoming (USDA USFS 2018i); Wetland margins of e SD & B Hills. (SDNHP 2018a); Occurs from Saskatchewan to Nova Scotia, south to the Black Hills of South Dakota and Wyoming, east from Missouri to New Jersey, also in Tennessee. In Wyoming, known from the Black Hills (Crook County) (WYNDD 2021a). Foxtail sedge occurs on the Black Hills National Forest in Crook County, Wyoming. It also occurs in South Dakota, where its only western occurrences are in the Black Hills. (USDA USFS 2021b). Within Region 2, Carex alopecoidea occurs in the Black Hills region of eastern Wyoming and western South Dakota (Moore et al. 2006)
slenderbeak sedge	*Carex athrostachya*	Single recent collection from cent B Hills. (SDNHP 2018a). In Dorn 2021 appendix, reported as from Black Hills but no specimens examined (possibly misidentified). A couple specimen reports from BKF on BL (SEINet 2021); one Pennington Co SD specimen report on BKF (CDVPMP 2021) (1993 Larson). Sivinski (2021) note: The Crook Co., WY, Elliott 15564 (BHSU) specimen photo on SEINet is misidentified.
southwestern showy sedge	*Carex bella*	Black Hills National Forest occurrences are in a concentrated area (within three square miles) in the Black Elk Wilderness. Additional sites have been reported from nearby Custer State Park. Black Hills occurrences are found at high elevations of the granitic central core in cool, moist, shaded white spruce (Picea glauca) forests often with paper birch (Betula papyrifera) and usually associated with granite rock outcrops. (USDA USFS 2018m); Southwestern showy sedge is quite restricted in range and habitat in the Black Hills. There is much that we don't know about the species, as there has been no thorough surveys, no monitoring, and very few and limited studies on the species in the area. One small sub-occurrence reported in the Black Hills area from near the outlet of Sylvan Lake in Sunday Gulch in Custer State Park has not been observed since 1987 and presumably has been lost to hiking and climbing access traffic. No other monitoring data is available for Black Hills populations. (Glisson 2003d).
brownish sedge	*Carex brunnescens*	Few occurrences in Black Elk Peak area. (SDNHP 2018a). 1975 Van Bruggen specimen at SDC says " Along Grizzly Creek on Northeast approach to Harney peak near beaver dams., N1/2 Sec.29, R5E, T2S" - location description sounds like it should be on BKF by T/R is on CSP (Mark Gabel confirmed that he also thought it was on BKF)(Gabel 2021a)
silvery sedge	*Carex canescens*	Can be found in the spruce forest wetlands of the high elevation Black Hills (SDNHP 2018a)
low northern sedge	*Carex concinna*	Uncommonly collected in Black Hills. (Rare Plant of SD 2021); Occurs from Alaska to Newfoundland, south to Oregon, Colorado, South Dakota and Michigan. In Wyoming, known from the Absaroka and Wind River Ranges, Black Hills and Yellowstone Plateau (Crook, Park and Sublette counties) (WYNDD 2021a).
Emory's sedge	*Carex emoryi*	In Wyoming in foothills of the Black Hills (WYNDD 2021a).
limestone meadow sedge	*Carex granularis*	Can be found in the Black Hills of Wyoming in Crook County (WYNDD 2021a).
greater bladder sedge	*Carex intumescens*	Few occurrences in Black Elk Peak area. (SDNHP 2018a); disjunct in the Black Hills of Wyoming and South Dakota. In Wyoming, known only from the Black Hills (Crook County) (WYNDD 2021a).
eastern star sedge	*Carex radiata*	The species can be found in the westernmost extent of the Black Hills of Wyoming (Crook County) (WYNDD 2021a).

Common Name	Scientific Name	Distribution on the Black Hills
blunt broom sedge	*Carex tribuloides*	Single 1992 collection from the Black Hills in Wyoming from a springhead wetland (WYNDD 2021a).
sheathed sedge	*Carex vaginata*	The species was discovered in 2009 in the central Black Hills (WYNDD 2021a).
broadleaf enchanter's nightshade	*Circaea canadensis* var. *canadensis*	This species is known to occur in the western Black Hills of South Dakota and Wyoming(WYNDD 2021a).
mountain lady's slipper	*Cypripedium montanum*	Two Black Hills occurrences are located on the Northern Hills Ranger District (Lawrence County, South Dakota) on mesic soil; one is in a white spruce/twinflower (Picea glauca/Linnaea borealis) forest community type and the other is in an aspen/bracken fern (Populus tremuloides/Pteridium aquilinum) dominant forest community type with white spruce (Picea glauca), paper birch (Betula papyrifera) and Ponderosa pine (Pinus ponderosa)(USDA USFS 2018i). Sivinski (2021) note: Not yet vouchered for Black Hills, no specimens on SEINet.
lesser yellow lady's slipper	*Cypripedium parviflorum*	An estimated 4,000 individuals exist in over 200 locations on the Forest (Bearlodge, Mystic and Northern Hills Ranger Districts). A Black Hills occurrences range in elevation from 3,800 to 6,400 feet. (USDA USFS 2018i); Fairly well distributed in the northern and eastern Black Hills and occasional in the central Black Hills. Southernmost Black Hills occurrence is in Wind Cave National Park. Known occurrences in Lawrence, Meade, Pennington and Custer Counties, SD and Crook Co, WY. Scattered, locally common to uncommon at low to mid elevation in the northern and eastern Black Hills, frequent in Spearfish Canyon and adjoining drainages (Larson & Johnson 2007 as cited in USDA USFS 2018d); Forests of B Hills and ne SD.(WYNDD 2021a)
California oatgrass	*Danthonia californica*	Can be found in the montane meadows of the Black Hills (WYNDD 2021a).
tufted hairgrass	*Deschampsia cespitosa*	Can be found in the Black Hills wet meadows at higher elevations (WYNDD 2021a).
slimleaf panicgrass	*Dichanthelium linearifolium*	Can be found in the Black Hills of Wyoming (WYNDD 2021a)
dicranella moss	*Dicranella cerviculata*	Known from few localities in the Black Hills (including Smith Gulch Fen, located on MY)(Kosovich-Anderson 2017)
Schreber's dicranella moss	*Dicranella schreberiana*	Known from few localities in the Black Hills (including Smith Gulch Fen, located on MY)(Kosovich-Anderson 2017)
shortleaf dicranum moss	*Dicranum brevifolium*	At least one specimen record on BKF (1977 Churchill, Cicero Peak)(CNABH 2021).
Ontario dicranum moss	*Dicranum ontariense*	At least one specimen record on BKF (1977 Churchill, Williams Spring Crook Co WY)(CNABH 2021).
longleaf hook moss	*Drepanocladus longifolius*	A couple specimen records on BKF (BH_Mosses_GIS, CNABH 2021).

Common Name	Scientific Name	Distribution on the Black Hills
spinulose woodfern	*Dryopteris carthusiana*	Single 1993 collection from central B Hills (SDNHP 2018a). Wyoming occurrences are in the Black Hills (Crook County) (WYNDD 2021a). Listed in Dorn 2021a appendix as no specimens seen (possibly mis-identified), Dorn could not find any of the Black Hills specimens to examine (Dorn 2021b). BKF specimen record report at BKF herbarium in Custer; C. Mayer relocated and documented the occurrence in 2021 (21SO10A)(Mayer 2021).
ovate spikerush	*Eleocharis ovata*	Known to occur in the Black Hills of Wyoming (Crook County)(WYNDD 2021a)
beaked spikerush	*Eleocharis rostellata*	In the Black Hills, it is only known to occur on calcareous substrates along Cascade Creek. It occurs on Black Hills National Forest, The Nature Conservancy's Whitney Preserve and private land. On National Forest land, it has been documented from J.H. Keith Cascade Falls and J.H Keith Cascade Springs Picnic Areas in Fall River County, South Dakota and ranges in elevation from 3,250 to 3,450 feet. In both areas plants are associated with warm springs and are likely dependent upon the constant moisture and warmth associated with these springs. (USDA USFS 2018m); Single known occurrence on Cascade Creek (WYNDD 2021a); The only currently known population of beaked spikerush in South Dakota is in Fall River County, along Cascade Creek, an area where several other rare plant species occur. The beaked spikerush population is present on lands administered by Black Hills National Forest (BHNF), and on surrounding private lands, including the Whitney Preserve owned and managed by The Nature Conservancy (TNC). Both biotic and abiotic disturbances may play a significant role in the distribution and abundance of beaked spikerush. Natural disturbances such as periodic insect outbreaks and fire may benefit a variety of species by the increased groundwater flow that results from the death of upland trees. However, the limited forest stands in this area suggest that increased groundwater flow from the death of upland trees is not an important factor for this drainage or this population of beaked spikerush. (Glisson 2003 b)
diverseglume wildrye	*Elymus diversiglumis*	Last collected in 1969 from woodlands of B Hills (WYNDD 2021a). Specimens from BKF (SEINet 2021).
stream orchid	*Epipactis gigantea*	only known to occur along Cascade Creek on National Forest land, it has been documented from J.H. Keith Cascade Falls and J.H Keith Cascade Springs Picnic Areas in Fall River County, South Dakota and ranges in elevation from 3,250 to 3,450 feet. In both areas plants are associated with warm springs and are likely dependent upon the constant moisture and warmth associated with these springs. No other warm springs have been documented on the Black Hills National Forest. (USDA USFS 2018i); Single known occurrence on Cascade Creek. (SDNHP 2018a)
dwarf scouring rush	*Equisetum scirpoides*	Black Hills riparian forests at higher elevations. (SDNHP 2018a)
variegated scouring rush	*Equisetum variegatum*	In Black Hills National Forest, variegated scouring rush is known only from Beaver Gulch in the Bear/Beaver Gulch Botanical Area (Glisson 2003c). 1990 NH BKF specimen (RM 2021). A couple BKF database records (USDA USFS 2021a).
Hooker's sandwort	*Eremogone hookeri* var. *pinetorum*	Single record in BKF database (09BB01A), but did not find associated specimen; specimen reports of E. hookeri on BKF (CDVPMP 2021) but not positively IDed as var pinetorum; one E. hookeri specimen at BKF herbarium at SO- appears to be var. pinetorum
tall cottongrass	*Eriophorum angustifolium*	A few BKF database records (USDA USFS 2021a). A few BKF specimen reports (CDVPMP 2021).

Common Name	Scientific Name	Distribution on the Black Hills
showy prairie gentian	*Eustoma exaltatum* ssp. *russellianum*	Reported in 2003 (Cascade Springs), has been searched for and not relocated since (Mayer 2021).
Downy Gentian	*Gentiana puberulenta*	Black Hills occurrences are associated with limestone substrates in the transition zone between dry to mesic grassland and forest habitats. Big blue-stem (Andropogon gerardii), a tall-grass prairie species, was documented from all sites, and most sites were associated with western snowberry (Symphoricarpos occidentalis) and leadplant (Amorpha canescens). Sites occur on the eastern edge of the Black Hills, in the vicinities of Rockerville and Blackhawk, South Dakota. Additional sites have been reported from private property. Black Hills occurrences range in elevation from 3,960 to 4,480 feet. (USDA USFS 2018m); Prairies of e SD & disjunct in B Hills. (Rare Plans of SD 2021)
slender cudweed	*Gnaphalium exilifolium*	Two other records (SEINet 2021) in Black Hills on PVT land in Lawrence Co (Bulldog Ranch (1946), Yellow Creek (1910)); listed in Dorn 2021a.
large pod pinweed	*Lechea intermedia* var. *intermedia*	In Wyoming, known only from the Black Hills (Crook County)(WYNDD 2021a). 1986 specimen reports on BKF Crook Co, WY (RM 2021); historic (1965) specimen record from MORU (SEINet 2021); another historic record (1924) near Black Elk Peak (SEINet 2021). Listed in Dorn 2021a.
wolf lichen	*Letharia vulpina*	A few specimen records from the Black Hills National Forest (CNALH 2021).
broad lipped twayblade	*Listera convallarioides*	There are five known occurrences on the Black Hills National Forest with one site extending onto BLM land. Occurrences are restricted to a 30 square mile area in the northern Black Hills, south of Lead, South Dakota. Black Hills occurrences are in saturated soil conditions adjacent to creeks and springs, in white spruce (Picea glauca) forests and range in elevation from 5,040 to 6,100 feet. (USDA USFS 2018m); Few occurrences in springhead wetlands of n B Hills (WYNDD 2021a).
small flowered woodrush	*Luzula parviflora*	This species can be found in the northern Black Hills (SDNHP 2018a).
stiff clubmoss	*Lycopodium annotinum*	In the Black Hills L. annotinum occurs in moist microhabitats within remnant boreal white spruce (Picea glauca) and paper birch/hazelnut (Betula papyrifera/Corylus cornuta) communities. Two occurrences are co-located with Lycopodium complanatum (Rocky Mountain Region sensitive species). Black Hills occurrences range in elevation from 4,900 to 6,300 feet. Two additional historic reports have not been relocated (USDA USFS 2018m); Few occurrences in n Black Hills. (SDNHP 2018a); Species occur in a dense colony in the Upper Sand Creek Botanical Area, Crook County, Wyoming; and smaller, separate populations of each species occur in Lawrence County, South Dakota (Hornbeck et al. 2003c).
ground cedar	*Lycopodium complanatum*	Occurrences are located in the northern Black Hills on shaded, north-facing slopes (USDA USFS 2018i). Few occurrences in n Black Hills (SDNHP 2018a). known only from the Black Hills (Crook County as cited in WYNDD 2021a). LYCO3 at BKF sites occurs only in scattered patches characteristic of decline in extent, brown dried stems often present. Lycopodium complanatum is found only in the Black Hills National Forest in Region 2. The boreal spruce habitats ground cedar and stiff clubmoss occupy in the Black Hills are disjunct from the main distribution of white spruce to the north and in the northern Rocky Mountains These remnant boreal forests occur primarily in the northern Black Hills on north facing slopes and draws with paper birch (Betula papyrifera) as a common seral or dominant canopy component (USDA USFS 2021b).

