



**United States Department of Agriculture**  
Forest Service

## **Botany Report**

Colville National Forest Plan Revision  
Draft Environmental Impact Statement

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September 29, 2015

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# Introduction

This report considers two groups of rare plants that occur or may occur in the planning area, federally listed threatened, endangered, or proposed (TE) and USDA Forest Service Region 6 sensitive plant species (S). Threatened and endangered species are those formally listed by the USDI Fish and Wildlife Service under the Federal Endangered Species Act (ESA). The Colville National Forest (Colville NF) does not currently have any federally threatened, endangered, or proposed threatened plant species. Any newly designated or discovered taxa listed by the ESA will be managed appropriately throughout the life of this plan.

Sensitive species include those vascular and non-vascular plant taxa and fungi from the R6 Regional Forester's Sensitive Species List. Many threatened, endangered, and sensitive (TES) plant species depend on special or unique habitats that may be rare or represent a small portion of a particular landscape. In forested landscapes these TES plant habitats include meadows; wetlands, including marshes, bogs, fens, carrs, swamps, springs and seeps; riparian areas; alpine fellfields; rock outcrops; cliffs; and talus. Table 1 provides a list of the sensitive plant species discussed in this plan.

## Relevant Laws, Regulations, and Policy

Threatened, endangered, and proposed plant species are designated under the Endangered Species Act (ESA) by the U.S. Fish and Wildlife Service. Although none are currently documented within the forest plan revision area, if any are found they would be managed in compliance with the ESA.

Forest Plan components will be evaluated for each alternative by their predicted ability to meet the direction set forth in the 1982 planning rule sections 219.26 and 219.27 (USDA FS 1982) and in their ability to achieve the desired condition for plants included on the Regional Forester's Sensitive Species List (USDA FS 2011). The Forest Service Manual provides direction to manage for sensitive plants in chapter 2670 (USDA FS 2005), invasive species in chapter 2900 (USDA FS 2011) and describes management, and use of native plant materials in chapter 2070 (USDA FS 2008). Additional direction regarding invasive plants is included in the Region 6 Invasive Plant Program, Preventing and Managing Invasive Plants, Final Environmental Impact Statement (USDA FS 2005).

Outcomes for the Regional Forester's sensitive species and rare plant habitat groups are summarized for the alternatives in the Environmental Consequences section below. These outcomes focus on risks to maintaining viable plant populations and high habitat effectiveness within the plan area. Generally, the action alternatives are not driven by plant viability issues. Therefore, the effects analyses and evaluation of the Regional Forester's sensitive plants plan components produced similar conservation outcomes across the action alternatives. If a set of plan components had differing influence on conservation outcomes because of differences in Management Area allocations, then additional outcomes are described. Sensitive plant taxa include 38 R6 Regional Forester's Sensitive Species (USDA FS 2011) with documented occurrences in the plan area.

Within the alternatives framework of plan revision, this report addresses the contribution of the proposed Colville National Forest Land and Resource Management Plan to the viability of federally listed plants (currently none) and the Regional Forester's sensitive plants.

Proposed forest plan desired conditions, objectives, and guidelines common to all action alternatives follow.

### *Desired condition*

#### *FW-DC-VEG-01. Plant Species Composition*

Native species and native plant communities are the desired dominant vegetation.

#### *FW-DC-VEG-02. Native Plant Materials*

Locally collected native plant materials are incorporated into project planning and implementation when restoration, rehabilitation, and revegetation goals support ecosystem integrity and resilience. Locally-adapted plant material inventories are maintained to provide for revegetation project needs.

#### *FW-DC-VEG-03. Native Plant Seeds and Other Genetic Material*

Seeds and genetic material from native vascular and non-vascular plants are available for the purposes of genetic or trait testing, climate change provenance trials, species identification, restoration, or rehabilitation activities. Seeds and other genetic materials are stored in both secure off-site facilities and on-site in existing seed orchards, select trees, evaluation plantations, and other established genetic resource test sites.

#### *FW-DC-VEG-04. Invasive Plant Species Integrated Management*

Forest terrestrial and aquatic ecosystems are in an ecological condition that resists introduction, establishment, and spread of invasive plant species. Established invasive plant infestations are not increasing in number or size, occur at low densities, and are reduced or removed. Risk of invasive plant infestations is maintained at a low level due to the effectiveness of prevention actions and the success of restoration efforts.

#### *FW-DC-VEG-5. Threatened, Endangered, and Sensitive Plant Species - Special and Unique Habitats*

Special and unique habitats support threatened, endangered, and sensitive plant species and populations and contribute to high quality suitable habitat for these species. Degraded or diminished special and unique habitats are restored within their natural range of variation.

#### *FW-DC-VEG-6. Threatened, Endangered, and Sensitive Plant Species - Management-Related Disturbance*

Ecological conditions and processes that sustain the habitats currently or potentially occupied by sensitive plant species are retained or restored. The geographic distributions of threatened, endangered and sensitive plant species in the Forest Plan area are maintained. This includes sufficient seed or vegetative reproduction to maintain existing plant populations and associated native plant community biodiversity. Soil disturbance is

managed to avoid degradation of threatened, endangered and sensitive plant species and their habitat as well as plant community composition, structure, and productivity.

*FW-DC-VEG-07. Threatened, Endangered, and Sensitive Plant Species - Habitat and Population Trends*

Population trends, amount of occupied habitat, and amount of unoccupied suitable habitat are stable or increasing for threatened, endangered, and sensitive plant species.

*FW-DC-WR-09. Wetlands, Seeps, Springs, and Other Groundwater-Dependent Systems*

National Forest System lands contribute to the timing, variability, and water table elevation in wetlands, seeps, springs and other groundwater-dependent systems. These features are within or moving toward proper functioning condition. Subwatershed scale is used for both Forest and project planning.

*FW-DC-WR-1. Native Plant Communities*

National Forest System lands contribute to the species composition and structural diversity of native plant communities in riparian management areas (including wetlands). These contribute to adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration; and supply amounts and distributions of coarse woody debris and fine particulate organic matter sufficient to sustain physical complexity and stability. Subbasin scale is used for Forest planning and 5<sup>th</sup> field watershed or subwatershed scale is used for project planning.

## **Objectives**

*FW-OBJ-VEG-01. Native Vegetation Restoration and Invasive Plants Prevention*

Within 15 years of plan implementation, actively restore an annual average of 50 acres of native vegetation consistent with site capability and integrated resource management objectives. Restoration could include mulching, seeding or planting to promote revegetation of native plants to help resist introduction, establishment, and spread of invasive plant species.

*FW-OBJ-VEG-02. Special and Unique Habitats*

Increase restoration of special and unique habitat per year so that 5 to 10 acres are treated within 15 years of plan implementation.

## **Standards**

*FW-STD-VEG-01. Threatened, Endangered, and Sensitive Plant Species - Surveys*

Surveys for threatened, endangered, and sensitive plant species shall be conducted in suitable habitat on National Forest System lands before habitat-disturbing activities to identify and protect vulnerable populations. All existing sites are identified and managed to support rare species recovery on National Forest System lands. Suitable habitat shall be managed to enhance or maintain rare species occurrences on the Forest.

### *FW-STD-VEG-02. Habitat Rehabilitation*

Use appropriate seeding, planting, or mulching methods to rehabilitate degraded sites resulting from invasive plants, forest activities or other disturbances when necessary to prevent reinvasion and promote ecosystem resiliency. Rehabilitation seeding and/or planting can be used for invasive species projects in occupied habitat or species management areas when proposed in an approved threatened, endangered, or sensitive species conservation plan.

## *Guidelines*

### *FW-GDL-VEG-01. Disturbance in Threatened, Endangered, and Sensitive Plant Species Occupied Habitat*

Soil and habitat disturbance should be managed within occupied habitat to the extent practicable to maintain or enhance threatened, endangered, and sensitive plant populations and avoid invasive plant species establishment or spread. Consequently, occupied habitat should not be used for timber harvest, fuel breaks or developments associated with wildfire suppression, delivery of fire retardant or petroleum products, placement of stock handling facilities, recreation or special use developments. Maintain at least a 100-foot buffer between the occupied habitat and these management activities.

Trees in occupied habitat that are felled for safety reasons should be retained on site as needed to maintain, protect, or enhance habitat unless such action is detrimental to the threatened, endangered, and sensitive species population or habitat and represents a threat through physical impacts or potential uncharacteristic fire.

All new road and trail construction should be designed to avoid the occupied habitat of threatened, endangered, and sensitive plants (minimum 50 foot buffer).

Use of prescribed fire should be avoided in occupied habitat except in areas occupied by fire-dependent or fire tolerant species. The method, timing, and intensity of prescribed burns should not promote the introduction, establishment, or spread of invasive species. Habitat restoration activities may proceed when designed to minimize impacts to threatened, endangered, and sensitive plant populations.

Slash piles and other fuels should be managed to avoid the occupied habitat of threatened, endangered, and sensitive plant species (minimum 100 foot buffer).

Grazing management (including timing, intensity, duration, frequency of use, and type and class of livestock) should allow for completion of threatened, endangered, and sensitive plants' annual life cycle and development and dispersal of reproductive materials like seed and spores. Maximum forage utilization of key species should not exceed 30 percent in occupied habitat of threatened, endangered, and sensitive plant species, except where an approved recovery plan or conservation strategy or agreement prescribes another utilization level. Salting or water developments should not be authorized or allowed such that they reduce threatened, endangered, and sensitive plant populations.

Mining operations should be authorized or allowed only if activities are planned to avoid threatened, endangered, and sensitive species plant species.

## FW-GDL-VEG-02. Plant Material Collection for Conservation Purposes

Commercial or non-commercial permits or authorizations should generally be issued for collection of seed or plant materials when project objectives are consistent with rare species conservation practices (these practices could include seed storage in recognized seed banks, or collection of plant material for restoration and rehabilitation purposes, or scientific research that benefits species viability).

# Affected Environment

## Regional Forester Sensitive Plants

Sensitive plants are designated by the regional forester, however, lists are periodically updated as new data on species occurrences, threats, and risks as well as habitat conditions and trends are assessed to inform species conservation status, vulnerability, and conservation priority. The dynamic nature of the sensitive species list is illustrated by Table 1, which compares the current sensitive species list of 38 documented species from the Colville NF with the 1988 historical list of 29 (USDA FS 1988). Fifteen species from the 1988 list are considered sensitive today.

Since 1988, sensitive species surveys and review of other data documented additional populations of many species, with the result that some were judged more secure and others rare and at risk. For example, in 1988 *Viola renifolia* was thought to be extirpated in Washington State, but through plant survey efforts, 65 sites are now documented on the Colville NF. Other species like *Botrychium minganense* turned out to be more widespread than previously thought and these were removed from the regional sensitive species list.

Table 1. Comparison of 1988 and 2011 Colville NF sensitive species lists.