Common Name	Scientific Name	Distribution on the Black Hills
northern bugleweed	*Lycopus uniflorus*	In Wyoming, known from the Black Hills and Yellowstone Plateau (Crook and Teton counties)(WYNDD 2021a).
five stamen miterwort	*Mitella pentandra*	Documented occurrences are within a 10 square mile area in the vicinity of Tinton, South Dakota. Black Hills sites occur in white spruce (Picea glauca) and paper birch/hazelnut (Betula papyrifera/Corylus cornuta) communities along small perennial and intermittent streams. Plants occur in mossy, moist to saturated, low areas. Some sites are associated with seeps. Black Hills occurrences range in elevation from 5,280 to 6,280 feet (USDA USFS 2018m); Few occurrences in n Black Hills. (SDNHP 2018a)
alpine notchleaf moss	*Paraleucobryum enerve*	Single 2008 specimen record in (BH_Mosses_GIS).
marsh grass of Parnassus	*Parnassia palustris*	Single occurrence in fen of n-cent SD. (SDNHP 2018a)
arrowleaf sweet coltsfoot	*Petasites frigidus* var. *sagittatus*	In the Black Hills it occurs in moist to saturated wetland areas along drainages and seeps ranging from full sun to shady white spruce (Picea glauca) forests often with paper birch (Betula papyrifera) or quaking aspen (Populus tremuloides). Black Hills occurrences range in elevation from 5,120 to 6,660 feet (USDA USFS 2018m). Its scattered distribution in the Rocky Mountains and Black Hills is likely the result of the geographic isolation of wetland habitats in these regions during the current inter-glacial drying trend (Froiland 1962; Price et al. 1996). The currently known metapopulation of arrowleaf sweet coltsfoot in the Black Hills is comprised of three populations in Lawrence County and one in Pennington County. Given the relatively close proximity of the South Dakota populations, it is likely that genetic exchange occurs between populations in the state. It is not known if there is any genetic exchange with other locations in the region, but it is probably limited since the nearest populations to the Black Hills are over 100 miles distant. (Glisson 2003) In the Black Hills, Wyoming, and Colorado, arrowleaf sweet coltsfoot approaches the southern end of its range, and generally occurs as scattered, disjunct populations, although it may be locally abundant (SDNHP 1986, 1988, 1993, 1994; Ode pers. comm. 2001; NatureServe 2001). (Gilsson 2003)
little fountain apple moss	*Philonotis fontana* var. *pumila*	At least one specimen record on BKF (BH_Mosses_GIS, CNABH 2021)
lodgepole pine	*Pinus contorta*	Known from a few locations in Lawrence County (BHSU Herbarium has 39 vouchers, RM has 6); Reported elevations range from 5,640-5,880 feet; Usually occurs in mixed conifer forest with dry soils (USDA USFS 2018e); scattered trees elsewhere in n B Hills. (SDNHP 2018a)
limber pine	*Pinus flexilis*	In the Black Hills P. flexilis is known to occur naturally within a two square mile area of the Black Elk Wilderness (Black Elk Peak area) and Custer State Park; sites range in elevation from 6,400 to 7,100 feet and are characterized by large granite outcrops, with P. flexilis often growing on north-facing, open rocky ridges, or partially shaded upper slopes with white spruce (Picea glauca), ponderosa pine (Pinus ponderosa), and common juniper (Juniperus communis). As part of the 2017 Limber Pine Restoration Project, additional seedlings have been planted in the Norbeck Wildlife Preserve ca. 1 mile northwest of Black Elk Peak at an elevation of 5,400 to 6,000 feet (USDA USFS 2018m); Localized in Black Elk Peak area of B Hills. (SDNHP 2018a); In Wyoming, known from every mountain range except the Black Hills (WYNDD 2021a)
greater featherwort	*Plagiochila asplenioides*	1 specimen record from the Black Hills National Forest (1986, Janssens) (BH_Mosses_GIS)

Common Name	Scientific Name	Distribution on the Black Hills
scentbottle	*Platanthera dilatata*	Rare in wetland habitats of the n B Hills. (SDNHP 2018a)
lesser roundleaved orchid	*Platanthera orbiculata*	Black Hills occurrences are distributed in three geographically separated regions of the Forest (Bearlodge Mountains, northwestern Black Hills and Black Elk Wilderness)(USDA USFS 2018i); Forested habitats of the n Black Hills. (SDNHP 2018a); Occurs across Canada, south along the Appalachians to South Carolina and Tennessee in the east and south to Washington and to the Black Hills of South Dakota and Wyoming. In Wyoming, known only from the Black Hills (Crook County)(WYNDD 2021a).
Jensen's polytrichum moss	*Polytrichum jensenii*	Known to occur on the BKF at Smith Gulch Fen (located on MY)(and possibly other locations)(Kosovich-Anderson 2017)
Platte River cinquefoil	*Potentilla plattensis*	Historic specimen report from Black Hills (1914, WH Over)(SEINet 2021); more recent BKF report and specimens from McIntosh Fen BA (located on MY)(2014, C. Mayer #1481, 1482 - one specimen is at FS office in Custer, and one was deposited at BHC Herbarium but is not currently on their online database); in BKF plant database 14SO05A (USDA USFS 2021a).
purple rattlesnake root	*Prenanthes racemosa*	Known from about 50 locations in Crook, Custer, Lawrence, Meade, and Pennington Counties; Reported elevations range from 4,080-6,320 feet; Usually occurs in mixed hardwood, riparian vegetation; Numerous herbarium vouchers from the Black Hills (BHSU has 27, RM has 6)(USDA USFS 2018j)
drops-of-gold	*Prosartes hookeri*	ca. 104 reported occurrences in Northern Black Hills and Bearlodge (however, many not verified by voucher specimens); Known occurrences range in elevation from 4400 to 6200 ft. and occur on open to shaded sites; Most occurrences are associated with paper birch/beaked hazelnut (Betula papyrifera/Corylus cornuta) community, often mixed with quaking aspen (Populus tremuloides)(USDA USFS 2018k)
intense light and dark lichen	*Pseudevernia intensa*	2 BKF locations - 1 in Black Elk Wilderness (Peter Nelson?) and one on NH district, Mary has the specimen on NH district (Zimmerman 2021a)
white veined wintergreen	*Pyrola picta*	Higher elevation forests of the n B Hills. (SDNHP 2018a)
cartilage lichen	*Ramalina sinensis*	Collected from Ward Draw in Lawrence County, and the other is T.3N., R1E, NW ¼ Section 36, also Lawrence County (Weins 2021b). No specimen reports from BKF found in CNALH 2021.
felted leafy moss	*Rhizomnium pseudopunctatum*	Documented on BKF (BH_Mosses_GIS).
sageleaf willow	*Salix candida*	two known occurrences, both in the central Black Hills on the Mystic Ranger District of the Black Hills National Forest. The single natural occurrence is located at McIntosh Fen Botanical Area (west of Deerfield, SD on Mystic Ranger District) at an elevation of 6,000 feet; a second experimental site was planted in 2007 near Heely Creek at an elevation of 6,300 feet (USDA USFS 2018i); one on the Black Hills National Forest in South Dakota (Decker 2006)
greenleaf willow	*Salix lasiandra* var. *caudata*	S. lasiandra var. caudata is considered a facultative wetland species in the Black Hills. There are three known occurrences of S. lasiandra var. caudata on the Black Hills National Forest all of which occur on floodplains or stream banks. Black Hills occurrences range in elevation from 4,800 to 5,620 feet. One additional historic report has not been relocated (USDA USFS 2018m).

Common Name	Scientific Name	Distribution on the Black Hills
shining willow	*Salix lucida*	S. lucida is considered a facultative wetland species in the Black Hills. There is only one documented occurrence of S. lucida on the Black Hills National Forest. An additional historical (1913) location near Deadwood, SD has not been relocated and is likely extirpated. The single central Black Hills site has two individuals and is in a dense willow (Salix spp.) shrubland floodplain along Rapid Creek at an elevation of 5,140 feet (USDA USFS 2018m); Single recent collection from cent B Hills. (SDNHP 2018a)
autumn willow	*Salix serissima*	There are five natural occurrences documented on the Black Hills National Forest and one experimental planting. These occurrences are located in the central to northern Black Hills and are associated with fens and wet meadows, often dominated by sedges (Carex species) and other willow (Salix) species (BKJF 2018i). Saturated, organic soils of n Black Hills (SDNHP 2018a). In the Black Hills National Forest, a large population of autumn willow occurs at McIntosh Fen (located in MY), a rare, calcareous fen meadow complex in Pennington County, and a much smaller population occurs on Middle Boxelder Creek in Lawrence County. Both populations occur in association with specific geologic and hydrologic conditions that have resulted in an elevated water table, fen-like habitats and saturated organic substrates. These habitats are extremely rare in the Black Hills.
bloodroot	*Sanguinaria canadensis*	Black Hills occurrences are limited to the northeast portion of the Forest, from the east side of Spearfish Canyon to west of Tilford. Additional sites have been reported from private land. Black Hills occurrences range in elevation from 3,800 to 5,000 feet (USDA USFS 2018i). Forests of e SD & disjunct in B Hills (SDNHP 2018a).
nodding saxifrage	*Saxifraga cernua*	Moist sites at higher elevations of B Hills (SDNHP 2018a).
Alberta saxifrage	*Saxifraga occidentalis*	Few collections from n Black Hills (SDNHP 2018a).
woolgrass	*Scirpus cyperinus*	
northern selaginella	*Selaginella rupestris*	Known from about 40 locations in Crook, Custer, Fall River, Lawrence, Meade, Pennington, and Weston Counties; Most occurrences are on the Hell Canyon District in Custer County; Reported elevations range from 4,480-6,040 feet; Usually occurs in ponderosa pine forest, grasslands or the transition between the two; Most likely under-reported due to perceived abundance and small stature (USDA USFS 2018f)
narrowleaf peatmoss	*Sphagnum angustifolium*	In the Black Hills S. angustifolium is currently reported from a single unconfirmed occurrence in the Rochford Cemetery Fen on the Mystic Ranger District at an elevation of 5,500 feet. (USDA USFS 2018i) but this was not confirmed as recently as 2021 (Shaw 2021).
Northern Peatmoss	*Sphagnum capillifolium*	known from few localities in the Black Hills (including Smith Gulch Fen, located on MY)(Kosovich-Anderson 2017)
Flat-top Bogmoss	*Sphagnum fallax*	known from few localities in the Black Hills (including Smith Gulch Fen, located on MY)(Kosovich-Anderson 2017)
Brown Peatmoss	*Sphagnum fuscum*	known from few localities in the Black Hills (including Smith Gulch Fen, located on MY)(Kosovich-Anderson 2017)
sheathed pondweed	*Stuckenia vaginata*	Last observed in Blue Dog Lake in 1962 (SDNHP (2018a); listed in Dorn 2021a; Pennington Co BKF specimen report (2000).