Plant Names	2011 R6 Sensitive Species List	1988 Forest Plan Sensitive Species List
<i>Antennaria corymbosa</i>	X	X
<i>Antennaria parvifolia</i>	X	
<i>Astragalus microcystis</i>	X	X
<i>Botrychium ascendens</i>	X	
<i>Botrychium crenulatum</i>	X	
<i>Botrychium hesperium</i>	X	
<i>Botrychium lanceolatum</i>		X
<i>Botrychium lineare</i>	X	
<i>Botrychium lunaria</i>		X
<i>Botrychium minganense</i>		X
<i>Botrychium paradoxum</i>	X	
<i>Botrychium pedunculatum</i>	X	
<i>Carex aenea</i>		X
<i>Carex buxbaumii</i>		X
<i>Carex capillaris</i>	X	
<i>Carex comosa</i>	X	
<i>Carex flava</i>		X
<i>Carex magellanica ssp. irrigua (C. pauperula)</i>	X	X
<i>Carex proposita</i>	X	
<i>Carex rostrata</i>	X	

Plant Names	2011 R6 Sensitive Species List	1988 Forest Plan Sensitive Species List
<i>Carex scopulorum</i> var. <i>prionophylla</i>		X
<i>Carex tenera</i>	X	
<i>Cicuta bulbifera</i>	X	X
<i>Crassula aquatica</i> ( <i>Tillaea aquatica</i> )		X
<i>Cryptogramma stelleri</i>	X	X
<i>Cypripedium parviflorum</i>	X	
<i>Dryas drummondii</i> var. <i>drummondii</i>	X	X
<i>Dryopteris cristata</i>	X	X
<i>Eriophorum viridicarinatum</i>	X	X
<i>Eurybia merita</i>	X	
<i>Gaultheria hispidula</i>	X	
<i>Geum rivale</i>	X	X
<i>Listera borealis</i>		X
<i>Lomatium sandbergii</i>	X	
<i>Lycopodium dendroideum</i>	X	X
<i>Muhlenbergia glomerata</i>	X	X
<i>Ophioglossum pusillum</i>	X	
<i>Phacelia franklinii</i>		X
<i>Pinus albicaulis</i>	X	
<i>Platanthera obtusata</i>	X	
<i>Poa nervosa</i> var. <i>nervosa</i>		X
<i>Ribes cognatum</i>		X
<i>Ribes oxycanthoides</i> ssp. <i>irriguum</i> ( <i>R. irriguum</i> )	X	X
<i>Salix candida</i>	X	X
<i>Salix maccalliana</i>	X	X
<i>Salix pseudomonticola</i>	X	
<i>Sanicula marilandica</i>	X	X
<i>Sisyrinchium montanum</i>	X	
<i>Sisyrinchium septentrionale</i>		X
<i>Spartina pectinata</i>	X	
<i>Thalictrum dasycarpum</i>		X
<i>Viola renifolia</i>	X	

Appendix A summarizes sensitive plant habitat groupings, number of sites, and acres of occupied habitat on the Colville NF using corporate data managed in the Natural Resource Management Threatened, Endangered, and Sensitive Plants application (NRM TESP) (USDA FS 2013). Also included in Appendix A are federal and Washington State (WDNR 2013) conservation status ranks from a national conservation partner, NatureServe (2013).

### *Forest vulnerability rating*

Some of the data in Appendix A were used to determine a species vulnerability rating within the plan area (Appendix B). The vulnerability rating for each sensitive species is based on its range-wide distribution characteristics, total number of sites occurring on the Forest, total area occupied by the sites, estimated number of individual plants, and the Washington State conservation rank from NatureServe. For example, a local endemic species with a single site occurrence that is small in area and populated with a few individual plants would be identified

as a highly vulnerable species in this context. In contrast, a wide-ranging species with tens of sites covering hundreds of acres with thousands of individual plants would be less vulnerable and represent the low vulnerability category. A highly vulnerable species is most sensitive to local extirpation from unplanned, chance events (i.e., stochasticity) that might have significant consequences for species conservation. The vulnerability rating here is, therefore, a relative ranking and is linked to specific risks associated with individual threats.

Vulnerability is also a function of population trends. While some past NRM TESP plant records lack complete information on condition and population size trends, a summary of existing information was used to estimate qualitative site and habitat status in addition to identification of existing reported threats. Plant site estimates are variable both year to year and seasonally; estimates represent a snapshot of population size that is difficult to interpret because demographic studies with information related to flowering mature, immature, and dormant plants are lacking.

The NRM TESP sightings data (USDA FS 2013) suggest a current static trend in sensitive species habitat effectiveness for most sites across all habitat groups; about 10 percent of sites have been identified with declining habitat condition. Of those with site estimates, about half of the sensitive plant sites are small with fewer than 50 plants at each site. About a quarter of all sites have fewer than 10 plants; only five percent of all occurrences have greater than 500 plants per site; 17 percent of all sites were identified as lacking sensitive plants (extirpated) at the last revisit to the occurrence.

The majority of these extirpated sites had supported *Botrychium* species – a genus that exhibits plant dormancy from year to year. Therefore, future multi-year monitoring would be needed to confirm any sensitive plant occurrence losses. Information from these data suggests that most sites are trending downward as well with only 40 percent showing static or increasing site sizes. Plant count data is variable both year to year and seasonally; it represents a snapshot of population size that is difficult to interpret. However, without conservation measures, there is a tendency for smaller populations to trend downward or become locally extirpated. In summary, species with a few small populations, declining condition, or declining numbers are more vulnerable and their ratings reflect this.

### Threats and Risk

This assessment occurs within a vulnerability (Appendix B), threat and risk matrix inherent in land and resource management planning. Threats were identified from literature (Camp and Gamon 2011) and local NRM TESP database sources (USDA FS 2013), and are summarized in Appendix C along with risk factors. For each of the threat factors in Appendix C a matrix was prepared evaluating the relationship between vulnerability and threats, which results in a risk determination of High, Medium, or Low (Table 2).

**Table 2. Relationship between vulnerability, threats, and risk. Red cells represent a high risk associated with each threat from Appendix C, yellow a medium risk, and green low risk. H=High, M=Medium, and L=Low. Results by species for all threats are shown in Appendix C.**

Vulnerability Rating	Hydrologic Threat		
	High	Medium	Low
High	HH	HM	HL
Medium	MH	MM	ML
Low	LH	LM	LL

Viability risk to TES plant species is defined as occupied habitat exposed to activities that damage or degrade habitat or populations. High risk is defined as impact levels that affect the Forest's ability to contribute to TES plant viability, and here is defined as greater than sixty-seven per cent of occupied habitat appreciably impacted.

### ***Sensitive Plant Species Habitat Groups***

For the purpose of analyses and discussion of the current affected environment, rare plant habitats were grouped into five types as described in the Forest Service NRM TESP database (2013) and the *Field Guide to the Rare Plants of Washington* (Camp and Gamon 2011). Plants within each group share broad environmental similarities and natural disturbance regimes, resource potential, and management opportunities that facilitate assessment of sensitive species site and habitat conditions and trends. Table 3 displays the distribution of rare plant taxa and sites across the environmental gradient of the Colville National Forest.

While plant diversity is an important attribute across all the habitat groups, the table shows that plant habitats encompassing wetlands, moist meadows, and riparian ecosystems provide habitat for the bulk of the documented sensitive plant species. Since 1998 and the implementation of the NRM TESP database, rare plant surveys have been conducted on 92,000 acres of the Colville NF to meet a number of management concerns. Information on occurrences is lacking on the remainder of the planning area.

**Table 3. Sensitive plant habitat groups, number of species within each habitat and number of occurrences (sites).**

<b>Habitat Group</b>	<b>Number of Sensitive Species</b>	<b>Number of Sites</b>
Alpine and subalpine meadows, fellfields, and parklands	5	44
Cliffs, talus, and rock outcrops	2	6
Dry meadows, open dry forests, and shrub steppe	6	115
Moist openings and wet forests	5	215
Wetlands, moist meadows, and riparian	20	186

#### ***Alpine and Subalpine Meadows, Fellfields, and Parklands Habitat Group***

Alpine areas are lands above the timberline dominated by low-growing cushion or tufted plants that are able to grow in the harsh environment at upper elevations. Plants here are exposed to short growing seasons, large daily temperature changes, high solar radiation loads, desiccating winds, freeze-thaw forces in the rooting zone, and low soil fertility. Within the plan area, these habitats are found on the highest peaks of the Selkirk Mountains in the east and the Kettle Crest in the western portion of the Forest. Fellfields are among the dominant vegetation community in alpine areas and are characterized by stony soils with surface rock that support sparse vegetation.

Subalpine meadows support herbaceous sedge, grass, or forb communities on a moisture gradient depending on slope, aspect, soils, and moisture availability. Subalpine parklands are a mosaic of herbaceous or shrub communities with sparse, discontinuous tree cover of whitebark pine, lodgepole pine, subalpine fir, or Engelmann spruce, typically occurring as a small group of trees expanding centrifugally. It is a transition zone from the closed-canopy subalpine forest and

the alpine zone upslope. At the upper end of this transition zone, krummholtz (climatically stunted and distorted trees) is the only form in which trees survive the harsh environment. Subalpine parkland is more widespread than alpine areas in the plan area. Parklands can be found throughout the upper reaches of the peaks and ridges of the Selkirk Mountains and the Kettle Crest. The plant communities in parklands are similar to fellfields, but the meadows that dominate parklands usually support more biomass than fellfields. There are about 12,500 acres of this type of vegetation on the Colville NF.

Table 4 shows the five sensitive species found in this habitat group. The number of sites and area occupied by *Carex proposita*, *Eurybia merita* and *Lomatium sandbergii* are small, reflecting the scarcity of effective habitat and limiting factors related to the plant species and, perhaps, the historic and current scale of plant surveys in these high elevation areas. The single *Lomatium sandbergii* site represents a historical collection in the Round Top Mountain Research Natural Area that has not been relocated since forest plan implementation in 1988; this population may be extirpated.

Four species are rated as highly vulnerable with low risks except for potential recreational effects in the No Action Alternative. On the other hand *Pinus albicaulis* is more widely distributed in subalpine forests and parklands where it establishes following fires and acts as a keystone species in these high elevation habitats. Threats to this tree species are related to climate change, western white pine blister rust, altered fire regime, and mountain pine beetle. The risk to the continued existence of many whitebark pine populations is high enough to warrant ESA listing (USDI FWS 2011) and it is currently a federal candidate for listing. Most of its occurrences are in a designated wilderness area or proposed special interest area.

**Table 4. Number of species occurrences and area occupied within alpine and subalpine meadows, fellfields, and parklands habitat group.**

Scientific Name	Number of Sites	Acres of Occupied Habitat	Vulnerability
<i>Carex proposita</i>	4	0.5	H
<i>Eurybia merita</i>	1	0.5	H
<i>Gaultheria hispidula</i>	1	0.5	H
<i>Lomatium sandbergii</i>	1	0.1	H
<i>Pinus albicaulis</i>	37	1,651	L

#### *Cliffs, Talus, and Rock Outcrops Habitat Group*

Cliffs are very steep or vertical surfaces of rock. Talus is accumulated boulders and cobbles at the base of cliffs or steep slopes. Rock outcrops contain bedrock that stands apart from the surrounding land surface. This habitat group has been avoided for most management activities. Threats include activities associated with recreational use, road construction and maintenance, and environmental change.

Sensitive species that occupy cliffs, talus, and rock outcrops are listed in Table 5. The numbers of documented occurrences are small with corresponding sites less than two acres per species. This group of species is highly vulnerable because of the low number of sites and limited total area occupied in special and unique habitats. Estimates of site size are also low with only 46

individual plants of *Cryptogramma stelleri*. The total number of plants at the two *Dryas drummondii* sites is unknown.

In the No Action Alternative, risks are low except for potential recreation effects. As is the case with the previous habitat group, plant surveys of cliff, talus, and rock outcrop habitats are seldom associated with proposed management activities, since these special habitats are rarely affected. Documentation of additional occupied sites in suitable habitat and subsequent revision of vulnerability ratings may occur as more information is developed through strategic plant surveys.

**Table 5. Number of species occurrences and area occupied within cliffs, talus, and rock outcrops habitat group.**

Scientific Name	Number of Sites	Acres of Occupied Habitat	Vulnerability
<i>Cryptogramma stelleri</i>	4	1.6	H
<i>Dryas drummondii</i> var. <i>drummondii</i>	2	1.7	H

#### *Dry Meadows, Open Dry Forests, and Shrub Steppe Habitat Group*

The habitat group of dry meadows, open dry forest, and shrub steppe supports a diverse group of drought-tolerant species adapted to harsh environments. This habitat group includes dry, open ponderosa pine and Douglas-fir forests (Williams, et al. 1995), sagebrush, dry meadow communities, and dry rocky grasslands. Six sensitive species that inhabit this group are listed in Table 6. Because of the number of existing sites, the area occupied by each species and the estimated number of total plants, this group of plants has medium levels of vulnerability. The six taxa have a range of sensitivities to threats related to successional status and responses to different disturbance regimes.

Past management activities that include fire, timber harvest, livestock grazing, off-road travel, and homesteading have affected plant communities in this habitat group. A rigorous monitoring program can support and inform management decisions related to implementing restoration projects to maintain or enhance sensitive species populations and habitat. Management opportunities include restoration of ecological conditions representing historical, as well as projected future range of variation.