Common Name	Scientific Name	Distribution on the Black Hills
hairy navel lichen	*Umbilicaria hirsuta*	One specimen report (Peter Nelson 2014) from BKF on the Northern Hills District under old ponderosa pine trees on south facing forest, on rock (Mary Zimmerman has specimen)(Zimmerman 2021a)
cranberry	*Vaccinium macrocarpon*	Recently discovered in Black Hills acid fen. (SDNHP 2018a)
thinleaf huckleberry	*Vaccinium membranaceum*	Restricted to forests in Lead/Deadwood area. (SDNHP 2018a)
squashberry	*Viburnum edule*	ca. 100 reported records in northwestern Black Hills (in Lawrence and Pennington Co.). Most records concentrated around Spearfish Canyon vicinity (likely considered part of a few larger “occurrences”) with several scattered additional occurrences to north and south of main concentration area. Known occurrences range in elevation from 4850 to 6250 ft., in shaded to partially shaded sites and are associated with paper birch (Betula papyrifera) or white spruce (Picea glauca) overstory. (USDA USFS 2018g); Cool, moist forests of Spearfish Ck watershed. (SDNHP 2018a)
American cranberrybush	*Viburnum opulus* var. *americanum*	Fairly well distributed in Northern Black Hills in Lawrence Co and Meade Co, SD and Crook Co, WY; Estimated 70+ “occurrences” when considering adjacent records; Black Hills occurrences range from 1 to >100 clumps; ca. 20 occurrences with ≥30 clumps (USDA USFS 2018h); In Wyoming, known only from the Black Hills (Crook County)(WYNDD 2021a). "Occasional at mid-elevations in the northern Black Hills," (p. 500, Larson & Johnson 1999). "Frequent in rich wooded ravines in Black Hills," (p. 361, Van Bruggen 1985). 4 collections in WY Black Hills. In 1931 described as "Rare on shaded slopes in the n Black Hills," (McIntosh 1931). Highbush Cranberry may be vulnerable to disturbances due to low population size. It occurs in the Dugout Gulch Special Botanical Area and the Sand Creek Late Successional Landscape on the Black Hills National Forest. (USDA USFS 2021b).
small white violet	*Viola macloskeyi*	Plan Area-specific information not available (sources checked include: SEINet 2021, USDA NRCS 2021, NatureServe 2021, SDNHP 2018b, CDVPMP 2021, USDA USFS 2021a, Mayer 2021, WYNDD 2021, WYNDD 2021b, FNA 2021).
white violet	*Viola renifolia*	Plan Area-specific information not available (sources checked include: SEINet 2021, USDA NRCS 2021, NatureServe 2021, SDNHP 2018b, CDVPMP 2021, USDA USFS 2021a, Mayer 2021, WYNDD 2021, WYNDD 2021b, FNA 2021).
Selkirk's violet	*Viola selkirkii*	Black Hills occurrences are known from Black Hills National Forest, Custer State Park and Mt. Rushmore National Memorial and are restricted to a concentrated area (ca. 36 square miles) of the central core on igneous or metamorphic bedrock; All documented occurrences on the Forest are located within the Black Elk Wilderness and/or the Norbeck Wildlife Preserve. Black Hills occurrences range in elevation from 5,200 to 7,000 feet (USDA USFS 2018i); Moist forests at higher elevations of the B Hills (SDNHP 2018a); In the Black Hills, the species is restricted to spruce-dominated forests in cold, shady ravines from 5,400 to 7,000 ft (1,645 to 2,135 m) elevation on soils derived from granitic parent material. In the Black Hills, great-spurred violet occurs from 5,400 to 7,000 ft (1,645 to 2,135 m) elevation on moist, mossy mats and benches, rocky slopes in cool, shaded ravines, plus cold air drainages and cliff bases (USDA Forest Service 2000; Marriott 2001a). There are currently 10 known occurrences of great spurred violet in Black Hills National Forest administered lands (Larson 1993; Hildebrand 1996; Marriott 2000; Marriott 2001c)(Hornbeck et al. 2003f).
warnstorfia moss	*Warnstorfia pseudostraminea*	known from BKF Smith Gulch Fen (located on MY)(and possibly other locations)(Kosovich-Anderson 2017)

Chapter 3. Ecological Conditions Assessed by the Assessment of Key Ecological Characteristics, Status of those Conditions for At-Risk species, and Species (or Groups of Species)

After determining which species are At-Risk in the plan area and determining what ecological conditions are needed for those species, the 2012 Planning Rule requires the USFS to assess the ecological conditions present in the plan area in the context of those species and their needs. This meets the requirements for parts 3 and 5 of 2012 Planning Rile Section 12.55.

Overall ecological conditions in the plan area are the subject of the Ecological Integrity of Forested Ecosystems: Status and Trend (EIFE-ST) assessment and the Integrity of Non-Forest Ecosystems: Status and Trend (EINFE-ST) assessment. For the At-Risk species assessment, relevant sections are summarized from EIFE-ST and EINFE-ST, along with the At-Risk species that require that system.

Note that all ecosystems in the plan area may be used as foraging habitat by Northern long-eared bat and by American kestrel but may not be a limiting factor to those species, as the limiting issues are often related to nesting/roosting habitat, disease, or other issues.

Ponderosa Pine

The current ecological integrity of Ponderosa pine is compromised by significant change in the type, size, and severity of ecological disturbances and by the current forest structure. Low resilience of current forest conditions will interact with climate change and current forest management practices to maintain the current simplified forest structure.

The ecological integrity of the ponderosa pine ecosystem is low and will likely continue to be low in the future, assuming even-aged vegetation management continues to be the dominant practice, given the following:

- The extent of ponderosa pine on the Black Hills National Forest is declining while nonstocked areas are increasing. This will continue as fire becomes more widespread as a result of climate change.
- While the most recent mountain pine beetle epidemic has ended, similar events will occur in the future, especially given the changing climate. They will occur multiple times during a forest rotation, having occurred historically approximately every twenty years.
- Forest structure across the landscape has been simplified and is not as diverse as the historical structure. Patch sizes are larger and more homogenous and tree density is higher but composed of smaller trees. Current forest conditions are more uniform and continuous, with fewer gaps and more even spacing, increasing the likelihood of crown fire. This is dissimilar to the uneven-aged and spatially heterogeneous forest structure found historically. These conditions compromise forest resilience and delivery of ecosystem services. This change in forest structure has likely also led to a loss in the diversity and biomass of understory species.
- There is a clear decline in late-successional habitat resulting from the recent mountain pine beetle mortality.
- Regeneration is generally prolific (when seed sources are present and competing vegetation is not a limiting factor), but high intensity fires and climate change will likely lead to more areas that do not regenerate and considerably more variable regeneration.

- Abundance of snags and down wood appear to be similar to what likely occurred historically in these forests.

At-Risk Species Use of Ponderosa Pine Woodlands

- Sleepy needlegrass (*Achnatherum robustum*)
- Monarch butterfly (*Danaus plexippus*)
- American Kestrel (*Falco sparerius*)(along edges only, or as cavity nesters)
- Black-backed Woodpecker (*Picoides arcticus*)
- American three-toed woodpecker (*Picoides dorsalis*) (in early successional areas with copious large woody debris, or in old growth as cavity nesters in large trees)
- Michigan moonwort (*Botrychium michiganense*)
- Leathery grapefern (*Botrychium multifidum*)
- Pale botrychium (*Botrychium pallidum*)
- Pointed tip mariposa lily (*Calochortus apiculatus*)
- Slimleaf panicgrass: Slim-leaf witchgrass (*Dichanthelium linearifolium*)(often in dry, stony or sandy sites)
- Hooker's sandwort (*Eremogone hookeri* var. *pinetorum*)
- Large pod pinweed; Narrowleaf Pinweed (*Lechea intermedia* var. *intermedia*)
- Wolf lichen (*Letharia vulpine*)
- Purple rattlesnake root; Glaucous Rattlesnake-root; Glaucous White Lettuce (*Prenanthes racemose*)
- White veined wintergreen; White-veined Pyrola (*Pyrola picta*)
- Cartilage lichen; Fan Ramalina; Burning Bush Lichen (*Ramalina sinensis*)
- Northern selaginella; Ledge Spikemoss; Rock Spikemoss (*Selaginella rupestris*)
- Hairy navel lichen (*Umbilicaria hirsuta*)
- Squashberry; Highbush Cranberry (*Viburnum edule*)

Species of Conservation Concern may be added or removed based on public comment, or additional information gathered throughout the plan revision process.

Table 3. Risk factors for ponderosa pine woodlands

Risk Factor	Species Potentially Impacted
Climate change	General habitat, Michigan moonwort (*Botrychium michiganense*), Pale botrychium (*Botrychium pallidum*)
Fire, exasperated by even age stand structure	General habitat, American kestrel (*Falco sparerius*), Wolf lichen (*Letharia vulpine*), White veined wintergreen; White-veined Pyrola (*Pyrola picta*)
Fire exclusion leading to open areas filling in with other woody species	Pale botrychium (*Botrychium pallidum*)
Timber harvest	Black-backed Woodpecker (*Picoides arcticus*)
Pine beetle (especially impacting older trees)	
Grazing impacts to understory	Pointed tip mariposa lily (*Calochortus apiculatus*), slimleaf panicgrass: Slim-leaf Witchgrass (*Dichanthelium linearifolium*).

Risk Factor	Species Potentially Impacted
Off-road vehicle use	Large pod pinweed; Narrowleaf Pinweed (*Lechea intermedia* var. *intermedia*)

White Spruce

Pure Spruce Areas

Areas of mostly pure spruce, where it existed historically on cool mesic sites will likely be at least moderate in the future if current management levels and forest plan direction continues. This is because these areas would tend to have longer fire return intervals and a greater presence of stand-replacing fire and would therefore be less impacted by fire exclusion. The white spruce on the Black Hills appears to be in good health with mortality that is in the realm of natural or expected mortality levels (Allen et al. 2019, Allen et al. 2021). Climate change compromises the status of white spruce ecosystems and therefore the future trend may be toward moderate ecological integrity.

At-Risk Species Use of White Spruce Areas

- Leathery grapefern (*Botrychium multifidum*)
- American dipper (*Cinclus mexicanus*), streams and riparian areas in this type
- Black-backed Woodpecker (*Picoides arcticus*)
- American kestrel (*Falco sparerius*), along edges.
- American three-toed woodpecker (*Picoides dorsalis*)(in early successional areas with copious large woody debris, or in old growth as cavity nesters in large trees)
- Groundnut (*Apios americana*)
- Fairy slipper (*Calypso bulbosa*)
- Slenderbeak sedge (*Carex athrostachya*)
- Southwestern showy sedge (*Carex bella*)
- Silvery sedge (*Carex canescens*) (acidic wetlands within this type)
- Low northern sedge (*Carex concinna*)(wetlands within this type)
- Greater bladder sedge (*Carex intumescens*)
- Eastern star sedge (*Carex radiata*)
- Broadleaf enchanter's nightshade (*Circaea canadensis* var. *canadensis*)
- Mountain lady's slipper (*Cypripedium montanum*)
- Lesser yellow lady's slipper (*Cypripedium parviflorum*)
- shortleaf dicranum moss; Shortleaf Broom Moss (*Dicranum brevifolium*)
- Diverse glume wild rye; Interrupted Wild Rye (*Elymus diversiglumis*)
- dwarf scouring rush (*Equisetum scirpoides*)(riparian areas within this type)
- Hooker's sandwort (*Eremogone hookeri* var. *pinetorum*)
- Broad lipped twayblade (*Listera convallarioides*)(saturated soils in this type)
- Small flowered woodrush (*Luzula parviflora*)
- Stiff clubmoss; Bristly Clubmoss (*Lycopodium annotinum*)
- Ground cedar; trailing clubmoss (*Lycopodium complanatum*)
- Limber pine; Rocky Mountain white pine (*Pinus flexilis*)

- Lesser roundleaved orchid; Dessert-plate Orchid (*Platanthera orbiculate*)
- Drops-of-gold; Hooker's Mandarin; Hooker's Fairy bells (*Prosartes hookeri*)
- Intense light and dark lichen; Western Antler Lichen (*Pseudevernia intensa*)
- Cartilage lichen; Fan Ramalina; Burning Bush Lichen (*Ramalina sinensis*)
- Nodding saxifrage (*Saxifraga cernua*)
- Thinleaf huckleberry; Square-twigged Huckleberry; Square-twig Blueberry (*Vaccinium membranaceum*)
- Squashberry; Highbush Cranberry (*Viburnum edule*)
- American cranberrybush; mooseberry; Guelder-rose Viburnum (*Viburnum opulus* var. *americanum*)
- White violet; Kidneyleaf White Violet (*Viola renifolia*)
- Selkirk's violet; great-spurred violet (*Viola selkirkii*)(granitic soils)

Table 4. Risk factors for white spruce

Risk Factor	Species Potentially Impacted
Canopy loss due to harvest	Groundnut (*Apios americana*), Fairy slipper (*Calypso bulbosa*), Broadleaf enchanter's nightshade (*Circaea canadensis* var. *canadensis*), Stiff clubmoss; Bristly Clubmoss (*Lycopodium annotinum*), Ground cedar; trailing clubmoss (*Lycopodium complanatum*), Lesser roundleaved orchid; Dessert-plate Orchid (*Platanthera orbiculate*), Drops-of-gold; Hooker's Mandarin; Hooker's Fairy bells (*Prosartes hookeri*), Intense light and dark lichen; Western Antler Lichen (*Pseudevernia intensa*), Cartilage lichen; Fan Ramalina; Burning Bush Lichen (*Ramalina sinensis*), Nodding saxifrage (*Saxifraga cernua*), American cranberrybush; mooseberry; Guelder-rose Viburnum (*Viburnum opulus* var. *americanum*), White violet; Kidneyleaf White Violet (*Viola renifolia*), Black-backed Woodpecker (Picoides arcticus)
Severe wildfire	All dependent species
Climate change	

Mixed-Conifer Areas

Many mixed-conifer areas that have succeeded to spruce due to fire exclusion occur on gentler slopes and drier sites. These stands currently exhibit moderate and declining ecological integrity.

Most of the white spruce ecosystem on the Black Hills is in the large diameter stand-size class and 60-100 years old. There are many small trees and suggest that white spruce regeneration and recruitment is occurring. There are enough seed sources and regeneration that this species is capable of sustaining itself.

Current data indicates an abundance of snags in the white spruce forest type. Given fire exclusion and the very limited management that is done in white spruce, down woody material should be at near-natural levels or higher.