**Table 6. Number of species occurrences and area occupied within dry meadows, open dry forests, and shrub steppe habitat group.**

Scientific Name	Number of Sites	Acres of Occupied Habitat	Vulnerability
<i>Antennaria parvifolia</i>	12	2.7	M
<i>Astragalus microcystis</i>	16	12.9	M
<i>Botrychium ascendens</i>	7	0.7	H
<i>Botrychium hesperium</i>	36	14.9	M
<i>Botrychium paradoxum</i>	16	5.6	M
<i>Botrychium pedunculosum</i>	28	17.0	M

### Moist Openings and Wet Forests Habitat Group

Moist meadows are typically saturated to partially flooded at snowmelt and become moist but well-drained within the rooting zone by midsummer. The water table may range from greater than eight inches in depth to near the surface at the end of the growing season. Often these meadows occur on the fringe of wetlands in the transition to upland vegetation (Kovalchik and Clausnitzer 2004). Wet forest sites occur within the western hemlock, western red-cedar, Engelmann spruce, and subalpine fir series on the Colville NF (Williams, et al. 1995).

Displayed in Table 7 are the five sensitive species occupying moist meadows or wet forest sites. (Those that occur in springs, seeps or riparian areas are included in the Wetlands, Moist Meadows, and Riparian Habitat group.) *Botrychium crenulatum* and *Viola renifolia* have a low vulnerability rating related to number and size of occurrences and estimated total plant population size. *Ophioglossum pusillum* is rated as moderately vulnerable. The remaining two sensitive species, *Lycopodium dendroideum* and *Sisyrinchium montanum*, are very rare on the Colville NF. Due to the limited distribution to one or two sites, small total population size and small areal extent of occupied habitat, the vulnerability ratings are high for these latter two species. Risks are low across many of the threat types except where the majority of sites occur in range allotments or management areas with a focus on timber production.

**Table 7. Number of species occurrences and area within moist openings, and wet forests habitat group.**

Scientific Name	Number of Sites	Acres of Occupied Habitat	Vulnerability
<i>Botrychium crenulatum</i>	142	90.3	L
<i>Lycopodium dendroideum</i>	2	1.9	H
<i>Ophioglossum pusillum</i>	5	2.0	M
<i>Sisyrinchium montanum</i>	1	0.1	H
<i>Viola renifolia</i>	65	109.0	L

### Wetlands, Moist Meadows, and Riparian Habitat Group

Species dependent on wetland and riparian habitats (bog, fen, carr, marsh, riparian zone, seep, spring, swamp, and wet meadow) are listed in Table 8. Peatlands are unique habitats and are a type of wetland with unconsolidated soil material consisting largely of partially decomposed or only slightly decomposed organic matter accumulated under conditions of excessive soil moisture. Two types of peatlands include bogs and fens. A bog is a soil and vegetation complex in which the lower parts are dead peat, gradually changing upwards to living plant tissues. This soil is usually saturated, relatively acidic, nutrient-poor, and dominated at ground level by mosses, principally species of *Sphagnum*. Bogs may be either forested or open and are generally associated with low temperatures, anaerobic conditions, short growing seasons and the water source is precipitation.

A fen is a peatland dominated by graminoids, sometimes with sparse scattered shrubs or trees, and a water table at the surface most of the year. It may be fed by the flow of groundwater upward through the peat or by mineral-rich surface water. A fen has a neutral to alkaline pH and supports relatively rich marsh-like vegetation. A marsh is a wetland where the vegetation is dominated by graminoids, with the water table at or above the surface most of the year and with little or no accumulation of peat on mineral soil.

A wet meadow is an herbaceous wetland on mineral soil. Generally, they occur in seasonally flooded basins and flats, and are especially prominent on the margins of peatlands. While soils are flooded in spring, the upper horizons are usually dry for part of the growing season (Kovalchik and Clausnitzer 2004). A carr is a shrub-dominated wetland on organic soil. Willows, mountain alder, red-osier dogwood or Douglas spiraea typically dominate carrs in eastern Washington. A swamp is vegetation dominated by trees, with the water table at or above the surface most of the year and with little or no accumulation of peat. They often intergrade with bogs, fens, or carrs.

A seep is a groundwater discharge area where the water table comes close to the soil surface. A spring is a groundwater discharge area that has more flow than a seep and often produces a channel or pool below the source. In general, a seep has less flow than a spring and may not result in water forming an unconfined flow. Springs and seeps are typically small, but well distributed on the forest (Kovalchik and Clausnitzer 2004). The riparian zone is a transitional area of vegetation between aquatic and terrestrial ecosystems. They require or tolerate conditions that are seasonally or perennially moist and are defined by the presence of specific vegetation.

Twenty of the 38 sensitive plant species on the Colville NF occur within these special and unique habitats. Only one of these taxa is rated as low vulnerability; 10 are moderately vulnerable and 9 are highly vulnerable. Seven species in this group are represented on the Forest by a single occurrence; seven taxa with fewer than 10 individual plants are documented. These very rare species on the Forest are sensitive to chance catastrophic events with detrimental outcomes to populations. Current risks associated with alteration of hydrologic regime and livestock grazing are elevated because of the potential loss of habitat effectiveness and extreme vulnerability of small populations. Annual monitoring of the most vulnerable species occurrences is needed to document current population conditions and trends and to inform planning and implementation of conservation measures that would improve habitat effectiveness and population vulnerability.

**Table 8. Number of species occurrences and area within wetlands, moist meadows, and riparian habitat group.**

Scientific Name	Number of Sites	Acres of Occupied Habitat	Vulnerability
<i>Antennaria corymbosa</i>	2	0.8	H
<i>Botrychium lineare</i>	1	0.0	H
<i>Carex capillaris</i>	1	0.1	H
<i>Carex comosa</i>	1	4.7	H
<i>Carex magellanica ssp. irrigua</i>	16	10.2	M
<i>Carex rostrata</i>	8	31.5	M
<i>Carex tenera</i>	1	5.2	H
<i>Cicuta bulbifera</i>	14	45.2	M
<i>Cypripedium parviflorum</i>	9	3.4	M
<i>Dryopteris cristata</i>	24	34.9	M
<i>Eriophorum viridicarinatum</i>	11	29.9	M
<i>Geum rivale</i>	27	65.2	M
<i>Muhlenbergia glomerata</i>	1	1.2	H
<i>Platanthera obtusata</i>	7	41.1	M
<i>Ribes oxycanthoides ssp. irriguum</i>	1	0.6	H

<b>Scientific Name</b>	<b>Number of Sites</b>	<b>Acres of Occupied Habitat</b>	<b>Vulnerability</b>
<i>Salix candida</i>	6	12.4	M
<i>Salix maccalliana</i>	3	1.6	H
<i>Salix pseudomonticola</i>	1	1.1	H
<i>Sanicula marilandica</i>	50	121.1	L
<i>Spartina pectinata</i>	2	0.2	M

DRAFT

# Environmental Consequences

## Methodology

### *Assumptions*

- Diversity objectives would be achieved for all native plant species through ecosystem diversity (coarse filter) plan components except for federally listed species (if discovered) and R6 sensitive species. The latter classes of plants are managed with consideration of species and habitat specific plan components including desired conditions, objectives, standards, and guidelines (fine filter).
- A conservation outcome for any group of sensitive species reflects the conservation outcome for each species in that group.
- Current vacant grazing allotments would continue in non-grazing status.

### *Introduction*

Under the 1982 planning rule, National Forests were required to manage habitat in order to maintain viable populations of existing species in planning areas. The planning rule further defines a viable population as “one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area.”

Critical information about factors limiting rare species distributions and populations is often lacking and until studies describing the complex abiotic and biotic interactions between species and their environments can be completed, conservation principles would advocate for a cautious approach to rare plant species management. As budgets limit study efforts, it is often enough to determine that there are a critical number of well-distributed, stable rare plant occurrences that ensure continued viability of the species of concern in the planning area. Particularly, this threshold is sought when the determination is that threats associated with resource management are countered with abatement, avoidance, or mitigation actions. In addition, species security is enhanced if habitat effectiveness is maintained in special and unique habitats supporting rare plant populations. Habitat effectiveness may be enhanced directly through management activities that reduce risks or indirectly by enhancing ecosystem integrity and resilience. It is, however, relevant to achieving conservation goals that sensitive plant source populations be protected from disturbances outside the historic range of variation. The details of life history traits and reproduction as well as interactions such as herbivory, mutualism (two organisms of different species benefitting from a relationship), and pollinator ecology remain incomplete due to the sheer number of candidates for priority study. Progress is measured incrementally as annual sensitive species inventories are entered into corporate databases for future analyses of condition and trend.

### *Process*

Conservation outcomes for the sensitive species are summarized below for all alternatives (Table 9) and will focus on risks to maintaining viable plant populations and habitats within the plan area. Generally, the action alternatives were not driven by plant viability issues. Therefore,

a set of TES plant, soil, vegetation, riparian management area, and livestock grazing desired future condition statements, objectives, standards, and guidelines are assessed as contributing to plant viability. This was done in threat-risk matrix associated with changes in alternative management areas. Some effects to species viability were similar across alternatives. Where a set of plan components had differing influence on conservation outcomes, the results are described below.

## Conservation Outcomes

Table 9 summarizes viability outcomes for each habitat group by alternative. For all habitat groups except “wetlands, moist meadows, and riparian,” the Proposed Action and other action alternatives “may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species” (MIIH). For “wetlands, moist meadows, and riparian,” the No Action Alternative would result in an action that “will impact individuals or habitat and may contribute to a trend towards federal listing or cause a loss of viability to the population or species” (WIFV=Will Impact Future Viability).

**Table 9. Species summary of viability outcomes by alternatives**

Habitat Groups	Alternatives					
	No Action	Proposed Action	R	P	O	B
Alpine and subalpine meadows, fellfields, parklands	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Cliffs, talus, rock outcrops	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Dry meadows, open dry forests, shrub steppe	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Moist openings, wet forests	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Wetlands, moist meadows, riparian	WIFV	MIIH	MIIH	MIIH	MIIH	MIIH

## Spatial and Temporal Context for Effects Analysis

The spatial context for effects analysis includes all Colville NF lands within the current administrative boundary. Temporal consideration is given to management of rare plant resources on the Colville NF for a period of fifteen to twenty years in the future, the approximate life of the forest plan.

## Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Resource management plans for other federal, state, and tribal lands adjacent to the Colville NF include provisions for the protection and management of rare plant resources. The Okanogan-Wenatchee NF, Panhandle NF, Bureau of Land Management, US Fish and Wildlife Service, Washington State Department of Natural Resources, Washington Dept. of Fish and Wildlife,

Kalispel Indian Reservation, and Colville Confederated Tribes recognize resource values associated with maintenance of rare plant populations and supporting habitat. Sensitive species lists may differ in details because of different agency criteria and agency habitat ownership. The state lists and state ranks are developed and maintained by the Washington Natural Heritage Program in collaboration with public agency, university, and private cooperators with botanical interests. The Pend Oreille PUD and Seattle City Lights have conducted rare plant surveys and are implementing conservation measures as needed in compliance with hydroelectric licenses on the eastern portion of the Forest along the Pend Oreille River. Allotment Management Plans (AMPs) have recently been completed with current management direction and future AMPs would incorporate changes as plan revision is implemented.

## Summary of Effects Common to All Alternatives

Plan components, including desired future conditions, objectives, standards, guidelines, land suitability, and land management allocations, as well as habitat group affinities are evaluated to describe the degree to which risks would be managed to affect desired conservation outcomes under each plan alternative. Many of the effects are common to all alternatives and plant habitat groups, and are discussed below. Other effects are evaluated by plant habitat group and alternative in Effects for Alternatives by Plant Habitat Group.

### **Environmental change**

The effects of climate change discussed in this section are common to all five rare plant habitat groups and all alternatives. Climate change predictions for the Inland Pacific Northwest include average temperature increases, changes in precipitation amounts, precipitation patterns, snowpack accumulations, snowmelt, and run-off regimen. These changes would affect extant sensitive plant populations and habitat components resulting in shifting spatial physiological optimums and habitat effectiveness. The detailed changes are unknown at the forest plan scale, but some general conclusions allow the relative ranking of vulnerable habitats and species:

- High elevation alpine and subalpine habitats would shift upwards in elevation with increasing temperatures and result in loss of suitable habitat on the higher mountainous areas (Astrup Felde et al. 2012, Miller-Struttmann et al. 2015, Munson and Sher 2015, Walther et al. 2002).
- Cliffs, talus, and rock outcrops where small changes in available moisture seeps and increased evapotranspiration<sup>1</sup> demand would impact plants established in stressful, rocky environments.
- Dry shrublands, grasslands, and forests supporting sensitive plants would experience greater evapotranspiration and changes in moisture patterns and drought that impact plant species composition and cover and, thus, habitat effectiveness of these communities (EcoAdapt 2015).
- Moist openings and wet forests would shrink in extent as both groundwater and precipitation input changes reduced and higher temperatures create greater evapotranspiration demand leading to compositional and structural shifts in associated plant communities (EcoAdapt 2015).