White spruce, with its isolated population in the Black Hills, is likely more vulnerable to changes in climate. It is not well-adapted to drought conditions and more widespread fire may reduce the prevalence of this species on the landscape. Even so, the Black Hills may continue to support refugia population of this species, particularly in colder, wetter locations, assuming fires do not reach these areas.

White spruce provides habitat diversity in a landscape dominated by ponderosa pine. Late-successional white spruce with its associated structural complexity (i.e., increased understory vegetation, downed woody debris, and snags), provides habitat for several Forest species and many rare plants in the Black Hills. These and other ecosystem services will likely continue to be provided in the future given the current and likely future ecosystem integrity of white spruce on the Black Hills.

At-Risk Species Use of Mixed-Conifer

- American kestrel (*Falco sparerius*), along edges
- Black-backed Woodpecker (*Picoides arcticus*)
- American three-toed woodpecker (*Picoides dorsalis*) (in early successional areas with copious large woody debris, or in old growth as cavity nesters in large trees)
- Leathery grapefern (*Botrychium multifidum*)
- Fairy slipper (*Calypso bulbosa*)
- Silvery sedge (*Carex canescens*)(acidic wetlands within this type)
- Greater bladder sedge (*Carex intumescens*)
- Eastern star sedge (*Carex radiata*)
- Sheathed sedge (*Carex vaginata*)
- Broadleaf enchanter's nightshade (*Circaea canadensis* var. *canadensis*)
- Mountain lady's slipper (*Cypripedium montanum*)
- Lesser yellow lady's slipper (*Cypripedium parviflorum*)
- Diverseglume wildrye; interrupted Wild Rye (*Elymus diversiglumis*)
- dwarf scouring rush (*Equisetum scirpoides*)(riparian areas within this type)
- Small flowered woodrush (*Luzula parviflora*)
- Stiff clubmoss; Bristly Clubmoss (*Lycopodium annotinum*)
- Ground cedar; trailing clubmoss (*Lycopodium complanatum*)
- Five stamen miterwort; Five-point Bishop's-cap (*Mitella pentandra*)
- Drops-of-gold; Hooker's Mandarin; Hooker's Fairy bells (*Prosartes hookeri*)
- Intense light and dark lichen; Western Antler Lichen (*Pseudevernia intensa*)
- Thinleaf huckleberry; Square-twigged Huckleberry; Square-twig Blueberry (*Vaccinium membranaceum*)
- Squashberry; Highbush Cranberry (*Viburnum edule*)
- American cranberrybush; mooseberry; Guelder-rose Viburnum (*Viburnum opulus* var. *americanum*)

Table 5. Risk factors for mixed-conifer

Risk Factor	Species Potentially Impacted
Climate change, especially if trending towards drier conditions	All species that depend upon this habitat

Risk Factor	Species Potentially Impacted
Canopy loss, loss of shaded areas in understory	American trailplant (*Adenocaulon bicolor*), Leathery grapefern (*Botrychium multifidum*), Stiff clubmoss; Bristly Clubmoss (*Lycopodium annotinum*), Five stamen miterwort; Five-point Bishop's-cap (*Mitella pentandra*), Drops-of-gold; Hooker's Mandarin; Hooker's Fairy bells (*Prosartes hookeri*), Intense light and dark lichen; Western Antler Lichen (*Pseudevernia intensa*), American cranberrybush; mooseberry; Guelder-rose Viburnum (*Viburnum opulus* var. *americanum*), Black-backed Woodpecker (Picoides arcticus)
Extreme wildfire	
Fire exclusion	Diverseglume wildrye; Interrupted Wild Rye (*Elymus diversiglumis*), Ground cedar; trailing clubmoss (*Lycopodium complanatum*), Intense light and dark lichen; Western Antler Lichen (*Pseudevernia intensa*)

Aspen

The ecological integrity of the aspen ecosystem on the Forest is moderate. Integrity is declining and will likely be low in the future as summarized here.

Overall, aspen extent is declining on the Forest due to replacement by pine and spruce. Fire exclusion and forest management practices that favor pine over aspen have led to a reduction in the extent of aspen and the vigor of existing stands. Aspen restoration treatments occur at a small scale and are not contributing significantly to the ecological integrity of aspen; the pace of aspen loss to succession is greater than the pace of restoration at the spatial extent of the Forest. Prescribed fire benefits aspen but is not implemented at a pace and scale to have a broad impact.

Grazing from livestock and wild ungulates is a stressor in the aspen ecosystem and fencing and other similar measures to prevent this browsing are difficult to do at large scales, with browsing also being an important infection route for canker fungi. The reduction in beavers in the riparian aspen forests on the Black Hills is a stressor given beavers stimulate aspen regeneration and restore ecosystem processes.

Under a changing climate, there will be both beneficial and detrimental effects to aspen on the Black Hills. Aspen resprouts after fire and will likely benefit if fire becomes more prevalent in the future. But the species is also vulnerable to moisture stress and severe drought conditions, which are tied to higher aspen mortality. Aspen in more xeric sites is particularly vulnerable. Increases in temperature may be challenging for aspen as well.

At-Risk Species Use of Aspen

- American kestrel (*Falco sparerius*), along edges
- American three-toed woodpecker (*Picoides dorsalis*)(in early successional areas with copious large woody debris, or in old growth as cavity nesters in large trees)
- Mountain lady's slipper (*Cypripedium montanum*)
- Lesser yellow lady's slipper (*Cypripedium parviflorum*)
- Arrowleaf sweet coltsfoot; (*Petasites frigidus* var. *sagittatus*)
- Drops-of-gold; Hooker's Mandarin; Hooker's Fairy bells (*Prosartes hookeri*)

Table 6. Risk factors for aspen

Risk Factor	Species Potentially Impacted
Stand replacement by conifer species	All species that depend upon this habitat

Risk Factor	Species Potentially Impacted
Livestock grazing	
Beaver population decline	

Bur Oak

The ecological integrity of the bur oak ecosystem on the Forest is high and will likely continue to be high in the future. Overall trends indicate it has been increasing in terms of acreage on the Forest. Data indicate no issue with regeneration and recruitment and there is no concern about significant impacts from insects or disease. Trees appear to be of sufficient size for mast production. It's well-adapted to fire, with its thick bark and ability to re-sprout after fire, and tolerant to drought, which will help maintain the species on the Forest even under a changing climate. Given this, no issues are anticipated with maintaining bur oak on the landscape and maintaining the ecosystem services it provides, such wildlife habitat and forage and cultural value. In fact, it may have an advantage under a changing climate.

At-Risk Species Use of Bur Oak

- Michigan moonwort (Botrychium michiganense)
- Lesser yellow lady's slipper (Cypripedium parviflorum)
- Bloodroot (Sanguinaria canadensis)

Table 7. Risk factors for bur oak

Risk Factor	Species Potentially Impacted
Conifer encroachment	Bloodroot (Sanguinaria canadensis)
Invasive plants	Bloodroot (Sanguinaria canadensis)

Paper Birch (Betula papyrifera)

Outside of quaking aspen and bur oak, paper birch is the most common hardwood tree found in the Black Hills. It is more common in the northern parts of the Black Hills, with some scattered trees and small stands in the southern part of the Forest (Blodgett et al. 2018).

While paper birch is sometimes found in ponderosa pine and other forest types, paper birch/beaked hazel forest is a unique, montane dry riparian type found at upper elevations on the forest. These forests tend to have dense canopies dominated by paper birch. They occur in drainage bottoms (with or without streams) and on slopes with northern aspects (Marriott and Faber-Langendoen 2000b). Emergent white spruce and ponderosa pine may be present in these areas. Shrub diversity can be high, but beaked hazel often dominates the shrub layer. The paper birch/beaked hazel ecosystem provides ecological conditions that support several emphasis plant species including bristle-stalk sedge (*Carex leptalea*) and large round-leaf orchid (*Platanthera orbiculata*) (SAIC 2003b). This community type is ranked as globally imperiled and critically imperiled in Wyoming (NatureServe 2022).

Assessments indicate that suitability for paper birch will decrease, or severely decrease with a changing climate. It is likely moisture limited in the Black Hills (Sieg 1990). Post-fire paper birch recruitment may be negatively impacted by warming temperatures and increased fire frequency combined with warming temperatures may decrease birch abundance (Timberlake et al. 2022).

Paper birch in the Black Hills exists as a small, disconnected population in the southernmost portion of its range in the central United States, suggesting that it would be difficult for the species to expand to adjacent locations with a changing climate (Timberlake et al. 2022).

Paper birch is vulnerable to root rotting pathogens making trees susceptible to toppling and reducing growth (Safford et al. 1990, Lockman et al. 2016). However, mortality of the overstory trees is well within expectations; thus root disease is helping with the natural thinning of the relatively dense overstory (Blodgett et al. 2018). However, negative effects from pathogens such as these may increase with climate change where trees are already drought stressed (Lockman et al. 2016).

Paper birch, along with white spruce, are two species with isolated populations in the Black Hills located well south of the remainder of their species range. As such, these two species are more vulnerable to changes in climate. Even so, the Black Hills may continue to support refugia population of these species, particularly in colder, wetter locations (Timberlake et al. 2022).

Paper birch, while rare on the Forest, provides forest diversity, with some wildlife species favoring birch habitat (Mills et al. 2000). Like white spruce, its disjunct distribution indicates the Black Hills population represents a unique element of biodiversity which extends to its understory associates.

At-Risk Species Use of Paper Birch

- Leathery grapefern (*Botrychium multifidum*)
- Michigan moonwort (*Botrychium michiganense*)
- Pale botrychium (*Botrychium pallidum*)
- Marsh bellflower (*Campanula aparinoides*)
- Foxtail sedge (*Carex alopecoidea*)
- Slenderbeak sedge (*Carex athrostachya*)
- Southwestern showy sedge (Carex bella)
- Limestone meadow sedge (*Carex granularis*)
- Eastern star sedge (*Carex radiata*)
- lesser yellow lady's slipper (*Cypripedium parviflorum*)
- Stiff clubmoss; Bristly Clubmoss (*Lycopodium annotinum*)
- Ground cedar; trailing clubmoss (*Lycopodium complanatum*)
- Five stamen miterwort; Five-point Bishop's-cap (*Mitella pentandra*)
- Lesser roundleaved orchid; Dessert-plate Orchid (*Platanthera orbiculate*)
- Purple rattlesnake root; Glaucous Rattlesnake-root; Glaucous White Lettuce (*Prenanthes racemose*)
- Drops-of-gold; Hooker's Mandarin; Hooker's Fairy bells (*Prosartes hookeri*)
- Bloodroot (*Sanguinaria canadensis*)
- Squashberry; Highbush Cranberry (*Viburnum edule*)
- American cranberrybush; mooseberry; Guelder-rose Viburnum (*Viburnum opulus* var. *americanum*)

Table 8. Risk factors for paper birch

Risk Factor	Species Potentially Impacted
Climate change. Gradual loss of the community via replacement by other species.	All species that depend upon this habitat

Risk Factor	Species Potentially Impacted
Climate change induced sudden loss via catastrophic wildfire. Loss of shaded understory areas.	Eastern star sedge (*Carex radiata*), Drops-of-gold; Hooker's Mandarin; Hooker's Fairy bells (*Prosartes hookeri*), American cranberrybush; mooseberry; Guelder-rose Viburnum (*Viburnum opulus* var. *americanum*)
Limited potential for range expansion – can't adapt to changing climate by colonizing new areas because none of the nearby areas are or will be suitable	All species that depend upon this habitat
Loss of canopy cover/shaded understory	Eastern star sedge (*Carex radiata*), Drops-of-gold; Hooker's Mandarin; Hooker's Fairy bells (*Prosartes hookeri*), American cranberrybush; mooseberry; Guelder-rose Viburnum (*Viburnum opulus* var. *americanum*)

Rocky Mountain Juniper (Juniperus scopulorum)

Rocky Mountain juniper is a drought-tolerant species that grows in dry climates. In the Black Hills, there are Rocky Mountain juniper woodlands and the species is also found in some ponderosa pine dominated forests.

Current estimate of the extent of Rocky Mountain juniper on the Black Hills NF is 17,209 acres. This is an apparent increase from a past estimate. It is likely juniper has increased in extent due to fire exclusion and other factors such as climate change and grazing have allowed for the expansion of juniper woodlands into meadows, grasslands, and other types (Scher 2002, USDA Forest Service RMRS 2021).

At-Risk Species Use of Rocky Mountain Juniper

- Some potential use by Brewer's Sparrow (*Spizella breweri*) where Juniper woodlands intergrade with sagebrush ecosystems.
- Pointed tip mariposa lily (*Calochortus apiculatus*)

Table 9. Risk factors for Rocky Mountain juniper

Risk Factor	Species Potentially Impacted
Climate change	
Fire, exasperated by even age stand structure	
Pine beetle (especially impacting older trees) Grazing	Pointed tip mariposa lily (*Calochortus apiculatus*)

Limber Pine (Pinus flexilis)

Limber pine occurs in isolated areas scattered over a small geographic area of about 2 square miles in the Black Elk Wilderness of the Black Hills National Forest and adjacent Custer State Park (Blodgett 2020). Recently many of these pines were killed by mountain pine beetle (MPB; *Dendroctonus ponderosae*) and white pine blister rust (WPBR; *Cronartium ribicola*), an exotic, invasive disease of 5-needle pines (Blodgett 2020, Blodgett 2019). There are 32 documented live limber pine on the Forest, most of which are seedlings or saplings (Blodgett 2019).