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<sup>1</sup> Loss of water from the soil both by evaporation and by transpiration from plants

In addition, climate change components would interact with pollinator ecology, plant phenology, invasive plant infestations, habitat connectivity, and fire regime shifts to indirectly impact existing sensitive species populations and their habitats (Miller-Struttmann et al. 2015). Shifts in some of these habitat factors may outpace the ability of plant species to adapt to changing environments (Walther et al. 2002). This leads to more isolated populations that increases stress in already vulnerable species. Condition and trend monitoring, and conservation of genetic material in seed banks have been identified as strategies to deal with these changing environments.

Fire suppression on federal lands has led to fuels accumulation in some fire types resulting in wildfires that are uncharacteristic in both fire effects and scale. Climate change may affect those factors and lead to more frequent or higher severity fires within these habitats (Devine et al. 2012). Plan alternatives that promote landscape scale restoration of sustainable vegetation types within historic and future ranges of variation would also provide habitat capable of supporting sensitive species populations. Restoration of the historic fire regime and the use of fire as a tool in ecosystem recovery efforts would improve current vegetation condition and positively influence the trend trajectory (Franklin and Johnson 2012, Ingalsbee 2015).

In all of these situations, understanding site and vegetation dynamics, monitoring the most vulnerable species, off-site gene conservation with seed collections and storage, and population supplementation would help meet conservation goals. The responses of sensitive plants to additional environmental stressors are unknown and may result in negative conservation outcomes.

#### **Alteration of hydrologic regime**

All alternatives provide guidance and direction regarding wetlands and riparian areas in each of the five rare plant habitat groups. Wetlands and riparian areas would be managed as Riparian Management Areas or Riparian Habitat Conservation Areas where aquatic and riparian-dependent resources receive primary emphasis and where special management direction applies. While there are small differences in riparian widths associated with each alternative, the risk analysis was unable to detect a small change between alternatives. Therefore, the species risk ratings were unchanged between the set of alternatives and were evaluated as a single factor common to all alternatives. Plant and aquatic/riparian standards and guidelines common to all alternatives promote the maintenance or enhancement of riparian/wetland processes and functions, including hydrologic connectivity and regime, and would protect existing sensitive species sites and suitable habitat from degradation.

#### **Gopher disturbance**

Northern gophers have been identified as an herbivore threat to several sensitive species occupying meadows and riparian rare plant habitat groups. Gopher populations could reach thresholds which would affect both habitat effectiveness and plant population conditions and trends for *Botrychium hesperium*, *B. paradoxum*, *B. pedunculatum*, and *Ophioglossum pusillum*. Preferred food for these underground-dwelling herbivores include herbaceous material (grass, roots, and forbs) produced during the growing season as well as tree and shrub material during the winter months. Their tunneling and mound building activity could disturb existing plants. Exposure of mineral soil could create an opportunity for invasive plants to become established in meadow habitats and compete with sensitive plants.

Gophers are ecosystem engineers and provide valuable ecosystem services including improvement of soil properties and as prey species supporting a host of predators in a complex food web (Case et al. 2013, Jones et al. 2008). Monitoring gopher mounds for indicators of potential impacts and implementing integrated pest management practices if needed would reduce the likelihood of negative effects to the sensitive species. Risks associated are generally low but may be medium when large gopher populations become established in meadow ecosystems. Essentially, the species risk ratings were unchanged for the full set of alternatives and were evaluated as a single factor common to all alternatives.

### **Invasive plants**

Invasive plants were identified as a threat to three of the rare plant habitat groups:

- Dry meadows, open dry forests, shrub steppe, rocky sites
- Moist openings and wet forest sites
- Wetlands, moist meadows, riparian areas

The invasive plant risk rating is from analyses of effects (both direct competition and nearby threat occurrence) represented by invasive plant infestation proximity to sensitive plant sites. That rating was completed during analyses to identify priority watersheds for the Watershed Condition Framework (USDA FS 2015). The total percentage of area for these two categories (direct competition and threat impact) was rated as Low, Medium, or High. An elevated risk was associated with particular species occurrences in priority watersheds and includes *Botrychium hesperium* from dry meadows, open dry forests, as well as *Botrychium ascendens*, *Botrychium crenulatum*, *Cicuta bulbifera*, and *Dryopteris cristata* from wetlands, moist meadows and riparian areas. If the invasive threat was alternatively identified in the literature or database observations, then the risk was rated as low. That was the situation for *Botrychium pedunculatum*, *Sisyrinchium montanum*, and *Viola renifolia* in moist openings and wet forest sites. The sensitive species risk ratings and plan components related to invasive plants were unchanged for the set of alternatives and were evaluated as a single factor common to all alternatives. An integrated invasive plant management program with emphases on prevention, effective control, and restoration would improve conservation outcomes.

### **Livestock grazing and trampling**

For all rare plant habitat groups except cliffs, talus and rock outcrops, livestock grazing and trampling may affect sensitive plants directly and habitat effectiveness indirectly. These interactions depend on the palatability of the plant species for certain livestock and the fragility of habitat components that, together, influence habitat effectiveness. Improperly timed herbivory (i.e., grazing) removes current year's vegetative growth and flower or fruit structures before maturation. Recurrent annual grazing during the growing season would interrupt critical life history events and may affect seedling recruitment and subsequent maintenance of population structure. Demographic studies support the critical need for periodic reproductive success in perennial vegetation systems. It is crucial, as well, for annual plants to produce reproductive structures and annual seed crops, in particular during poor growing years. A link between carbohydrate storage and plant vigor is affected by heavy season-long grazing and can lead to individual plant impacts and changes in plant community composition and structure (Kovalchik and Clausnitzer 2004).

Trampling affects not only the vegetation directly but the soils and habitat supporting rare plant populations. This is particularly an issue in maintenance of wet soils throughout the grazing

season after attainment of range readiness in terrestrial vegetation types (Kovalchik and Clausnitzer 2004). Lowered habitat effectiveness, reflected in the reduced ability to support desired vegetation components and ecosystem functions, could be a detrimental outcome. Maintenance of soil productive capacity and essential attributes is critical for the contribution of ecosystem services from Forest lands. This grazing and trampling risk is assessed as the proportion of each species' total occupied habitat occurring within allotments and represents the exposure of these sensitive species to impacts. It is recognized that plant sensitivity to both grazing and trampling varies spatially and temporally with attributes of the grazing system and site-specific characteristics including associated plant species, soil moisture, and soil texture, in addition to seasonal sensitivity shifts connected to plant phenology. Risks were assigned for the active growing season.

### **Plant collecting**

For all rare plant habitat groups and alternatives, unauthorized plant collection risk levels are associated with ease of access to sites and habitat. Documented sites within roadless areas (such as wilderness, recommend wilderness, research natural areas, etc.), or with lower road densities are at lower risk than those occurring in management areas with higher density roads and public access. While there are permits for commercial or personal use of native plant materials, terms and conditions associated with plant collection prohibit sensitive and listed plant taxa from collection. Should they be found on the forest, the collection of federally listed plant species can only be authorized under the authority of the United States Fish and Wildlife Service. Scientific plant materials collection of sensitive species (also personal use permit) authorization is delegated from Region 6 to the Forest level and should not affect sensitive plant populations. Risks associated with unauthorized plant collection have been identified for three sensitive species (*Cypripedium parviflorum*, *Eurybia merita*, and *Gaultheria hispidula*) discussed below by habitat group. There is little risk for the remaining 35 taxa, because they have not been identified as targets for collection.

## **Effects for Alternatives by Plant Habitat Group**

The threats and risks to sensitive plant occurrences within a particular management area are altered by Forest-wide and management area plan components, including desired future conditions, standards, and guidelines for suitable conservation outcomes. Effects therefore vary by plant habitat group and alternative and are discussed below for each group.

### ***Alpine and Subalpine Meadows, Fellfields, and Parklands Habitat Group***

#### **1. Summary of Effects**

The conservation outcome is the same for all alternatives: May impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Alpine and subalpine meadows, fellfields, and parklands habitats are generally a high vulnerability group with exposure to environmental change from climatic and fire regime factors (Miller-Struttman et al. 2015, Munson and Sher 2015). Whitebark pine is exposed to threats from insect and disease, as well as environmental changes (Devine et al. 2012). Additionally, this group of species has exposure to livestock grazing, recreational activity, hydrologic regime

alteration, and plant collecting. Together this creates high to medium levels of risk for desired conservation outcomes.

Conservation measures in the current direction do not focus on essential habitat components and critical life history events that support development of sustainable populations and maintenance of high habitat effectiveness. They do not consider climate change as an additional environmental stressor. The No Action Alternative would maintain existing conditions and trends, vulnerabilities, and risks to these sensitive species. Indications are that trends for some sensitive plant populations and habitat are declining under current management. On the other hand, action alternatives (i.e., the Proposed Action and Alternative P) that promote landscape scale restoration of sustainable vegetation types within historic and future ranges of variation would continue to provide capable habitat as a corollary to protection of the source populations. This includes restoration of disturbances, such as fire, that are responsible for landscape character. The proposed conservation goals to maintain or enhance existing populations are mediated by application of plan components. These include protective standards and guidelines as well as implementation of plant monitoring that targets population and habitat conditions and trends.

Although Alternatives R and B would allocate similar acres to the Recommended Wilderness (RW) management area, where human-caused effects may be reduced, the risks are driven by threats somewhat independent of that management allocation. In addition, the remaining action alternatives allocate more acreage of this habitat to the Backcountry management area where effects on sensitive plant species are similar to those in RW, so the conservation outcome across all alternatives is the same.

## **2. Threats and Risks to Viability**

### **Alteration of hydrologic regime**

Some of these sensitive plant occurrences are found in headwater or streamside environments where this habitat element may frame conservation concerns. This threat includes activities that affect the amount, timing, or quality of water maintaining sensitive plant habitat within wetlands and riparian sites. The risk rating is related to the exposure of plant sites to potential change. This is assessed as the proportion of the total occupied habitat of each species that occurs within wetland or riparian ecosystems (L: 0-33%, M: 34-67%, H: 68-100%). Risks associated with this threat are generally medium; however, the effect is somewhat magnified by the high vulnerability of most species found in this rare plant habitat group.

### **Insect and Disease**

Detailed information on threats of insect and disease affecting sensitive species is lacking for most taxa. However, there are assessments describing the existing threats for the *Pinus albicaulis* ecosystem from both western white pine blister rust and mountain pine beetle (USDI FWS 2011, Spies et al. 2010). Across the range of *Pinus albicaulis*, these agents have contributed significantly to recent tree mortality. This species is a candidate for federal listing with a “warranted but precluded” finding issued in 2011. Continued implementation of the Pacific Northwest whitebark pine restoration strategy would be a critical management action to accomplish conservation goals. In the Pacific Northwest, whitebark pine is highly vulnerable to insects and diseases (Devine et al. 2012), thus the risk is rated as high for this species and low for the remainder of the sensitive species in this rare plant habitat group.

### **Environmental change**

See effects common to all alternatives.

### **Livestock grazing and trampling**

See effects common to all alternatives.

### **Plant collecting**

See effects common to all alternatives. In addition, a low risk is associated with unauthorized plant collection for *Eurybia merita* in this habitat group. There is little risk for the remaining four taxa, since they have not been identified as targets for collection.

### **Recreational use**

This threat category includes site use and development, and trail use and construction. Two species in this group, *Carex proposita* and *Eurybia merita*, occur in meadow habitats that are favored for recreational use or trails development. The risk for these taxa was high when 67 percent or greater exposure of existing sites occurred in management areas with non-wilderness recreation emphases. Potential effects include disturbance from trampling and camping. Vulnerability is high because of the limited number of sites and plants, and the total size of all occurrences. The proposed conservation goal to maintain or enhance existing populations is mediated by application of plan components including protective standards and guidelines as well as implementation of monitoring that targets population and habitat conditions and trends. Establishing trails and camping areas in locations that avoid these populations in addition to monitoring and initiating further surveys in suitable habitat are management actions that would improve conservation outcomes for these two species.

## **Cliffs, Talus, and Rock Outcrops Habitat Group**

### **1. Summary of Effects**

The conservation outcome is the same for all alternatives: May affect individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species (MIIH).

Cliffs, talus, and rock outcrops habitats supporting *Cryptogramma stelleri*, *Dryas drummondii* var. *drummondii*, and *Lycopodium dendroideum* are a high vulnerability group with exposure to threats including environmental change from climatic factors and recreation use.

The No Action Alternative would maintain existing conditions and trends, vulnerabilities, and risks to these sensitive species. Indications are that current population trends are static or improving. However, conservation measures in the current direction do not focus on essential habitat components Critical life history events that support development of sustainable populations and maintenance of high habitat effectiveness nor do they consider climate change as an additional environmental stressor. On the other hand, action alternatives that promote conservation goals to maintain or enhance existing populations are mediated by application of plan components. These include protective standards and guidelines as well as implementation of plant monitoring that targets population and habitat conditions and trends.

### **2. Threats and Risks to Viability**

#### **Environmental change**

See effects common to all alternatives.

## **Plant collecting**

See effects common to all alternatives.

## **Recreational use**

This threat category includes site use and development, and trail use and construction. The risk for these taxa was high if 67 percent or greater exposure of existing sites occurred in management areas with non-wilderness recreation emphases. Potential effects include disturbance from recreational trampling, climbing, and shoreline development. Vulnerability is high because of the limited number of sites and plants, and the total size of all occurrences. The proposed conservation goal to maintain or enhance existing populations is mediated by application of plan components including protective standards and guidelines as well as implementation of monitoring that targets population and habitat conditions and trends. Establishing trails, climbing routes, and camping areas in locations that avoid these populations would contribute to the sustainability of these three species. Effectiveness monitoring and initiating further surveys in suitable habitat also support conservation goals. All action alternatives provide guidance and direction to accomplish these actions, while the No Action Alternative lacks specific direction.

## **Road building and maintenance**

Risk associated with road building and maintenance is related to direct effects of physical disturbance to sensitive plant populations. The potential use of native rock sources for road construction and surfacing includes identification of borrow pits and gravel sources. The risk for these species occurrences in this habitat group is currently low since the species occur, principally, in unroaded allocations.

## ***Dry Meadows, Dry Forests, and Shrub Steppe Habitat Group***

### ***1. Summary of Effects***

The conservation outcome is the same for all alternatives: May impact individuals or habitat (MIIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Dry meadows, open dry forests, and shrub steppe habitats supporting *Antennaria parvifolia*, *Astragalus microcystis*, *Botrychium ascendens*, *B. hesperium*, *B. paradoxum*, and *B. pedunculosum* are rated for vulnerability as medium to high vulnerability with exposure to threats including environmental change, gopher disturbance, invasive plants, livestock grazing and trampling, recreation use, road building, and timber harvest activities.

The No Action Alternative would maintain existing conditions and trends, vulnerabilities, and risks to these sensitive species. Indications are that current population trends are static or improving while habitat condition may be trending downward. Conservation measures in current direction do not focus on essential habitat components and critical life history events that support development of sustainable populations and maintenance of high habitat effectiveness nor do they consider climate change as an additional environmental stressor. On the other hand, action alternatives that promote conservation goals to maintain or enhance existing populations is mediated by application of plan components. These include protective standards and guidelines as well as implementation of plant monitoring that targets population and habitat conditions and trends.

The risks to sensitive plant occurrences within a particular management area are altered by Forest-wide and MA plan components including desired future conditions, standards, and guidelines for effective conservation outcomes.

## **2. Threats and Risks to Viability**

### **Environmental change**

This threat is used to qualitatively summarize the effects to the environment supporting sensitive plant species. It includes factors such as climate change, fire regime shifts, plant succession, and soil raveling and erosion. Additionally, in fire-maintained meadows, past fire suppression and subsequent plant succession has affected habitat effectiveness for *Antennaria parvifolia*. Plan alternatives that promote landscape scale restoration of sustainable vegetation types within historic and future ranges of variation would also provide habitat capable of supporting sensitive species populations. Restoration of the historic fire regime and the use of fire as a tool in ecosystem recovery efforts would improve current vegetation condition and influence habitat trend trajectory in a positive sense.

In some portions of the landscape, soil-forming processes, including soil raveling and erosion, continue to affect sensitive plant environments for *Astragalus microcystis* and affect existing populations. The genus *Astragalus* has an affinity for early seral stages in disturbance regimes, so it is possible the species could be adequately maintained. Site observations indicate the species has increased its cover in disturbed areas left to recover. Timber harvest activities conducted adjacent to occupied shrublands, livestock grazing, and prescribed fire are management activities that affect this species. Improper livestock grazing, unnaturally high fire frequency, and invasion by exotic plants are the biggest threats to the sensitive species occupying these habitats. Higher fire frequencies are to be expected with a higher proportion of non-native invasive species in the plant community.

### **Gopher disturbance**

See effects common to all alternatives.

### **Invasive plants**

See effects common to all alternatives.

### **Livestock grazing and trampling**

See effects common to all alternatives.

### **Plant collecting**

See effects common to all alternatives.

### **Recreational use**

This threat category includes site use and development, trail use and construction, and recreational vehicle use. Ten species have been identified to occur in habitats that are favored for recreational development such as shorelines, or in meadows accessed by OHV users, or on cliffs in potential rock-climbing routes. In this habitat group, *Astragalus microcystis* and the *Botrychium* species are exposed to these risks. The risk for these taxa was high, if 67 percent or greater exposure of existing sites occurred in management areas with non-wilderness recreation emphases.

The risk from OHV incursions into occupied habitat has recently declined to a low level with the completion of the Colville NF Travel Management Subpart A analysis; OHV use in vulnerable habitat is restricted. Otherwise, the risk is high for recreational developments including trails. Establishing trails and camping areas in locations that avoid these populations would reduce risk and contribute to the sustainability of these three species. The proposed conservation goal to maintain or enhance existing populations is mediated by application of plan components including protective standards and guidelines as well as implementation of monitoring that targets population and habitat conditions and trends. Effectiveness monitoring and initiating further surveys in suitable habitat also support conservation goals. All action alternatives provide guidance and direction to accomplish these actions, while the No Action Alternative lacks specific direction.

### **Road building and maintenance**

Risk associated with road building and maintenance is related to direct effects of physical disturbance to sensitive plant populations. Risk for the species would be elevated (Medium to High) for the No Action. These risks would be reduced in the Proposed Action and other action alternatives. Since additional plan components mediate desired conservation outcomes in all action alternatives, the total effects would be reduced and would support sensitive species sustainability.

### **Timber harvest activities**

The risks associated with timber harvest activities include direct effects to plant populations from physical effects as well as indirect effects from environmental site changes due to light, moisture, or soil property alterations related to the treatments. *Antennaria parvifolia* sites in the dry forest rare plant habitat group are at risk to exposure.

Some of the indirect effects may benefit early seral species in a forested landscape. *Antennaria parvifolia* may benefit from treatments, but a conservative approach should also consider protection and monitoring of source populations both pre-and post-treatment. Potential exposure to this threat is high, but total effects would be reduced by both plan components and potential species responses to management activities. All alternatives support sensitive species sustainability outcomes.

## ***Moist Openings and Wet Forests Habitat Group***

### ***1. Summary of Effects***

The conservation outcome is the same for all action alternatives: May impact individuals or habitat (MIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Moist openings and wet forest habitats support *Botrychium crenulatum*, *Lycopodium dendroideum*, *Sisyrinchium montanum*, and *Viola renifolia*. Two of those species are rated as highly vulnerable (*Sisyrinchium montanum* and *Lycopodium dendroideum*); *Botrychium crenulatum* and *Viola renifolia* are rated low vulnerability. High vulnerability reflects a low number of sites and total plants, and small total size of occupied sites. Exposure to threats include alteration of hydrologic regime, environmental change, gopher disturbance, invasive species, livestock grazing and trampling, recreation use, road building, and timber harvest activities.

The No Action Alternative would maintain existing conditions and trends, vulnerabilities, and risks to these sensitive species; local data indicate that current site trends are mixed with static and improving trends for *Lycopodium dendroideum* and *Viola renifolia*, respectively. Conservation measures in current direction do not focus on essential habitat components and critical life history events that support development of sustainable populations and maintenance of high habitat effectiveness, nor do they consider climate change as an additional environmental stressor. On the other hand, action alternatives that promote conservation goals to maintain or enhance existing populations are mediated by application of plan components. These include protective standards and guidelines as well as implementation of plant monitoring that targets population and habitat conditions and trends.

## **2. Threats and Risks to Viability**

### **Alteration of hydrologic regime**

Some of these sensitive plant occurrences are found in streamside environments where this habitat element frames conservation concerns. This threat includes activities that affect the amount, timing, or quality of water maintaining sensitive plant habitat within wet forest and wet openings. The risk rating is related to the exposure of plant sites to potential change. This is assessed as the proportion of the total occupied habitat of each species that occurs within wetland or riparian ecosystems (L 0-33%, M 34-67%, H 68-100%). Risks associated with this threat are high and medium; however, the effect is somewhat magnified by the high vulnerability of two species found in this habitat group.

### **Environmental change**

This threat is used to qualitatively summarize the effects to the environment supporting sensitive plant species. In this habitat group, discussion focus is on climate change (see effects common to all alternatives) and fire regime shifts.

Fire suppression on federal lands has led to fuels accumulation in some fire types with resultant wildfires that are uncharacteristic in both fire effects and scale. Additionally, in fire-maintained meadows, past fire suppression and subsequent plant succession may affect habitat effectiveness for taxa in this group like *Sisyrinchium montanum*. Plan alternatives that promote landscape scale restoration of sustainable vegetation types within historic and future ranges of variation would also provide habitat capable of supporting sensitive species populations. Restoration of the historic fire regime and the use of fire as a tool in ecosystem recovery efforts would improve current vegetation condition and influence habitat trend trajectory in a positive sense.

### **Gopher disturbance**

See effects common to all alternatives.

### **Invasive plants**

See effects common to all alternatives.

### **Livestock grazing and trampling**

See effects common to all alternatives.

### **Plant collecting**

See effects common to all alternatives.

### **Recreational use**

This threat category principally includes recreational vehicle use. Ten species have been identified to occur in habitats that are favored for recreational development such as shorelines, or in meadows accessed by OHV users, or on cliffs in potential rock-climbing routes; in this habitat group *Sisyrinchium montanum* is exposed to risks of OHV use in meadows. The risk for this taxa was medium to low in management areas with non-wilderness recreation emphases.

The risk from OHV incursions into occupied habitat has recently declined to a low level with the completion of the Colville NF Travel Management Subpart A analysis; OHV use in vulnerable habitat was restricted. Establishing trails and camping areas in locations that avoid populations of these four sensitive species would reduce risk and contribute to the sustainability of these taxa. The proposed conservation goal to maintain or enhance existing populations is mediated by application of plan components including protective standards and guidelines as well as implementation of monitoring that targets population and habitat conditions and trends. Effectiveness monitoring and initiating further surveys in suitable habitat also support conservation goals. All action alternatives provide guidance and direction to accomplish these actions, while the No Action Alternative lacks specific direction.

### **Road building and maintenance**

Risk associated with road building and maintenance is related to direct effects of physical disturbance to sensitive plant populations. Risks for these four species are low to medium for all alternatives because of the lower percent of occurrences in roaded areas. There are slightly lower risks in the Proposed Action and Alternatives P and R but the difference has no effect on the conservation outcome. Even a medium risk becomes a conservation concern for *Sisyrinchium montanum* because of the high vulnerability of this species. These risks are reduced in action alternatives since additional plan components mediate desired conservation outcomes.

### **Timber harvest activities**

The risks associated with timber harvest activities include direct effects to plant populations from physical impacts as well as indirect effects from environmental site changes due to light, moisture, or soil property alterations related to the treatments.