A variety of management activities have been done to help ensure persistence of this species on the Forest. This includes branch pruning for white pine blister rust, bulk seed collections, verbenone

pouches for mountain pine beetle protection, individual “mother tree” seed collections and planting (Blodgett 2019).

A new limber pine population was established in 2017 in the Norbeck Wildlife Preserve of the Black Hills National Forest. Two-year-old limber pine seedlings were planted in 2017 and in 2018 at 7 areas in the preserve. No additional recent mortality of these seedlings was observed, suggesting they are established or have passed the initial planting-shock (Blodgett 2020). Additional planting in this area was planned for 2021. Observations of these new seedlings suggest limber pine grows better on "good" sites with deep soil and no competition, versus harsh, rocky, thin-soil sites (Blodgett 2020).

At-Risk Species Use of Limber Pine

- Limber pine; Rocky Mountain white pine (*Pinus flexilis*)

Table 10. Risk factors for limber pine

Risk Factor	Species Potentially Impacted
Mountain pine beetle	Limber pine (*Pinus flexilis*)
Blister rust	Limber Pine (*Pinus flexilis*)

Other Forested Ecosystems and Species

Lodgepole Pine

As described in USDA Forest Service (2015), lodgepole pine is found primarily on the Northern Hills Ranger District in the Swede Gulch area. Harvest has taken place in these stands. Lodgepole pine is regenerating but not prolifically. The Forest Health Service Center has documented that some of the mature Lodgepole are being attacked by mountain pine beetle. Most, however, have not been infested.

Lodgepole pine is a very small component of the forest, estimated at less than 100 acres (FSVeg Spatial 2021).

At-Risk Species Use of Lodgepole Pine

- Lodgepole pine (*Pinus contorta*)

Table 11. Risk factors for lodgepole pine

Risk Factor	Species Potentially Impacted
Mountain pine beetle	Lodgepole pine (*Pinus contorta*)
Timber harvest	Lodgepole pine (*Pinus contorta*)
Extreme wildfire events	Lodgepole pine (*Pinus contorta*)

Douglas-Fir

As described in USDA Forest Service (2015), Douglas-fir is found on Northern Hills and Hell Canyon Ranger Districts. This species is not native to the Black Hills and was planted in past decades. Some of the Douglas-fir in the Sunday Gulch area on Hell Canyon Ranger District, planted in the 1930s, was recently cut in favor of aspen.

Douglas-fir is a very small component of the forest, estimated at less than 100 acres (FSVeg Spatial 2021).

At-Risk Species Use of Douglas-Fir

No known at-risk species in the Black Hills are dependent upon Douglas-Fir.

Table 12. Risk factors for Douglas-fir

Risk Factor	Species Potentially Impacted
unknown	

Non-forested Terrestrial Ecosystems

Dry Plains and Shrublands

The primary plant association found on the Black Hills NF is Mountain Mahogany/Side Oats Grama shrubland. It is best developed east of Newcastle, WY and found on low-elevation limestone derived soils. Total vegetative cover is generally greater than 50%; herbaceous stratum is relatively sparse generally ranging from 10 to 25%.

At-Risk Species Use of Dry-Plains and Shrublands

- Downy Gentian (*Gentiana puberulenta*)
- Bloodroot (*Sanguinaria canadensis*)

Table 13. Risk factors for dry plains and shrublands

Risk Factor	Species Potentially Impacted
Private land conversion	Downy Gentian (Gentiana puberulenta), Bloodroot (Sanguinaria canadensis)

Dry Mixed Grass Prairies

The most common dry mixed grass prairie type in the Black Hills is the Northern Great Plains Little Bluestem Prairie, dominated by little bluestem, blue and side-oats grama and often thread-leafed sedge. It occurs throughout the study area but stands at higher elevations tend to be reduced in size. The other Dry Mixedgrass Prairie type, Needle-and-Thread - Blue Grama Mixedgrass Prairie, is restricted to the lower elevations (Marriott and Faber-Langendoen 2000a).

At-Risk Species Use of Dry Mixed Grass Prairies

- Frenchman's Bluff grapefern (*Botrychium gallicomontanum*)
- Downy Gentian (*Gentiana puberulenta*)
- Northern selaginella; Ledge Spikemoss; Rock Spikemoss (*Selaginella rupestris*)
- Black-footed ferret (*Mustela negripes*)(potential)

Table 14. Risk factors for dry mixed grass prairies

Risk Factor	Species Potentially Impacted
unknown	

Mesic Mixed Grass Prairies

Mesic mixed grass prairies are most extensive in the Red Valley and much of the Hogback Rim. Two associations are currently recognized for the Black Hills: Western Wheatgrass – Green Needlegrass and Western Wheatgrass - Needle-and-Thread Mixed grass Prairies. Stands can be difficult to classify due to shared dominants among both mesic and dry mixed-grass types. Species distribution often is patchy, with local dominance variable (Marriott and Faber-Langendoen 2000a).

At-Risk Species Use of Mesic Mixed Grass Prairies

- lesser yellow lady's slipper (*Cypripedium parviflorum*)
- Northern selaginella; Ledge Spikemoss; Rock Spikemoss (*Selaginella rupestris*)
- Black-footed ferret (*Mustela negripes*)(potential)

Table 15. Risk factors for mesic mixed grass prairies

Risk Factor	Species Potentially Impacted
unknown	

Black Hills Montane Grasslands

Black Hills Montane Grasslands are endemic to the Black Hills (i.e., this plant association does not occur anywhere else outside of the area), occurring at higher elevations on the Limestone Plateau and adjacent Central Core (Marriott and Faber-Langendoen 2000a). During the 1999 field season, a comprehensive survey of Black Hills Montane Grassland was completed (Marriott 2000). High-ranking examples were found on the southern Limestone Plateau and adjacent Central Core, and on Warren Peaks in the Bear Lodge Mountains (Marriott, 2012). These highest-ranking examples exhibit the following three native species: *Sporobolus heterolepis, Achnatherum richardsonii, Danthonia intermedia* (prairie dropseed - Richardson’s needlegrass - timber oatgrass).

At-Risk Species Use of Black Hills Montane Grasslands

- Frenchman's Bluff grapefern (*Botrychium gallicomontanum*)
- lesser yellow lady's slipper (*Cypripedium parviflorum*)
- California oatgrass (*Danthonia californica*)
- Tufted hairgrass (*Deschampsia cespitosa*)
- Slender cudweed (*Gnaphalium exilifolium*)
- Small-flowered woodrush (*Luzula parviflora*)
- Alpine notchleaf moss; paraleucobryum moss (*Paraleucobryum enerve*)
- Platte River cinquefoil (*Potentilla plattensis*)

Table 16. Risk factors for Black Hills montane grasslands

Risk Factor	Species Potentially Impacted
Severe wildfires in adjacent areas (erosion, sedimentation, damage from firefighting activities.	Tufted hairgrass (*Deschampsia cespitosa*)
Dewatering of wet meadows.	Tufted hairgrass (*Deschampsia cespitosa*), Alpine notchleaf moss; paraleucobryum moss (*Paraleucobryum enerve*), Platte River cinquefoil (*Potentilla plattensis*)

Aquatic Ecosystems

Lakes and Reservoirs

There are 38 named lakes and ponds among the 808 surface waterbody features within the Black Hills NF (U.S. Geological Survey [USGS] 2021. Virtually all of the lakes are man-made reservoirs that allow for control of the water levels and outflow. Total surface area of reservoirs within the Black Hills NF is approximately 2,000 acres. Larger reservoirs are typically more resilient to fluctuations in temperature, dissolved oxygen, pollution inputs and sedimentation rates than smaller lakes. 47 smaller lakes and ponds in the South Dakota portion of the Black Hills NF are stocked and managed for trout (South Dakota Game, Fish, and Parks [SDGFP] 2020).

At-Risk Species Use of Lakes and Reservoirs

- Longleaf hook moss (*Drepanocladus longifolius*)
- Slender cudweed (*Gnaphalium exilifolium*)(margins)
- Sheathed pondweed; ig-sheathed Pondweed (*Stuckenia vaginata*)(alkali waters less than 2m/6ft depth, with little wave action)
- Small white violet; Macloskey's Violet (*Viola macloskeyi*)(margins)
- Finescale dace (*Chrosomus neogaeus*)

Table 17. Risk factors for lakes and reservoirs

Risk Factor	Species Potentially Impacted
Drought, especially related to climate change	All dependent species
Invasive aquatic organisms	All dependent species
Pollution, water quality	Sheathed pondweed; ig-sheathed Pondweed (*Stuckenia vaginata*)

Streams

There are nearly 3,500 miles of drainages within the plan area, with an estimated 950 miles of perennial streams within the boundaries of the Black Hills NF. Most surface drainage features drain from west to east. Sediment, bed and bank stability, and temperature are among the primary components of concern (USDA Forest Service 2010a).

The diminution or complete disappearance of flow where streams cross sedimentary formations (Brown 1944, Orr 1975) can be significant. These channel segments are recharge zones to aquifers, which can be an important ground-water sources. The diminution or disappearance of flow means that

surface water yields can be significantly increased only in areas upstream from the loss zones—except in the case of floods or other high flows that exceed the intake capacities of channels.

Most streams, when at their base flow level, go completely dry downstream of where they cross the Minnelusa and Madison outcrops (Carter et al. 2002, Carter et al. 2003, USDA Forest Service 2005a). Only Rapid Creek, Whitewood Creek, and Spearfish Creek consistently maintain perennial flows through the loss zone on the South Dakota portion of the Forest (Carter et al. 2002a). Many miles of Forest streams disappear during drought cycles. Stream sections below such loss zones are often dry because the amount of loss exceeds stream inputs (SDGFP 2020).

Thirty-six percent (27) watersheds that lie either completely or partially in the Black Hills NF are considered functioning properly with the remaining watersheds Functioning at Risk (Class 2). There are no Class 3 (Impaired Function) wetlands in the Black Hills NF. Aquatic habitat condition is considered good in 40 watersheds (53 percent) and the aquatic biota condition is considered good in 37 watersheds (49 percent). Riparian and wetland vegetation is in good condition in only 4 watersheds (5 percent).

At-Risk Species Use of Streams

- American dipper (*Cinclus mexicanus*)
- Slender cudweed (*Gnaphalium exilifolium*)(margins)
- Northern bugleweed (*Lycopus uniflorus*)(margins)
- Little fountain apple moss; philonotis moss (*Philonotis fontana* var. *pumila*) (margins)
- Small white violet; Macloskey's Violet (*Viola macloskeyi*)(margins)
- Finescale dace (*Chrosomus neogaeus*)

Table 18. Risk factors for streams

Risk Factor	Species Potentially Impacted
Drought, especially related to climate change	All dependent species
Invasive aquatic organisms	Moss species

Riparian/Wetland

Riparian ecosystems are those areas situated adjacent to rivers, lakes, and streams. These systems are characterized by periodic flooding that reorganizes alluvial soils and provides a seed bed for various riparian plant species. Riparian ecosystems support a variety of interactions between terrestrial and aquatic ecosystem constituents and are generally comprised of a variety of tall and low deciduous trees, shrub species and herbaceous plants.

Riparian areas on the forest vary considerably in terms of structure and diversity, ranging from sedge/grass/forb communities to shrub/deciduous/tree communities. Riparian stands often form mosaics of shrubs, trees, and open meadow. Oxbows and other wetlands support emergent wetland-obligate species.

Most riparian systems in the Black Hills have been severely degraded, with noted decreases in *Populus* and *Salix* cover (Hoffman and Alexander 1987). These declines are generally attributed to historic gold and hydro mining operations as well as historic and current water diversions to support mining efforts, and grazing pressures from both native ungulates and domestic livestock. Declines in the distribution and overall density of *Salix* have also been linked to disease or insects (Froiland

1962). Fire can also influence this system, however changes to the disturbance regime (e.g., flooding, dams, heavy grazing and trampling by both domestic animals and wildlife) are also factors.

Outside of floodplains, forests of quaking aspen and birch are located where groundwater produces adequate soil moisture to support deciduous trees. Riparian hardwood species include paper birch (*Betula papyrifera*), which are associated with higher elevation mesic northern aspects. Paper birch are often found in association with quaking aspen over burn scars, which may colonize smaller stream and drainage areas. High elevation riparian areas contain willows and water birch. The general elevation threshold between 4,000 and 6,240 feet may contain mixed stands of oak, ash, box elder, elm, and hawthorn. Lower elevation riparian shrublands contain western snowberry, gooseberry, currant, and rose with silver sagebrush occurring on floodplains (Hoffman and Alexander 1987).