Potential exposure to this threat is variable for this suite of species. Risk remains high to medium for *Viola renifolia* across all action alternatives. For *Lycopodium dendroideum* and *Sisyrinchium montanum*, risks are generally low to medium. These differences reflect the degree of fidelity to MAs in which timber harvest occurs across alternatives. Total effects are reduced by common plan components across the action alternatives. All alternatives support sensitive species sustainability outcomes.

## ***Wetlands, Moist Meadows, and Riparian Habitat Group***

### **1. Summary of Effects**

The conservation outcome for the No Action Alternative is: Will affect individuals or habitat with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability to the population or species. The conservation outcome is the same for all action alternatives: May affect individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Wetlands, moist meadows, and riparian habitats support the majority of Colville NF sensitive plant species, 20. Only one of these taxa is rated as low vulnerability; the remainder are rated

high (9 species) and medium vulnerability (10). Seven species in this group are represented on the Forest by a single occurrence; six taxa with fewer than 10 individual plants are documented. High vulnerability reflects a low number of sites and total plants, and small total size of occupied sites. Exposure to threats include alteration of hydrologic regime, environmental change, gopher disturbance, invasive plants, livestock grazing and trampling, plant collection, recreation use, road building, timber harvest activities, and windthrow (trees uprooted or broken by wind).

Local data indicate that current habitat trends are mixed with 43 wetland, moist meadow, or riparian sites trending downward in habitat effectiveness. Population trends are mixed with seven species indicating declining trends, nine are static, and eight have improving trends (the remaining three have no indication). The No Action Alternative would maintain existing conditions and trends, vulnerabilities, and risks to these sensitive species. In particular, the nine highly vulnerable species are at risk of loss of sustainability. Conservation measures in current direction do not focus on essential habitat components and critical life history events that support development of sustainable populations and maintenance of high habitat effectiveness nor do they consider climate change as an additional environmental stressor. On the other hand, action alternatives that promote conservation goals to maintain or enhance existing populations are mediated by application of plan components. These include protective standards and guidelines as well as implementation of plant monitoring that targets population and habitat conditions and trends.

## **2. Threats and Risks to Viability**

### **Alteration of hydrologic regime**

Most of these sensitive plant occurrences are found in wetlands, moist meadows, and riparian habitats where this habitat element frames conservation concerns. This threat includes activities that affect the amount, timing, or quality of water maintaining sensitive plant habitat within this group, including maintenance of ecosystem services from beavers. The risk rating is related to the exposure of plant sites to potential change. This is assessed as the proportion of the total occupied habitat of each species that occurs within wetland or riparian ecosystems (L 0-33%, M 34-67%, H 68-100%). Risks associated with this threat are high for 19 species and medium for the remaining one. However, plan components proposed for all but the no action alternative are expected to maintain habitat effectiveness for the species in this group.

### **Environmental change**

This threat is used to qualitatively summarize the affects to the environment supporting sensitive plant species. In this habitat group, discussion focus is on climate change and fire regime shifts. This habitat group is a top priority when considering climate change effects and mitigation measures in project planning and implementation. In addition, climate change may lead to more frequent or higher severity fires within these habitats. Plan alternatives that promote landscape scale restoration of sustainable vegetation types within historic and future ranges of variation would also provide habitat capable of supporting sensitive species populations. Restoration of the historic fire regime and the use of fire as a tool in terrestrial ecosystems would inform recovery efforts in these habitats.

### **Gopher disturbance**

See effects common to all alternatives.

### **Invasive plants**

See effects common to all alternatives.

### **Livestock grazing and trampling**

See effects common to all alternatives. The species risk ratings were unchanged for the set of alternatives and were evaluated as a single factor common to all alternatives; nine species were rated as high risk, two were rated as medium risk, and nine as low risk; two of the high vulnerability species in this group are exposed to excessive risk from livestock grazing and trampling. The risk from this threat is a contributing factor in determination of the conservation outcome for species in this habitat group. The action alternatives address this risk with plan components, standards and guidelines to contribute to species viability.

### **Plant collecting**

See effects common to all alternatives. In addition, risks associated with unauthorized plant collection have been identified for two species in this rare plant habitat group. The risk is high for *Cypripedium parviflorum* and low for *Gaultheria hispidula*. There is little risk for the remaining 18 taxa, since they have not been identified as targets for collection.

### **Recreational use**

This threat category principally includes recreational vehicle use. Ten species have been identified to occur in habitats that are favored for recreational development such as shorelines, or in meadows accessed by OHV users, or on cliffs in potential rock-climbing routes; in this habitat group, *Botrychium paradoxum*, *Botrychium pedunculatum*, *Dryopteris cristata*, *Geum rivale*, and *Ophioglossum pusillum* are exposed to risks of OHV use in meadows. The risk for these taxa is medium to low in management areas with non-wilderness recreation emphases. The risk from OHV incursions into occupied habitat has recently declined to a low level with the completion of the Colville NF Travel Management Subpart A analysis; OHV use in vulnerable habitat was restricted.

Establishing trails and camping areas in locations that avoid populations of these 20 sensitive species would reduce risk and contribute to the sustainability of these taxa. The proposed conservation goal is to maintain or enhance existing populations. Application of plan components, including protective standards and guidelines and implementation of monitoring that targets population and habitat conditions and trends, is mediated. Effectiveness monitoring and initiating further surveys in suitable habitat also support conservation goals. All action alternatives provide guidance and direction to accomplish these actions, while the No Action Alternative lacks specific direction.

### **Road building and maintenance**

Risks associated with road building and maintenance are related to direct effects of physical disturbance to sensitive plant populations. Risks for these 20 species are low for all alternatives because of the lower percent of species occurrences in roaded areas and the currently existing and proposed direction on maintenance of ecosystem integrity within the wetland-riparian habitat group. There are slightly lower risks in the Proposed Action and Alternatives P and R, but the difference has no effect on the conservation outcome. Additionally, road density and location standards contribute to species viability by lowering risks from associated impacts. Nonetheless, monitoring high vulnerability species when road management activities may affect sites would inform continuing conservation measures.

### **Timber harvest activities**

The risks associated with timber harvest activities include direct effects to plant populations from physical impacts as well as indirect effects from environmental site changes due to light, moisture, or soil property alterations related to the treatments.

Potential exposure to this threat is low for this suite of species. Total effects are reduced by common plan components that maintain and promote ecosystem integrity, process, and function across the alternatives. All alternatives support sensitive species sustainability outcomes for this particular threat.

### **Windthrow**

Since the majority of Colville NF sensitive species are found in wetland or riparian habitats, a windthrow (trees uprooted or broken by wind) risk to existing sites and habitats has been identified. The risk results from the interaction of site factors, extreme weather events, and the ability of a tree to withstand strong winds without breakage or blowdown, including rooting habit and disease occurrence. Where this threat negatively affects existing sensitive species populations or affects habitat effectiveness, it is associated with sites in conifer- or hardwood-dominated riparian stands. However, if blowdown occurs at the edge of wetland habitats, it is generally an addition to habitat diversity. The windthrow threat is generally a low risk except for sites supporting *Botrychium lineare* and *B. crenulatum* where it is elevated to a medium level because of past events. In addition, the interaction of this threat alone with vulnerability ratings implies different outcomes for the two *Botrychiums* and it reinforces the conservation risk associated with a single, chance event affecting a lone site supporting a small population (*B. lineare*). While the alternatives that address ecosystem integrity and resilience with landscape level restoration goals can be judged to provide less risk for this threat, the species risk ratings were unchanged for the set of alternatives and were evaluated as a single factor common to all alternatives.

### ***Cumulative Effects***

Cumulative effects include the past, present, and reasonably foreseeable future activities that contribute to TES plant species viability. Resource management plans for other federal, state, and tribal lands adjacent to the Colville NF include provisions for the protection and management of rare plant resources. The cumulative effect of adjacent lands management would not change any of the direct and indirect effects because management direction supports rare plant viability. While sensitive species lists may differ in details because of different agency criteria and agency habitat ownership, the state lists and state ranks are developed and maintained by the Washington Natural Heritage Program in collaboration with public agency, university, and private cooperators with botanical interests. Resource management projects focused on restoration of riparian and terrestrial resources associated with the Vision 2020 Project are assumed to follow management direction that would contribute to the viability of TES plant species and would not contribute to additional cumulative effects. The Pend Oreille PUD relicensing would not contribute to further effects and would implement conservation measures as needed to renew hydroelectric licenses. Allotment Management Plans would be managed to standard and would not contribute to further cumulative effects.

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## Appendix A. Sensitive Species Attribute Summaries.

**\*Federal Status (USDI FWS 2011)**

**+Washington Natural Heritage Program State Rank (NatureServe 2013)**

Washington State rank (WNHP 2013) characterizes the relative rarity or endangerment within the state of Washington. Factors including, but not limited to, number of known occurrences are considered when assigning a rank. Two codes together represent an inexact range (e.g., S1S2) or different ranks for breeding and non-breeding populations (e.g., S1B, S3N). Values and their definitions:

- **S1** = Critically imperiled in the state because of extreme rarity or other factors making it especially vulnerable to extirpation from the state. (Typically 5 or fewer occurrences or very few remaining individuals or acres)
- **S2** = Imperiled in the state because of rarity or other factors making it very vulnerable to extirpation from the state. (Typically 6 to 20 occurrences or few remaining individuals or acres)
- **S3** = Rare or uncommon in the state. (Typically 21 to 100 occurrences)
- **SNR** = Not yet ranked. Sufficient time and effort have not yet been devoted to ranking of this taxon.

Scientific Name (Common Name)	Habitat Group	Number of sites	Acres of Occupied Habitat	Federal and WNHP State Rank	Threats
<i>Antennaria corymbosa</i> (flat-top pussytoes)	Wetlands, moist meadows, riparian	2	0.8	S1	Livestock grazing and trampling, alteration of hydrologic regime, noxious weeds
<i>Antennaria parvifolia</i> (Nuttall's pussytoes)	Dry meadows, open dry forests, shrub steppe	12	2.7	S2	Conifer encroachment, livestock grazing and trampling, noxious weeds, herbicide application
<i>Astragalus microcystis</i> (least bladdery milk-vetch)	Dry meadows, open dry forests, shrub steppe	16	12.9	S2	Livestock grazing and trampling, recreational use, erosion of riverbanks, noxious weeds
<i>Botrychium ascendens</i> (upward-lobed moonwort)	Dry meadows, open dry forests, shrub steppe	7	0.7	S2	Livestock grazing and trampling, alteration of hydrologic regime, herbicide application
<i>Botrychium crenulatum</i> (crenulate moonwort)	Moist openings, wet forests	142	90.3	S3	Timber harvest activities, road building and maintenance, livestock grazing and trampling, blowdown, herbicide application

Scientific Name (Common Name)	Habitat Group	Number of sites	Acres of Occupied Habitat	Federal and WNHP State Rank	Threats
<i>Botrychium hesperium</i> (western moonwort)	Dry meadows, open dry forests, shrub steppe	36	14.9	S1	Livestock grazing and trampling, noxious weeds, gopher disturbance, recreational trail and recreational vehicle use, herbicide application
<i>Botrychium lineare</i> (slender moonwort)	Wetlands, moist meadows, riparian	1	0.0	S1	Livestock grazing and trampling; timber harvest activities, road building and maintenance, blowdown
<i>Botrychium paradoxum</i> (twin-spiked moonwort)	Dry meadows, open dry forests, shrub steppe	16	5.6	S2	Livestock grazing and trampling; recreational vehicle use, road building and maintenance, noxious weeds, timber harvest activities, gopher disturbance, herbicide application
<i>Botrychium pedunculosum</i> (stalked moonwort)	Dry meadows, open dry forests, shrub steppe	28	17.0	S2	Livestock grazing and trampling, road building and maintenance, recreational vehicle use, noxious weeds, gopher disturbance, herbicide application
<i>Carex capillaris</i> (hair-like sedge)	Wetlands, moist meadows, riparian	1	0.1	S1	Alteration of hydrologic regime, recreational use
<i>Carex comosa</i> (bristly sedge)	Wetlands, moist meadows, riparian	1	4.7	S2	Alteration of hydrologic regime, noxious weeds, shoreline recreational development
<i>Carex magellanica</i> <i>ssp. irrigua</i> (poor sedge)	Wetlands, moist meadows, riparian	16	10.2	S2S3	Alteration of hydrologic regime, livestock grazing and trampling

Scientific Name (Common Name)	Habitat Group	Number of sites	Acres of Occupied Habitat	Federal and WNHP State Rank	Threats
<i>Carex proposita</i> (Smoky Mountain sedge)	Alpine and subalpine meadows, fellfields, parklands	4	0.5	S2	Livestock grazing and trampling
<i>Carex rostrata</i> (beaked sedge)	Wetlands, moist meadows, riparian	8	31.5	S1	Livestock grazing and trampling, alteration of hydrologic regime
<i>Carex tenera</i> (quill sedge)	Wetlands, moist meadows, riparian	1	5.2	S1	Alteration of hydrologic regime, recreational use, shoreline recreational development.
<i>Cicuta bulbifera</i> (bulb-bearing water-hemlock)	Wetlands, moist meadows, riparian	14	45.2	S2	Livestock grazing and trampling, recreational trail use, alteration of hydrologic regime, noxious weeds.
<i>Cryptogramma stelleri</i> (Steller's rockbrake)	Cliffs, talus, rock outcrops	4	1.6	S1S2	Recreational use (climbing)
<i>Cypripedium parviflorum</i> (yellow lady's slipper)	Wetlands, moist meadows, riparian	9	3.4	S2	Alteration of hydrologic regime, livestock grazing and trampling, plant collecting.
<i>Dryas drummondii</i> var. <i>drummondii</i> (Drummond's mountain-avens)	Cliffs, talus, rock outcrops	2	1.7	S2	Recreational use and shoreline development
<i>Dryopteris cristata</i> (crested woodfern)	Wetlands, moist meadows, riparian	24	34.9	S2	Livestock grazing and trampling, recreational use, alteration of hydrologic regime, noxious weeds, recreational trail and recreational vehicle use
<i>Eriophorum viridicarinatum</i> (green-keeled cottongrass)	Wetlands, moist meadows, riparian	11	29.9	S2	Livestock grazing and trampling, alteration of hydrologic regime

Scientific Name (Common Name)	Habitat Group	Number of sites	Acres of Occupied Habitat	Federal and WNHP State Rank	Threats
<i>Eurybia merita</i> (arctic aster)	Alpine and subalpine meadows, fellfields, parklands	1	0.5	S1S2	Recreational use, plant collecting, livestock grazing and trampling
<i>Gaultheria hispidula</i> (creeping snowberry)	Alpine and subalpine meadows, fellfields, parklands	1	0.2	S2	Alteration of hydrologic regime, plant collecting
<i>Geum rivale</i> (water avens)	Wetlands, moist meadows, riparian	27	65.2	S2S3	Alteration of hydrologic regime, livestock grazing and trampling, noxious weeds, recreational vehicle use
<i>Lomatium sandbergii</i> (Sandberg's desert-parsley)	Alpine and subalpine meadows, fellfields, parklands	1	0.1	S1	Single historical site on Forest may be extirpated.
<i>Lycopodium dendroideum</i> (treelike clubmoss)	Moist openings, wet forests	2	1.9	S2	Timber harvest activities, recreational use, livestock grazing and trampling
<i>Muhlenbergia glomerata</i> (spiked muhly)	Wetlands, moist meadows, riparian	1	1.2	S1S2	Alteration of hydrologic regime, livestock grazing and trampling, timber harvest activities

Scientific Name (Common Name)	Habitat Group	Number of sites	Acres of Occupied Habitat	Federal and WNHP State Rank	Threats
<i>Ophioglossum pusillum</i> (northern adderstongue)	Moist openings, wet forests	5	2.0	S1S2	Alteration of hydrologic regime, livestock grazing and trampling, gopher disturbance, noxious weeds, recreational vehicle use
<i>Pinus albicaulis</i> (whitebark pine)*	Alpine and subalpine meadows, fellfields, parklands	37	1,651	Federal Candidate, not state ranked	Disease and insect mortality, alteration of environment (fire and climate)
<i>Platanthera obtusata</i> (small northern bog-orchid)	Wetlands, moist meadows, riparian	7	41.1	S2	Livestock grazing and trampling, timber harvest activities, road building, alteration of hydrologic regime
<i>Ribes oxycanthoides</i> ssp. <i>irriguum</i> (Idaho gooseberry)	Wetlands, moist meadows, riparian	1	0.6	S2	Alteration of hydrologic regime, livestock trampling
<i>Salix candida</i> (hoary willow)	Wetlands, moist meadows, riparian	6	12.4	S1	Alteration of hydrologic regime (beaver and fire)
<i>Salix maccalliana</i> (McCall's willow)	Wetlands, moist meadows, riparian	3	1.6	S1	Alteration of hydrologic regime (beaver and fire)
<i>Salix pseudomonticola</i> (false mountain willow)	Wetlands, moist meadows, riparian	1	1.1	S1	Alteration of hydrologic regime (beaver and fire)
<i>Sanicula marilandica</i>	Wetlands, moist	50	121.1	S2	Alteration of hydrologic regime, livestock grazing

Scientific Name (Common Name)	Habitat Group	Number of sites	Acres of Occupied Habitat	Federal and WNHP State Rank	Threats
(black snake-root)	meadows, riparian				and trampling, timber harvest activities
<i>Sisyrinchium montanum</i> (strict blue-eyed grass)	Moist openings, wet forests	1	0.1	S1	Alteration of hydrologic regime, livestock grazing and trampling, noxious weeds, recreational vehicle use, herbicide application
<i>Spartina pectinata</i> (prairie cordgrass)	Wetlands, moist meadows, riparian	2	0.2	S2	Alteration of hydrologic regime, noxious weeds.
<i>Viola renifolia</i> (kidney-leaved violet)	Moist openings, wet forests	65	109.0	S2	Alteration of hydrologic regime, livestock grazing and trampling, road building and maintenance, noxious weeds, herbicide application

## Appendix B. Vulnerability Ratings by Species.

Ratings are high (H), medium (M), and low (L). Site reflects the number of sites and individuals on the Colville NF, Area reflects the total occupied area on the Colville NF, and Plant reflects the State NatureServe ranks.

Scientific Name	Site	Area	Plant	Vulnerability Rating
<i>Antennaria corymbosa</i>	H	H	M	H
<i>Antennaria parvifolia</i>	M	M	L	M
<i>Astragalus microcystis</i>	M	L	M	M
<i>Botrychium ascendens</i>	M	H	M	H
<i>Botrychium crenulatum</i>	L	L	L	L
<i>Botrychium hesperium</i>	M	L	M	M
<i>Botrychium lineare</i>	H	H	H	H
<i>Botrychium paradoxum</i>	M	M	H	M
<i>Botrychium pedunculosum</i>	M	L	M	M
<i>Carex capillaris</i>	H	H	H	H
<i>Carex comosa</i>	H	M	H	H
<i>Carex magellanica ssp. irrigua</i>	M	L	M	M
<i>Carex proposita</i>	M	H	M	H
<i>Carex rostrata</i>	M	L	M	M
<i>Carex tenera</i>	H	M	H	H
<i>Cicuta bulbifera</i>	M	L	L	M
<i>Cryptogramma stelleri</i>	M	M	H	H
<i>Cypripedium parviflorum</i>	M	M	H	M
<i>Dryas drummondii</i> var. <i>drummondii</i>	H	M	M	H
<i>Dryopteris cristata</i>	M	L	M	M
<i>Eriophorum viridicarinatum</i>	M	L	L	M

Scientific Name	Site	Area	Plant	Vulnerability Rating
<i>Eurybia merita</i>	H	H	M	H
<i>Gaultheria hispidula</i>	H	H	M	H
<i>Geum rivale</i>	M	L	L	M
<i>Lomatium sandbergii</i>	H	H	H	H
<i>Lycopodium dendroideum</i>	H	M	M	H
<i>Muhlenbergia glomerata</i>	H	M	H	H
<i>Ophioglossum pusillum</i>	M	M	M	M
<i>Pinus albicaulis</i>	L	L	L	L
<i>Platanthera obtusata</i>	M	L	L	M
<i>Ribes oxycanthoides</i> ssp. <i>irriguum</i>	H	H	H	H
<i>Salix candida</i>	M	L	M	M
<i>Salix maccalliana</i>	M	M	H	H
<i>Salix pseudomonticola</i>	H	H	H	H
<i>Sanicula marilandica</i>	L	L	L	L
<i>Sisyrinchium montanum</i>	H	H	H	H
<i>Spartina pectinata</i>	M	L	L	M
<i>Viola renifolia</i>	L	L	L	L

## Appendix C. Vulnerability, Threats, Risks, and Management Actions.

Appendix C illustrates the interplay between vulnerability (Appendix B), threats, the resultant risk, and the management actions that are necessary to ensure viability of each taxon and habitat group.

- \* Vulnerability ratings are based on plant distribution, number of sites (majority of weight), area occupied, number of individual plants, state rank.
- \*\* Environmental change related to fire, climate, conifer encroachment, riverbank erosion.
- \*\*\* Recreational use was related to site use and development, trail, recreational vehicle use.
- # Wetland/riparian species rated as % of habitat; data lacking for wetland species still rated as high because of wetland habitat; low or medium for other habitat.
- ## Invasives rating comes from risk analyses for direct effect and threat in 2008 analyses of priority watersheds. Percent of area under these categories was rated as High, Medium, or Low. If threat was identified somewhere else (e.g., literature) w/out data then threat was rated as Low.
- ### Ratings were dependent on habitat effectiveness with wet habitats as Low, dry habitats as High, and Medium for all else.
- +This threat is associated with sites in conifer or hardwood-dominated riparian stands.

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))										Risks	Management Action				
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives##	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***				Road building, maintenance###		Timber Harvest	
											No Action Alternative	All Action Alternatives			No Action Alternative	All Action Alternatives	No Action Alternative	All Action Alternatives
<i>Antennaria corymbosa</i>	Wetlands, moist meadows, riparian	H	H	L	L	L	L	L	L	L	L	L	L	L	L	Extremely rare, peripheral in NE WA, number of sites and area	Protect site, monitor habitat and population trends, seed collection and	

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))													Risks	Management Action	
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###		Timber Harvest			
											No Action Alternative	All Action Alternatives	No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives
																	by MAs (Wilderness, RNAs, Backcountry vs AM1-3), and habitat w/in ARCS	storage, limit herbivore effects on plants and habitat
<i>Antennaria parvifolia</i>	Dry meadows, open dry forests, shrub steppe	M	L	L	M	L	L	H	L	L	H	L	H	L	M	H	Peripheral in NE WA, disturbance regime, number of sites and area by MAs (Wilderness, RNAs, Backcountry vs AM1-3) and w/in allotments, invasive priority WS	Return to historic disturbance regime, prescribed fire, limit herbivore effects on plants and habitat

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))											Risks	Management Action			
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###			Timber Harvest		
											No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives	No Action Alternative	All Action Alternatives
<i>Astragalus microcystis</i>	Dry meadows, open dry forests, shrub steppe	M	L	L	L	L	L	L	L	L	L	L	L	L	H	L	Regional endemic in NE WA, disturbance regime, number of sites and area by MAs (Wilderness, RNAs, Backcountry vs AM1-3) and w/in allotments	Return to historic disturbance regime, prescribed fire, limit herbivore effects on plants and habitat
<i>Botrychium ascendens</i>	Dry meadows, open dry forests, shrub steppe	H	M	L	L	L	H	H	L	L	L	L	L	L	H	H	Peripheral in NE WA, number of sites and area by MAs (Wilderness, RNAs, Backcountry vs AM1-3) w/in ARCS and allotments	Defer grazing until spores are mature and dispersed, limit herbivore effects on plants and habitat, limit ground disturbance

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))											Risks	Management Action			
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###			Timber Harvest		
											No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives	No Action Alternative	All Action Alternatives
<i>Botrychium crenulatum</i>	Moist openings, wet forests	L	H	L	L	L	H	H	L	M	L	L	L	L	H	H	Peripheral in NE WA, number of sites and area by MAs (Wilderness, RNAs, Backcountry vs AM1-3), w/in ARCS and allotments	Limit herbivore effects on plants and habitat (defer grazing until spores are mature and dispersed), limit ground disturbance, may tolerate low-intensity fire in late summer or early fall.
<i>Botrychium hesperium</i>	Dry meadows, open dry forests, shrub steppe	M	M	L	L	L	M	H	L	L	M	L	H	L	H	H	Peripheral in NE WA, disturbance regime, number of sites and area by MAs (Wilderness, RNAs, Backcountry vs	Limit herbivore effects on plants and habitat (defer grazing until spores are mature and dispersed), limit ground disturbance