At-Risk Species Use of Riparian/Wetland Areas

- Black-billed hummingbird (*Archilochus alexandri*)
- Black-billed cuckoo (*Coccyzus erythropthalmus*)
- Leathery grapefern (*Botrychium multifidum*)
- Swamp thread moss *(Bryum uliginosum*)
- Marsh bellflower (*Campanula aparinoides*)
- Foxtail sedge (*Carex alopecoidea*)
- Slenderbeak sedge (*Carex athrostachya*)
- Southwestern showy sedge (*Carex bella*)
- Brownish sedge (*Carex brunnescens*)
- Low northern sedge (*Carex concinna*)
- greater bladder sedge (*Carex intumescens*)
- Emory's sedge (*Carex emori*)
- Greater bladder sedge (*Carex intumescens*)
- Eastern star sedge (*Carex radiata*)
- Blunt broom sedge (*Carex tribuloides*)
- Broadleaf enchanter's nightshade (*Circaea canadensis* var. *canadensis*)
- Lesser yellow lady's slipper (*Cypripedium parviflorum*)
- California oatgrass (*Danthonia californica*)
- Schreber's dicranella moss; Schreber's Forklet Moss (*Dicranella schreberiana*)
- Shortleaf dicranum moss; Shortleaf Broom Moss (*Dicranum brevifolium*)
- Longleaf hook moss (*Drepanocladus longifolius*)
- Ovate spikerush (*Eleocharis ovata*)
- Beaked spikerush (*Eleocharis rostellata*)
- Diverseglume wildrye; Interrupted Wild Rye (*Elymus diversiglumis*)
- Dwarf scouring rush (*Equisetum scirpoides*)
- Variegated scouring rush; Variegated Horsetail (*Equisetum variegatum*)
- Tall cottongrass; Narrowleaf Cotton-grass (*Eriophorum angustifolium*)
- Showy prairie gentian (*Eustoma exaltatum* ssp. *russellianum*)
- Slender cudweed (*Gnaphalium exilifolium*)
- Broad lipped twayblade (*Listera convallarioides*)
- Stiff clubmoss; Bristly Clubmoss (*Lycopodium annotinum*)

- Ground cedar; trailing clubmoss (*Lycopodium complanatum*)
- Northern bugleweed (*Lycopus uniflorus***)**
- Five stamen miterwort; Five-point Bishop's-cap (*Mitella pentandra*)
- Marsh grass of Parnassus (*Parnassia palustris*)
- Arrowleaf sweet coltsfoot; (*Petasites frigidus* var. *sagittatus*)
- Little fountain apple moss; philonotis moss (*Philonotis fontana* var. *pumila*)
- Greater featherwort (*Plagiochila asplenioides*)
- Scentbottle; Tall White Bog Orchid (*Platanthera dilatate*)
- Platte River cinquefoil (*Potentilla plattensis*)
- Felted leafy moss; Felt Round Moss (*Rhizomnium pseudopunctatum*)
- Sageleaf willow; Hoary Willow (*Salix candida*)
- Greenleaf willow (*Salix lasiandra* var. *caudata*)
- Shining willow (*Salix lucida*)
- Autumn willow (*Salix serissima*)
- Bloodroot (*Sanguinaria canadensis*)
- Nodding saxifrage (*Saxifraga cernua*)
- Alberta saxifrage; Western Saxifrage (*Saxifraga occidentalis*)
- Woolgrass; Cottongrass Bulrush (*Scirpus cyperinus*)
- Sheathed pondweed; ig-sheathed Pondweed (*Stuckenia vaginata*)
- Hairy navel lichen (*Umbilicaria hirsuta*)
- Cranberry; Large Cranberry (*Vaccinium macrocarpon*)
- Small white violet; Macloskey's Violet (*Viola macloskeyi*)
- White violet; Kidneyleaf White Violet (*Viola renifolia*)

Table 19. Risk factors for riparian/wetlands

Risk Factor	Species Potentially Impacted
Drought, especially related to climate change	All dependent species
Invasive aquatic organisms	
Grazing	Foxtail sedge (*Carex alopecoidea*), Low northern sedge (*Carex concinna*), blunt broom sedge (*Carex tribuloides*)
Water impoundment	All dependent species
Invasive plants	All dependent plant species
Impacts to riparian areas from severe wildfire in surrounding areas	Black-billed hummingbird (*Archilochus alexandri*), Greater bladder sedge (*Carex intumescens*), blunt broom sedge (*Carex tribuloides*), Diverseglume wildrye; Arrowleaf sweet coltsfoot; (*Petasites frigidus* var. *sagittatus*), Little fountain apple moss; philonotis moss (*Philonotis fontana* var. *pumila*), Greenleaf willow (*Salix lasiandra* var. *caudata*), Autumn willow (*Salix serissima*)
Recreation	Black-billed hummingbird (*Archilochus alexandri*), Northern bugleweed (*Lycopus uniflorus***),** Sageleaf willow; Hoary Willow (*Salix candida*)
Beaver activity	Northern bugleweed (*Lycopus uniflorus***)**
Herbivory by native or domestic species	Arrowleaf sweet coltsfoot; (*Petasites frigidus* var. *sagittatus*)

Karst

There is an extensive network of caves beneath the Black Hills NF, a result of the presence of water-soluble rocks in the geologic layers below. The most well-known caves of the Black Hills are Jewel and Wind Caves They are the third and sixth longest known caves in the world. While these two features are not managed by the Forest Service, impacts on them are considered during planning because of the underground linkages between karst resources under the Forest Service's purview and the National Park Service management of Jewel and Wind Caves.

Karst ecosystems are delicate and finite. It is assumed that the formation of new caves has substantially slowed in the recent age and protection of caves like Jewel and Wind Cave is essential to their longevity. Threats related to karst ecosystems include groundwater contamination.

At-Risk Species Use of Cave and Karst Areas

- Northern Long-eared bat (*Myotis septentrionalis*)

Table 20. Risk factors for cave and karst areas

Risk Factor	Species Potentially Impacted
White-nose syndrome	Northern Long-eared bat (*Myotis septentrionalis*)
Recreational use	Northern Long-eared bat (*Myotis septentrionalis*)

Aquifers

The major bedrock aquifers beneath the Black Hills are the Deadwood, Madison, Minnelusa, Minnekahta, and Inyan Kara aquifers. Aquifers primarily receive recharge from infiltration of precipitation, and the Madison and Minnelusa aquifers also receive substantial recharge from streamflow losses (Carter et al. 2003). A Precambrian aquifer is also present at the deepest layers of geologic formation. Major aquifers are associated with the Limestone Plateau and outcrops along the Hogback encircling the Black Hills region; and that the Precambrian aquifers are associated with the granite and metamorphic central core of the Black Hills.

A study of groundwater flow, quality, and mixing in relation to Wind Cave National Park was conducted during 2007–2010 (Long et al. 2012). The study indicated that there were no contaminant concerns derived from sampled springs, sinks, or cave drips for the constituents analyzed (arsenic, nitrate plus nitrite, trace metals, tritium, and chlorofluorocarbons). Higher arsenic levels found in springs are likely the result of natural conditions from existing shale layers.

Lowering of the water table is a concern, as availability of groundwater is dependent on being able to reach it with wells. Aquifer observation wells in South Dakota show that water levels have fluctuated during the period of record (previous 30-50 years), but that the average water table elevation has not substantially changed in the aquifers monitored, and in many cases, was higher in 2020 than in previous years (South Dakota Department of Natural Resources 2021). The USGS also maintains a system of groundwater monitoring wells that may be referenced in further detail.

Table 21. Risk factors for aquifers

Risk Factor	Species Potentially Impacted
Long term drought, especially related to climate change	Species dependent upon groundwater fed ecosystems

Phreatophytic Ecosystems

Phreatophytic ecosystems are unique due to the type of vegetation species they support and they include riparian as well as other phreatophytic ecosystems in the Forest. Phreatophytic vegetation is always dependent on ground water and is therefore well correlated with the distribution of groundwater. The root systems of phreatophyte species are capable of penetrating to depths ranging from just over one foot to more than one hundred feet below the surface.

At-Risk Species Use of Phreatophytic Ecosystems

- Leathery grapefern (*Botrychium multifidum*)
- longleaf hook moss (*Drepanocladus longifolius*)

Table 22. Risk factors for phreatophytic ecosystems

Risk Factor	Species Potentially Impacted
Long-term drought, especially related to climate	Leathery grapefern (*Botrychium multifidum*), longleaf hook moss (*Drepanocladus longifolius*)

Discharge Ecosystems

Discharge ecosystems occur where groundwater emerges or reaches the upper 12 inches of the ground surface. These include springs, wetlands, lakes, streams, and some riparian habitats where ground water is closer to the surface. Consequently, there is no clear division with the riparian systems described above.

Hydrological changes are the primary influence on plant communities in this group. They typically support vegetation with low to dense cover dominated by sedges, with cattails and bulrush more prevalent in larger and deeper open water areas such as ponds and lakes. Wet meadows and prairies are comparatively drier, particularly in late summer. Depressional wetlands are found in the low parts of floodplains where water collects. These sites may also occur with strongly saline soils and halophytic plant species. Floodplain forests may have an open to closed canopy dominated by deciduous trees and various willow species (*Salix* spp.) in the lower and midstory vegetation strata.

At-Risk Species Use of Discharge Ecosystems

- Southern maidenhair fern (*Adiantum capillus-veneris*)
- Low northern sedge (*Carex concinna*)(seeps)

Table 23. Risk factors for discharge ecosystems

Risk Factor	Species Potentially Impacted
Invasive Plants	Southern-maidenahir fern (*Adiantum capillus-veneris*)
Cattle grazing	Southern-maidenahir fern (*Adiantum capillus-veneris*)
Water diversion	All SCC that are dependent upon this ecosystem

Springs

Thousands of springs are present in the Black Hills NF. Hundreds of these springs are artesian, or free-flowing, and originate from confined aquifers around the periphery of the Black Hills, which are

the formative springs for flowing surface water features. Collectively, these springs are a large source of groundwater discharge, contributing to the flow of streams, creation of wetlands, and volume of lakes in the region.

Artesian springs generally emerge from or near outcrop areas of the Spearfish Formation, which is a low permeability hydrogeologic unit (Long et al. 2012). This formation has a high shale content, is interspersed with flowing groundwater in fractures, and has numerous cavities created by dissolved gypsum. Artesian springs in the southern Black Hills may flow upward through breccia pipes that allow groundwater from deep bedrock aquifers to emerge from overlying formations (Hayes 1999). Springs can be differentiated from waters originating in aquifers via temperature and hydrochemical conditions. A detailed account of spring types and geologic descriptions can be found in USGS publications by Carter et al (2002 and 2003).

Warm, or geothermal, springs are a unique feature of the plan area. Warm springs have been recognized as a unique biological feature, since these habitats support several rare plant species found only in South Dakota.

- Low northern sedge (*Carex concinna*)
- Beaked spikerush (*Eleocharis rostellata*)
- Stream orchid; Giant Helleborine (*Epipactis gigantea*)

Table 24. Risk factors for springs ecosystems

Risk Factor	Species Potentially Impacted
Impacts for high intensity wildfire in adjacent areas	Stream orchid; Giant Helleborine (*Epipactis gigantea*)
Recreational impacts from use of hot/warm springs	All SCC that are dependent upon this ecosystem

Peatlands/Fens

Peatlands which include the subtypes features of fens and bogs, occur where minerotrophic groundwater emerges at the surface, such as at the lower slopes of a hill or cliff or in floodplains, and are characterized by saturated soil conditions due to an elevated water table and the accumulation of organic material. There are over 2,400 known peatlands on the Black Hills NF (USFS 2022). Two notable examples include the McIntosh Fen and a small area on Middle Boxelder Creek.

At-Risk Species Use of Peatlands/Fens

- Leathery grapfern (*Botrychium multifidum*)
- Acute brachythecium moss (*Brachythecium actum*)
- Brownish sedge (*Carex brunnescens*)
- Silvery sedge (*Carex canescens*)
- Emory’s sedge (*Carex emori*)
- Limestone meadow sedge (*Carex granularis*)
- Greater bladder sedge (*Carex intumescens*)
- Sheathed sedge (*Carex vaginata*)
- Lesser yellow lady's slipper (*Cypripedium parviflorum*)
- Dicranella moss; Spur-necked Forklet Moss (*Dicranella cerviculata*)
- Schreber's dicranella moss; Schreber's Forklet Moss (*Dicranella schreberiana*)
- Variegated scouring rush; Variegated Horsetail (*Equisetum variegatum*)

- Tall cottongrass; Narrowleaf Cotton-grass (*Eriophorum angustifolium*)
- Showy prairie gentian (*Eustoma exaltatum* ssp. *russellianum*)
- Stiff clubmoss; Bristly Clubmoss (*Lycopodium annotinum*)
- Northern bugleweed (*Lycopus uniflorus***)**
- Alpine notchleaf moss; paraleucobryum moss (*Paraleucobryum enerve*)
- Marsh grass of Parnassus (*Parnassia palustris*)
- Arrowleaf sweet coltsfoot; (*Petasites frigidus* var. *sagittatus*)
- Jensen's polytrichum moss (*Polytrichum jensenii*)
- Platte River cinquefoil (*Potentilla plattensis*)
- Felted leafy moss; Felt Round Moss (*Rhizomnium pseudopunctatum*)
- Sageleaf willow; Hoary Willow (*Salix candida*)
- Shining willow (*Salix lucida*)
- Autumn willow (*Salix serissima*)
- Woolgrass; Cottongrass Bulrush (*Scirpus cyperinus*)
- Sphagnum; narrowleaf peatmoss (*Sphagnum angustifolium*)
- Sphagnum; Northern Peatmoss (*Sphagnum capillifolium*)
- Sphagnum; Flat-top Bogmoss; Flat-topped Sphagnum Moss (*Sphagnum fallax*)
- Sphagnum; Brown Peatmoss (*Sphagnum fuscum*)
- Cranberry; Large Cranberry (*Vaccinium macrocarpon*)
- White violet; Kidneyleaf White Violet (*Viola renifolia*)
- Warnstorfia moss; Spring Hook Moss (*Warnstorfia pseudostraminea*)(acidic conditions)

Table 25. Risk factors for peatlands/fens

Risk Factor	Species Potentially Impacted
Moisture balance due to climate change	All peatland/fen dependent species
Moisture balance due to human-caused water diversion, drainage or excessive groundwater withdrawal	
Grazing	
Extreme wildfires (especially when accompanied by drought/lower water tables)	Autumn willow (*Salix serissima*)

Ecological or Habitat Features Not Addressed in Ecological Types

Ecological conditions in the plan area necessary to meet the requirements for each at-risk species that were ***not*** addressed by the assessment of key ecosystem characteristics (table 26) meets the requirements for part 4 of the 2012 Planning Rule Section 12.55. These conditions are described in greater detail below.