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))														Risks	Management Action
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###		Timber Harvest			
											No Action Alternative	All Action Alternatives	No Action Alternative	All Action Alternatives	No Action Alternative	All Action Alternatives		
																	AM1-3) and w/in allotments	
<i>Botrychium lineare</i>	Wetlands, moist meadows, riparian	H	M	L	L	L	L	H	L	M	L	L	L	L	H	H	Extremely rare in planning area, peripheral in NE WA, number of sites and area by MAs (Wilderness, RNAs, Backcountry vs AM1-3) and habitat w/in ARCS and allotments	Protect site, monitor habitat and population trends, limit herbivore effects on plants and habitat
<i>Botrychium paradoxum</i>	Dry meadows,	M	M	L	L	L	L	H	L	L	H	L	L	L	M	H	Peripheral in NE WA, number of sites and area	Defer grazing until spores are mature and

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))											Risks	Management Action			
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###			Timber Harvest		
											No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives	No Action Alternative	All Action Alternatives
	open dry forests, shrub steppe																by MAs (Wilderness, RNAs, Backcountry vs AM1-3) and habitat w/in ARCS and allotments	dispersed, limit herbivore effects on plants and habitat, limit ground disturbance
<i>Botrychium pedunculatum</i>	Dry meadows, open dry forests, shrub steppe	M	M	L	L	L	L	H	L	L	M	L	M	L	M	H	Peripheral in NE WA, number of sites and area by MAs (Wilderness, RNAs, Backcountry vs AM1-3) and habitat w/in ARCS and allotments	Limit herbivore effects on plants and habitat (defer grazing until spores are mature and dispersed), limit ground disturbance
<i>Carex capillaris</i>	Wetlands, moist meadows,	H	H	L	L	L	L	L	L	L	H	L	L	L	M	H	Extremely rare in planning area, peripheral in NE WA,	Protect site, monitor habitat and population trends, seed

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))													Risks	Management Action	
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###		Timber Harvest			
											No Action Alternative	All Action Alternatives	No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives
	riparian																number of sites and area by MAs (Wilderness, RNAs, Backcountry vs AM1-3) and habitat w/in ARCS and allotments	collection and storage
<i>Carex comosa</i>	Wetlands, moist meadows, riparian	H	H	L	L	L	L	L	L	L	L	L	L	H	H		Extremely rare in planning area, peripheral in NE WA, number of sites and area by MAs (Wilderness, RNAs, Backcountry vs AM1-3) and habitat w/in ARCS and	Protect site, monitor habitat and population trends, seed collection and storage

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))													Risks	Management Action	
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###		Timber Harvest			
											No Action Alternative	All Action Alternatives	No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives
																	allotments	
<i>Carex magellanica ssp. irrigua</i>	Wetlands, moist meadows, riparian	M	H	L	L	L	L	H	L	L	L	L	L	L	H	H	Peripheral in NE WA, number of sites and area by MAs (Wilderness, RNAs, Backcountry vs AM1-3) and habitat w/in ARCS and allotments	Maintain ecosystem integrity and function

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))											Risks	Management Action			
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###			Timber Harvest		
											No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives	No Action Alternative	All Action Alternatives
<i>Carex proposita</i>	Alpine, subalpine meadows, fellfields, parklands	H	M	L	L	L	L	H	L	L	H	L	L	L	M	H	Disturbance regime, regional endemic in NE WA, MAs, allotments	Limit herbivore effects on plants and habitat
<i>Carex rostrata</i>	Wetlands, moist meadows, riparian	M	H	L	L	L	L	H	L	L	M	L	L	L	H	H	Peripheral in NE WA, MAs, habitat w/in ARCS, allotments	Maintain ecosystem integrity and function, limit herbivore effects on plants and habitat
<i>Carex tenera</i>	Wetlands, moist meadows, riparian	H	H	L	L	L	L	L	L	L	H	L	L	L	M	H	Extremely rare in planning area, peripheral in NE WA, MAs, habitat w/in ARCS, allotments	Protect site, monitor habitat and population trends, seed collection and storage

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))										Risks	Management Action				
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***				Road building, maintenance###		Timber Harvest	
											No Action Alternative	All Action Alternatives			No Action Alternative	All Action Alternatives	No Action Alternative	All Action Alternatives
<i>Cicuta bulbifera</i>	Wetlands, moist meadows, riparian	M	H	L	L	L	H	H	L	L	L	L	L	L	H	H	Peripheral in NE WA, MAs, habitat w/in ARCS, allotments	Maintain ecosystem integrity and function, limit herbivore effects on plants and habitat
<i>Cryptogramma stelleri</i>	Cliffs, talus, rock outcrops	H	L	L	L	L	L	L	L	L	H	L	L	L	M	H	Peripheral in WA, MAs	Monitor recreation use
<i>Cypripedium parviflorum</i>	Wetlands, moist meadows, riparian	M	H	L	L	L	L	H	H	L	L	L	L	L	H	H	Peripheral in NE WA, MAs, habitat w/in ARCS, allotments	Maintain ecosystem integrity and function, limit herbivore effects on plants and habitat
<i>Dryas drummondii</i> var. <i>drummondii</i>	Cliffs, talus, rock outcrops	H	L	L	L	L	L	L	L	L	H	L	L	L	M	H	Extremely rare in planning area, population peripheral in NE	Protect site, monitor habitat and population trends, seed collection and

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))													Risks	Management Action	
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###		Timber Harvest			
											No Action Alternative	All Action Alternatives	No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives
																	WA, MAs	storage
<i>Dryopteris cristata</i>	Wetlands, moist meadows, riparian	M	H	L	L	L	H	M	L	L	L	L	L	L	H	H	Peripheral in NE WA, MAs, habitat w/in ARCS, allotments	Maintain ecosystem integrity and function, limit herbivore effects on plants and habitat
<i>Eriophorum viridicarinatum</i>	Wetlands, moist meadows, riparian	M	H	L	L	L	L	M	L	L	L	L	L	L	L	L	Peripheral in NE WA, MAs, habitat w/in ARCS, allotments	Maintain ecosystem integrity and function, limit herbivore effects on plants and habitat

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))													Risks	Management Action	
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###		Timber Harvest			
											No Action Alternative	All Action Alternatives	No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives
<i>Eurybia merita</i>	Alpine, subalpine meadows, fellfields, parklands	H	M	L	L	L	L	H	L	L	H	L	L	L	M	L	Extremely rare in planning area, population peripheral in NE WA, MAs	Protect site, monitor habitat and population trends, seed collection and storage, limit herbivore effects on plants and habitat, do not permit plant collection
<i>Gaultheria hispidula</i>	Alpine, subalpine meadows, fellfields, parklands	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	Extremely rare in planning area, population peripheral in NE WA, MAs	Protect site, monitor habitat and population trends, seed collection and storage, do not permit plant collection
<i>Geum rivale</i>	Wetlands, moist meadows, riparian	M	H	L	L	L	L	H	L	L	M	L	L	L	H	H	Peripheral in NE WA, MAs, habitat w/in ARCS, allotments	Maintain ecosystem integrity and function, limit herbivore

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))											Risks	Management Action			
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###			Timber Harvest		
											No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives	No Action Alternative	All Action Alternatives
																	effects on plants and habitat	
<i>Lomatium sandbergii</i>	Alpine, subalpine meadows, fellfields, parklands	H	M	L	L	L	L	L	L	L	L	L	L	L	L	L	Peripheral in WA, historical occurrence in RNA	Conduct surveys in suitable habitat
<i>Lycopodium dendroid-deum</i>	Moist openings, wet forests	H	M	L	L	L	L	M	L	L	H	L	L	L	M	L	Extremely rare in planning area, population peripheral in NE WA, MAs	Protect site, monitor habitat and population trends, limit herbivore effects on plants and habitat
<i>Muhlenbergia glomerata</i>	Wetlands, moist meadows, riparian	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	Extremely rare in planning area, population peripheral in NE WA, Mas,	Protect site, monitor habitat and population trends, limit herbivore effects on plants and

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))											Risks	Management Action			
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###			Timber Harvest		
											No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives	No Action Alternative	All Action Alternatives
																	habitat w/in ARCS, allotments	habitat, seed collection and storage
<i>Ophioglossum pusillum</i>	Moist openings, wet forests	M	H	L	L	L	L	H	L	L	L	L	L	L	H	H	Peripheral in NE WA, MAs, habitat w/in ARCS, allotments	Maintain ecosystem integrity and function, limit herbivore effects on plants and habitat
<i>Pinus albicaulis</i>	Alpine, subalpine meadows, fellfields, parklands	L	L	H	H	L	L	M	L	L	H	L	L	L	M	L	Disturbance regime, regional endemic in NE WA, MAs, allotments	Implement R6 Whitebark Pine Restoration Strategy

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))											Risks	Management Action			
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###			Timber Harvest		
											No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives	No Action Alternative	All Action Alternatives
<i>Platanthera obtusata</i>	Wetlands, moist meadows, riparian	M	H	L	L	L	L	H	L	L	L	L	L	L	H	H	Peripheral in NE WA, MAs, habitat w/in ARCS, allotments	Maintain ecosystem integrity and function, limit herbivore effects on plants and habitat
<i>Ribes oxycanthoides</i> ssp. <i>irriguum</i>	Wetlands, moist meadows, riparian	H	H	L	L	L	L	H	L	L	L	L	L	L	H	H	Extremely rare in planning area, population peripheral in NE WA, Mas, habitat w/in ARCS, allotments	Verify plant identification, protect site, monitor habitat and population trends, seed collection and storage, limit ground disturbance
<i>Salix candida</i>	Wetlands, moist meadows, riparian	M	H	L	L	L	L	L	L	L	L	L	L	L	H	H	Peripheral in WA; maintain hydrology with sustainable timber management	Maintain ecosystem integrity and function

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))													Risks	Management Action	
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###		Timber Harvest			
											No Action Alternative	All Action Alternatives	No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives
																	practices and maintenance and conservation of local beaver populations.	
<i>Salix maccalliana</i>	Wetlands, moist meadows, riparian	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	Peripheral in NE WA, MAS, habitat w/in ARCS, allotments	Maintain ecosystem integrity and function
<i>Salix pseudo-monticola</i>	Wetlands, moist meadows, riparian	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	Extremely rare in planning area, peripheral in NE WA, MAS, habitat w/in ARCS, allotments	Protect site, monitor habitat and population trends, seed collection and storage
<i>Sanicula marilandica</i>	Wetlands, moist meadows, riparian	L	H	L	L	L	L	H	L	L	L	L	L	H	H	L	Peripheral in NE WA, MAS, habitat w/in ARCS,	Maintain ecosystem integrity and function, limit herbivore

Scientific Name	Habitat Group	Vulnerability*	Threats (associated risks rated High (H), Medium (M), and Low (L))													Risks	Management Action	
			Alternation of hydrologic regimes#	Diseases and Insects	Environmental Change**	Gopher Disturbances	Invasives###	Livestock grazing and trampling	Plant Collecting	Windthrow+	Recreational use***		Road building, maintenance###		Timber Harvest			
											No Action Alternative	All Action Alternatives	No Action Alternative	All Action Alternatives	No Action Alternative			All Action Alternatives
																	allotments	effects on plants and habitat
<i>Sisyrinchium montanum</i>	Moist openings, wet forests	H	H	L	L	L	L	L	L	L	L	L	M	L	H	L	Extremely rare in planning area, population peripheral in NE WA, MAs, habitat w/in ARCS, allotments	Protect site, monitor habitat and population trends, limit herbivore effects on plants and habitat, seed collection and storage
<i>Spartina pectinata</i>	Wetlands, moist meadows, riparian	M	H	L	L	L	L	L	L	L	L	L	L	L	H	H	Peripheral in WA, habitat w/in ARCS	Maintain ecosystem integrity and function
<i>Viola renifolia</i>	Moist openings, wet forests	L	H	L	L	L	L	H	L	L	L	L	M	L	H	H	Peripheral in WA, habitat w/in ARCS, allotments	Maintain ecosystem integrity and function, limit herbivore