Large Prairie Dog Colonies

Associated At-Risk species: Black-footed ferret (*Mustela negripes*).

Black-footed ferrets require a rich supply of prey animals to meet their metabolic requirements and they prey almost exclusively on prairie dogs. This can deplete the population of smaller colonies. In

areas where Black-footed ferrets are present, lethal control of prairie dog colonies or disease epidemics can reduce colony populations to levels below that necessary to support the ferrets.

Access to Flowering Species, Especially Herbaceous Dicots

- Associated At-Risk species: Monarch butterfly, Black-billed hummingbird (*Archilochus alexandri*)

Nectar-feeding animals require access to flowering plants. Such flowering plants can be at risk from range management practices that favor grass/monocot species. Vegetative succession leading to more closed canopies with sparse understory or carpets of conifer needles that act as an allelopathic barrier to presence of herbaceous species can also lead to reduction in such flowering species and the pollinators that depend upon them.

Snags for Cavity Nesting

- Associated At-Risk species: American three-toed woodpecker (*Picoides dorsalis*), Black-billed cuckoo (*Coccyzus erythropthalmus*).

Snags used by cavity nesting species need to be large enough for the diameter of the tree well above ground level to be wide enough to contain a nest-sized cavity without toppling the portion of the tree above the cavity. .

The cavities themselves are usually initially created by woodpecker species and often later reused by other species who may enlarge the cavity if necessary. Cavity-suitable aspen trees can be most critical because aspen stands tend to be rich in bark and cambium tunneling insects that are favored by woodpeckers. These stands with large aspen trees can then host a sort of source population of woodpeckers than forage in surrounding forests and create more cavities.

Risks to this habitat feature relate to removal of snags and of older larger trees that might be destined to become snags.

Sagebrush Habitat

Associated At-risk species: Brewer’s sparrow.

There is very little sagebrush habitat on the Black Hills NF, this habitat type can be damaged or eliminated by fire, conifer encroachment, chaining or other practices that maintain the habitat with more grass and herbaceous vegetation and less woody vegetation.

Prey Balance

Associated At-Risk species: American kestrel, black-footed ferret, northern long-eared bat.

Predator species require prey. Rodent species are common prey animals for many species, insects are prey for many bird species and most bat species. Prey balance can be impacted by activities that reduce such prey species such as application of insecticide or lethal control of rodent populations.

Old Roadbeds

Associated At-Risk species: Pale botrychium (*Botrychium pallidum*).

Some plant species prefer more open habitats such as road beds that are no longer in use but which have not regrown back into trees. Threats to such roads could include reactivation of the roads or illegal use of closed roads.

Calcerous / Limestone Soils

Associated At-Risk species: Swamp thread moss (*Bryum uliginosum*), Low northern sedge (*Carex concinna*), limestone meadow sedge (*Carex granularis*), sheathed sedge (*Carex vaginata*), lesser yellow lady's slipper (*Cypripedium parviflorum*), beaked spikerush (*Eleocharis rostellata*) beaked spikerush (*Eleocharis rostellata*), Downy Gentian (*Gentiana puberulenta*), Felted leafy moss; Felt Round Moss (*Rhizomnium pseudopunctatum*), Sageleaf willow; Hoary Willow (*Salix candida*).

Many plant species are edaphically adapted to grow in soil types that might be less suitable or even toxic to other species. Such plants may be a competitive disadvantage in more typical “good” soil types.

Threats to this habitat are activities that disturb these soil types. Grading, covering, or compacting can damage the plants using the soil type, and this can include projects that only damage relatively small areas.

Granite Outcrops in Spruce Forests

Associated At-Risk Species: Slenderbeak sedge (*Carex athrostachya*), Southwestern showy sedge (*Carex bella*), Selkirk's violet; great-spurred violet (*Viola selkirkii*).

Risk to this habitat type can include recreation use such as camping near such outcrops or rock climbing, especially if climbers “clean” routes by removing plant species sprouting from cracks and crevices.

Old Beaver Ponds

Associated At-Risk species: Limestone meadow sedge (*Carex granularis*).

There are no identified risks to this habitat type.

Talus Slopes in Spruce or Mixed Conifer Ecosystems

Associated At-Risk species: Thinleaf huckleberry; Square-twigged Huckleberry; Square-twig Blueberry (*Vaccinium membranaceum*).

There are no identified risks to this habitat type.

Risk Factors not Associated with Specific Habitat Types or Conditions

The following risk factors are not limited to any particular habitat type or they impact the dominant species in the habitat, such that the risk factor.

Disease- White-pine Blister Rust

Species impacted: Limber pine (*Pinus flexilis*).

White-pine blister rust (*Cronartium ribicola*) can be very damaging to limber pine and ecosystems dominated by limber pine, with smaller trees most severely impacted. *Ribes* species act as an intermediate host for the pathogen.

Insect: Mountain Pine Beetle

Species impacted: Limber pine (*Pinus flexilis*), lodgepole pine (*Pinus contorta*).

Mountain pine beetle (*Dendroctonus ponderosae*) epidemics can be very damaging to pine-dominated forests, causing mortality as high as 95%. As the number of dead trees in the forest increases, the forest because increasingly fire prone, with greater potential for extreme fire behavior leading to stand replacement fires or fires that leave the soils damaged enough to result in post-fire vegetation communities that are markedly different from pre fire conditions.

Forests can and often do tolerate low levels of pine beetle infestation, killing small numbers of trees, with many trees being infected by small numbers of beetles and surviving. In that situation the beetle larvae can be a valuable food source for woodpecker species. It is unclear what prompts a low density beetle infestation to morph into a widespread infestation with resultant mass die-off.

Risk Factors Impacting Black-Footed Ferrets

At-Risk Species impacted: Black-footed ferret.

Sylvatic plague (*Yersinia pestis*) does strongly impact ferret populations directly, but instead decimates the prey population (prairie dogs). The plague pathogen infects the rodents via parasitic fleas. Once established, the disease may spread throughout the colony (including very large colonies) and killing up to 100% of the prairie dogs. Once the prairie dogs are gone the ferrets have insufficient food to survive. Plague can be managed by dusting the prairie dog den openings with flea powder, eliminating the fleas that transmit the pathogen.

Canine distemper (*paramyxovirus*) may pass from domestic dogs and other canine predators to ferrets. Distemper caused significant mortality among the first generation of captive bred black-footed ferrets released into the wild and has since been recognized as a significant complicating matter in re-establishing a self-sustaining wild population. Management to protect ferrets includes immunization and control of domestic dogs and sometimes wild canids as well as immunization of the ferrets themselves.

Domestic dogs can be a threat to black-footed ferrets and many other wildlife species. Control includes fencing of some reintroduction sites to exclude dogs, as well as leash laws. Wild canids (coyotes and foxes) can also be a threat, they can be managed through predator control activities.

Conversely, animal pest control activities can be harmful to ferrets. Rodenticides used to control prairie dogs can harm ferrets that consume dying or recently dead prairie dogs. Poison bait distributed with the intent to kills coyotes or other predators can also be consumed by ferrets resulting in sickness and death.

Collection

At-Risk species potentially impacts: Fairy slipper (*Calypso bulbosa*), dicranella moss; Spur-necked Forklet Moss (*Dicranella cerviculata*), Showy prairie gentian (*Eustoma exaltatum* ssp. *russellianum*), Sphagnum; Northern Peatmoss (*Sphagnum capillifolium*), Sphagnum; Flat-top Bogmoss; Flat-topped Sphagnum Moss (*Sphagnum fallax*), Sphagnum; Brown Peatmoss (*Sphagnum fuscum*).

This issue can be driven by social factors with potential to impact other species. Collection may be for scientific reasons such as documenting species presence by adding to herbarium/museum collections or collecting for genetic analysis. This can include professional scientists but there are also many dedicated amateur biologists who also collect plant animal species.

Some collectors collect plants and fungi for medicinal use or for cultural or religious reasons. Some collect flowers or other vegetation for use as decoration. Commercial seed collectors gather seeds for use in restoration and reseeding efforts.

Disease – White-Nose Syndrome

At-Risk species impacted: Northern Long-eared bat (*Myotis septentrionalis*).

White-nose syndrome is caused by a fungal pathogen (*Pseudogymnoascus destructans*) that can become established in bat populations and in areas where bats congregate. The presence of this disease can destroy entire bat populations if present in large maternity colonies. Beginning around 2006 the pathogen became widespread in the eastern U.S., leading to the death of millions of bats. Since then efforts to implement regulations and professional practices for accessing large caves and abandoned mines have limited spread in the western U.S well enough to stabilize the situation.

Stochastic Extirpation

At-Risk species potentially impacted: Broadleaf enchanter's nightshade (*Circaea canadensis* var. *canadensis*), shortleaf dicranum moss; Shortleaf Broom Moss (*Dicranum brevifolium*), beaked spikerush (*Eleocharis rostellata*), dwarf scouring rush (*Equisetum scirpoides*), Alpine notchleaf moss; paraleucobryum moss (*Paraleucobryum enerve*), Marsh grass of Parnassus (*Parnassia palustris*), Shining willow (*Salix lucida*), Finescale dace (*Chrosomus neogaeus*).

“Stochastic extirpation” refers to the risk that some species face due to having very low population numbers or very small habitats or ranges. The risk is that relatively small actions could result in the loss of such a species within the plan area. For example, if a species has a habitat consisting of one small wetland, and that wetland is drained, or if a small section of stream becomes polluted and that section is the only place a given species of fish still survives on the plan area.

These sorts of impacts can be unpredictable and rare. They are generally avoided through proper application of project-level planning processes, but the risk remains.

Table 26. Ecological conditions in the plan area necessary to meet the requirements of for each at-risk species

Common Name	Scientific Name	Needs freedom from physical disturbance to individuals and/or habitat	Needs freedom from competition from weeds and/or the impacts of the treatment of those weeds	Needs the maintenance of shade and/or soil moisture and/or prevention of the loss of canopy	Needs intact cliff and/or seep habitat	Needs intact wetland habitat	Needs intact dry rocky habitat	Needs a specific habitat or host species	Impacted by a departure from natural disturbance, needs disturbance restored	Needs intact open or alpine habitat
TEPC Species										
Black footed ferrets	*Mustela nigripes*									
Northern long-eared bat	*Myotis septentrionalis*									
Monarch butterfly (	*Danaus plexippus*		X			X				X
Leedy's Roseroot	*Rhodiola integrifolia* ssp. *leedyi*		X		X					
SCC Animals										
Black-billed hummingbird	*Archilochus alexandri*	X								
American dipper	*Cinclus mexicanus*									
Black-billed cuckoo	*Coccyzus erythropthalmus*									
American Kestrel	*Falco sparverius*									
Black-backed woodpecker	*Picoides arcticus*									

Common Name	Scientific Name	Needs freedom from physical disturbance to individuals and/or habitat	Needs freedom from competition from weeds and/or the impacts of the treatment of those weeds	Needs the maintenance of shade and/or soil moisture and/or prevention of the loss of canopy	Needs intact cliff and/or seep habitat	Needs intact wetland habitat	Needs intact dry rocky habitat	Needs a specific habitat or host species	Impacted by a departure from natural disturbance, needs disturbance restored	Needs intact open or alpine habitat
American three-toed woodpecker	*Picoides dorsalis*									
Brewer's sparrow	*Spizella breweri*									
Finescale dace	Chrosomus neogaeus									
SCC Plants										
Sleepygrass	*Achnatherum robustum*		X							
Southern Maidenhair Fern	*Adiantum capillus-veneris*	X	X			X				
Groundnut	*Apios americana*			X						
Frenchman's Bluff grapefern	*Botrychium gallicomontanum*	X						X	X	
Michigan moonwort	*Botrychium michiganense*	X							X	
leathery grapefern	*Botrychium multifidum*	X							X	
pale botrychium	*Botrychium pallidum*	X						X	X	
acute brachythecium moss	*Brachythecium acutum*					X				

Common Name	Scientific Name	Needs freedom from physical disturbance to individuals and/or habitat	Needs freedom from competition from weeds and/or the impacts of the treatment of those weeds	Needs the maintenance of shade and/or soil moisture and/or prevention of the loss of canopy	Needs intact cliff and/or seep habitat	Needs intact wetland habitat	Needs intact dry rocky habitat	Needs a specific habitat or host species	Impacted by a departure from natural disturbance, needs disturbance restored	Needs intact open or alpine habitat
swamp thread moss	*Bryum uliginosum*					X				
pointed tip mariposa lily	*Calochortus apiculatus*	X					X			
fairy slipper	*Calypso bulbosa*	X		X				High elevation spruce forests		
marsh bellflower	*Campanula aparinoides*	X						X		
foxtail sedge	*Carex alopecoidea*					X				
slenderbeak sedge	*Carex athrostachya*					X				
southwestern showy sedge	*Carex bella*	X		X		X				X
brownish sedge	*Carex brunnescens*			X		X				X
silvery sedge	*Carex canescens*			X		X				
low northern sedge	*Carex concinna*	X		X	X	X		Calcareous soils		
Emory's sedge	*Carex emoryi*	X	X			X				
limestone meadow sedge	*Carex granularis*	X				X		Birch and beaver ponds		
greater bladder sedge	*Carex intumescens*					X				
eastern star sedge	*Carex radiata*	X		X		X		birch		

Common Name	Scientific Name	Needs freedom from physical disturbance to individuals and/or habitat	Needs freedom from competition from weeds and/or the impacts of the treatment of those weeds	Needs the maintenance of shade and/or soil moisture and/or prevention of the loss of canopy	Needs intact cliff and/or seep habitat	Needs intact wetland habitat	Needs intact dry rocky habitat	Needs a specific habitat or host species	Impacted by a departure from natural disturbance, needs disturbance restored	Needs intact open or alpine habitat
blunt broom sedge	*Carex tribuloides*					X				
sheathed sedge	*Carex vaginata*					X				
broadleaf enchanter's nightshade	*Circaea canadensis* var. *canadensis*	X		X		X				
mountain lady's slipper	*Cypripedium montanum*	X		X				aspen		X
lesser yellow lady's slipper	*Cypripedium parviflorum*	X	X					birch or spruce		X
California oatgrass	*Danthonia californica*							montane meadows		X
tufted hairgrass	*Deschampsia cespitosa*							moist meadows		X
slimleaf panicgrass	*Dichanthelium linearifolium*	X					X			X
dicranella moss	*Dicranella cerviculata*			X		X				X
Schreber's dicranella moss	*Dicranella schreberiana*				X	X				
shortleaf dicranum moss	*Dicranum brevifolium*				X			rocks and rotted wood		
Ontario dicranum moss	*Dicranum ontariense*					X		humus and rotting wood		
longleaf hook moss	*Drepanocladus longifolius*					X		submerged		

Common Name	Scientific Name	Needs freedom from physical disturbance to individuals and/or habitat	Needs freedom from competition from weeds and/or the impacts of the treatment of those weeds	Needs the maintenance of shade and/or soil moisture and/or prevention of the loss of canopy	Needs intact cliff and/or seep habitat	Needs intact wetland habitat	Needs intact dry rocky habitat	Needs a specific habitat or host species	Impacted by a departure from natural disturbance, needs disturbance restored	Needs intact open or alpine habitat
spinulose woodfern	*Dryopteris carthusiana*	X		X		X				
ovate spikerush	*Eleocharis ovata*					X				
beaked spikerush	*Eleocharis rostellata*					X				
diverseglume wildrye	*Elymus diversiglumis*			X		X				
stream orchid	*Epipactis gigantea*	X	X		X	X				
dwarf scouring rush	*Equisetum scirpoides*	X		X		X				
variegated scouring rush	*Equisetum variegatum*					X				
Hooker's sandwort	*Eremogone hookeri* var. *pinetorum*							open pine and spruce woodland		
tall cottongrass	*Eriophorum angustifolium*					X				
showy prairie gentian	*Eustoma exaltatum* ssp. *russellianum*	X				X				
Downy Gentian	*Gentiana puberulenta*							savannah type communities-associated with limestone		X
slender cudweed	*Gnaphalium exilifolium*					X		mountain meadow		X

Common Name	Scientific Name	Needs freedom from physical disturbance to individuals and/or habitat	Needs freedom from competition from weeds and/or the impacts of the treatment of those weeds	Needs the maintenance of shade and/or soil moisture and/or prevention of the loss of canopy	Needs intact cliff and/or seep habitat	Needs intact wetland habitat	Needs intact dry rocky habitat	Needs a specific habitat or host species	Impacted by a departure from natural disturbance, needs disturbance restored	Needs intact open or alpine habitat
large pod pinweed	*Lechea intermedia* var. *intermedia*	X					X			
wolf lichen	*Letharia vulpina*							bark above snowline		
broad lipped twayblade	*Listera convallarioides*	X		X		X				
small flowered woodrush	*Luzula parviflora*			X		X				X
stiff clubmoss	*Lycopodium annotinum*		X	X		X		spruce birch hazel		
ground cedar	*Lycopodium complanatum*			X				boreal remnant	X	
northern bugleweed	*Lycopus uniflorus*	X				X				
five stamen miterwort	*Mitella pentandra*			X	X	X		spruce birch/hazel		
alpine notchleaf moss	*Paraleucobryum enerve*				X	X				
marsh grass of Parnassus	*Parnassia palustris*					X				
arrowleaf sweet coltsfoot	*Petasites frigidus* var. *sagittatus*					X				
little fountain apple moss	*Philonotis fontana* var. *pumila*				X	X				
lodgepole pine	*Pinus contorta*	X						mixed conifer forest with dry soils		

Common Name	Scientific Name	Needs freedom from physical disturbance to individuals and/or habitat	Needs freedom from competition from weeds and/or the impacts of the treatment of those weeds	Needs the maintenance of shade and/or soil moisture and/or prevention of the loss of canopy	Needs intact cliff and/or seep habitat	Needs intact wetland habitat	Needs intact dry rocky habitat	Needs a specific habitat or host species	Impacted by a departure from natural disturbance, needs disturbance restored	Needs intact open or alpine habitat
limber pine	*Pinus flexilis*	X					X		X	X
greater featherwort	*Plagiochila asplenioides*					X				
scentbottle	*Platanthera dilatata*	X				X				
lesser roundleaved orchid	*Platanthera orbiculata*	X		X		X				
Jensen's polytrichum moss	*Polytrichum jensenii*					X				
Platte River cinquefoil	*Potentilla plattensis*					X		moist meadow too		
purple rattlesnake root	*Prenanthes racemosa*	X						many different forest types		
drops-of-gold	*Prosartes hookeri*	X		X				paper/hazel/aspen		
intense light and dark lichen	*Pseudevernia intensa*	X						bark of conifers		
white veined wintergreen	*Pyrola picta*	X		X				dry coniferous forests		
cartilage lichen	*Ramalina sinensis*							found on various conifer species		
felted leafy moss	*Rhizomnium pseudopunctatum*					X		calcareous and rich		
sageleaf willow	*Salix candida*	X			X	X				

Common Name	Scientific Name	Needs freedom from physical disturbance to individuals and/or habitat	Needs freedom from competition from weeds and/or the impacts of the treatment of those weeds	Needs the maintenance of shade and/or soil moisture and/or prevention of the loss of canopy	Needs intact cliff and/or seep habitat	Needs intact wetland habitat	Needs intact dry rocky habitat	Needs a specific habitat or host species	Impacted by a departure from natural disturbance, needs disturbance restored	Needs intact open or alpine habitat
greenleaf willow	*Salix lasiandra var. caudata*					X				
shining willow	*Salix lucida*					X				
autumn willow	*Salix serissima*	X	X			X				
bloodroot	*Sanguinaria canadensis*	X	X	X				mostly with hardwood communities		
nodding saxifrage	*Saxifraga cernua*					X				
Alberta saxifrage	*Saxifraga occidentalis*					X				X
woolgrass	*Scirpus cyperinus*					X				
northern selaginella	*Selaginella rupestris*	X						ponderosa woodlands and grasslands		
narrowleaf peatmoss	*Sphagnum angustifolium*	X				X				
Northern Peatmoss	*Sphagnum capillifolium*	X				X				
Flat-top Bogmoss	*Sphagnum fallax*	X				X				
Brown Peatmoss	*Sphagnum fuscum*	X				X				
sheathed pondweed	*Stuckenia vaginata*	X	X			X		submerged		

Common Name	Scientific Name	Needs freedom from physical disturbance to individuals and/or habitat	Needs freedom from competition from weeds and/or the impacts of the treatment of those weeds	Needs the maintenance of shade and/or soil moisture and/or prevention of the loss of canopy	Needs intact cliff and/or seep habitat	Needs intact wetland habitat	Needs intact dry rocky habitat	Needs a specific habitat or host species	Impacted by a departure from natural disturbance, needs disturbance restored	Needs intact open or alpine habitat
hairy navel lichen	*Umbilicaria hirsuta*				X			on silicious rocks		
cranberry	*Vaccinium macrocarpon*	X		X		X				
thinleaf huckleberry	*Vaccinium membranaceum*	X								
squashberry	*Viburnum edule*			X				spruce birch		
American cranberrybush	*Viburnum opulus* var. *americanum*					X		spruce birch		
small white violet	*Viola macloskeyi*					X				
white violet	*Viola renifolia*			X		X				
Selkirk's violet	*Viola selkirkii*	X		X		X		remnant boreal forest		
warnstorfia moss	*Warnstorfia pseudostraminea*				X	X				

Chapter 4. Sustainability

Environmental Sustainability of At-Risk Species

Environmental sustainability of At-Risk species on the BHNF is the ability of the At-Risk species to maintain or recover viable populations, as well as to function in ways that support interdependent species. This means that the At-Risk species survive, but also contribute to the survival of other species, by acting as food sources, or by manipulating their environment in ways that benefits other species (such as butterflies pollinating flowers).

At-Risk species are, almost by definition, of uncertain environmental sustainability.

Economic Sustainability of At-Risk Species

The economic value of At-Risk species has several aspects to it. The public sees value in the preservation of species perceived as rare or at-risk. This translates into support for programs aimed at protecting or recovering these species, which have economic impacts in the form of government/other employees who work with the species (both in the species' local environment, as well as off-site workers). Tourism to see these species and the environments that they depend upon also has economic impacts.

Protection of native species environments can translate into indirect economic value, such as decreased costs for cities to purify drinking water if water quality is better due to measure designed primarily to protect native fish.

There can be negative impacts as well, in the form of restrictions and regulations. Ranchers may need to spend more money on fences or move cattle more often, special use permits may be denied, and timber harvest volume can drop.

It can be possible for the economic aspects of the management of At-Risk species to be mixed. Some groups benefit and others see harm; the impacts to these groups can change or even swap as regulations increase or decrease over time due to changes in law and the policies of the government agencies that manage At-Risk species and their environments. Extractive users and tourism-related businesses often face such alternate impacts.

Overall, the economic sustainability of At-Risk species is strongly tied to the social perception of the value of these species as translated through policy, law, and consumer choice.

Social Sustainability of At-Risk Species

At-Risk species have social value. To some extent, the *social* sustainability of species can be the inverse of their perceived *environmental* sustainability. People may value species more because they are perceived as being rare or at-risk. Conversely, people may see the social value of species protection drop if they perceive that the costs of protecting the species are too high.

This makes for a mixed analysis of the social sustainability of At-Risk species. People will support the continued protection and management of such species, but they may withdraw that social support if the economic cost is perceived as being too high or if government regulation is too restrictive.

Chapter 5. Current Forest Plan and its Context within the Broader Landscape

Existing Forest Plan Management Direction for At-Risk Species

An important part of the Forest planning process is to make determinations of the need to change management direction, referred as Need for Change. This is accomplished by assessing the current situation using existing information. The assessment process involves identifying planning area ecosystems, ecosystem drivers and stressors, trends, key ecosystem characteristics, risk factors, information gaps, and incorporates public review and input on issues and management concerns within the planning area. Collectively, this informs the Need for Change. This document details our initial review of existing information and identifies our preliminary draft Need for Change.

Issues in the Broader Landscape

Invasive and noxious nonnative plant species across the broader landscape across all land ownerships is increasing and an issue. Increasing recreation activity is a trend that should be included (tier to or integrate from the Recreation Assessment). Development and changes in private land uses adjacent to the planning area impacts At-Risk species.

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Appendix 1. Threatened, endangered, proposed, and candidate species ecosystems and habitat characteristics

Table 27. Threatened, endangered, proposed, and candidate species ecosystems and habitat characteristics

Species	ESA Status	Occurrence data
Black-footed ferret *Mustela nigripes*	Endangered	One occurrence on Bear Lodge Ranger District. Nearby reintroduction sites on National Park Service managed lands adjacent to BHNF
Northern Long-eared bat *Myotis septentrionalis*	Threatened	106 known records on several ranger districts
Monarch butterfly *Danaus plexippus*	Candidate	Six records from the plan area (Hell Canyon and Mystic Ranger Districts)
Leedy's Roseroot *Rhodiola integrifolia ssp. Leedyi*	Threatened	One known occurrence in the Plan Area