

Cliff Knox Project

Rare Plants Report

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Introduction

This biological evaluation reviews potential effects or impacts that the proposed actions and alternatives may create to plant species in the Cliff Knox planning area that are (1) listed as threatened, endangered, or proposed for federal listing under the Endangered Species Act of 1973 as amended, (2) designated as sensitive (FSM 2670) by the Regional Forester of the Pacific Northwest Region, or (3) identified as species of local conservation concern and/or considered indicators of local biodiversity hotspots.

There are currently 132 species of rare plants, fungi, and/or lichens that are documented or suspected to occur on the Forest (Appendix A. Malheur National Forest rare plant list). There are no species that are federally-listed (threatened or endangered), and only one species is proposed for federal listing, whitebark pine (*Pinus albicaulis*), which does not occur within the project area. Thirty-four Region 6 sensitive species are documented on the Forest and 98 are suspected. These species shall be collectively referred to as “rare plants” or “sensitive plants” interchangeably throughout this report.

Regulatory Framework

This report follows Forest Service policy to “review all planned, funded, executed, or permitted programs and activities for possible effects on endangered, threatened, proposed, or sensitive species” through the biological evaluation process. A biological evaluation is the means of conducting the review and documenting the findings (FSM 2672.4). The objectives of a biological evaluation (as defined in FSM 2672.41) are:

- To ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or contribute to animal species or trends toward Federal listing of any species.
- To comply with the requirements of the Endangered Species Act, that actions of Federal agencies not jeopardize or adversely modify critical habitat of federally-listed species.
- To provide a process and standard by which to ensure that threatened, endangered, proposed, and sensitive species receive full consideration in the decision making process.

Furthermore, this document is consistent with the Malheur National Forest Land and Resource Management Plan (hereafter Malheur Forest Plan), which requires “a biological evaluation for use in planning proposed projects when sensitive species are present or suspected to be present” (Malheur Forest Plan, Ch. IV, Forest-wide Standard 66). It also fulfills, in part, requirements of the National Environmental Policy Act of 1969 (NEPA) which directs federal agencies to “... insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken” [40 CFR §1500.1(b)].

Issues and Design Criteria

Issues (objectives) for the proposed projects in the planning area and the related design criteria are listed in Cliff Knox Final Environmental Impact Statement, Appendix C.

Resource Indicators and Measures

Direct physical disturbance and indirect consequences of disturbance have the potential to disrupt or reduce the integrity of rare plant populations and habitat. Disturbances have the potential to destroy individual plants or alter the distinctive characteristics of the habitat.

Table 1. Resource element, indicator, and measure for assessing effects to rare plants

Resource element	Resource indicator	Measure	Indicator source
Rare plant populations and habitats	Integrity of populations and habitats	Potential impacts to integrity	FSM Chapter 2670; USDA Departmental Regulation 9500-4; Malheur Forest Plan Forest-wide Standards 56 and 62

Rare Plants

Methodology

A pre-field review was conducted to determine what rare plants and rare plant habitats are known or possible in the planning area and the adjacent area. The findings were used to help target specific areas for more in depth on the ground botanical surveys.

Information Sources

The pre-field review includes the following list of sources to inform surveyors of potential rare plants and rare plant habitats within and adjacent to the planning area.

- USFS Region 6 Sensitive Species List (<https://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/>)
- GIS mapping layers (vegetation, streams and wetlands, aerial imagery)
- Project GIS layers showing potential activity units
- “Field Guide to Sensitive Plants of the Malheur National Forest” (USDA Forest Service, unpublished document 2015). Information includes associated habitats, species distributions, key identification characters, photos, and drawings.
- United States Department of Interior Fish and Wildlife Service website. This website identifies which federally listed, proposed, and candidate species occur in each county of each state. This website was queried to determine which federally listed, candidate, and proposed plant species may occur in Grant and Malheur Counties, Oregon.
- Forest Service Natural Resource Manager database (USDA Forest Service 2015). This database includes information on where botanical surveys and known sensitive plant populations are documented. This database was queried to determine where populations of sensitive plants are known within, and adjacent to, the planning area.
- Rare Threatened and Endangered species of Oregon list, Oregon Biodiversity Information Center, 2015.

Botanical surveys for rare plants were conducted according to standard Forest Service procedures (USDA Forest Service 2009) using the intuitive control technique. Areas that were determined to have the highest probability of rare plant occurrence were targeted as the first priority for surveys. Next, surveys were focused in areas where it was anticipated that ground disturbing activities would occur. Additional surveys were done in representative areas of various habitat types in the planning area. Due to the large size of the planning area, not all areas of potential disturbance could be surveyed. Therefore, there is a possibility that there are additional undiscovered populations of rare plants within the planning area. When rare plants are found, project design criteria for botany are applied. If necessary, additional mitigations for protection would be developed.

The following assumptions were used to guide the determination of environmental consequences (effects or impacts):

Species are given a “No Impact” determination if (1) they are not suspected in the project because the project is outside of the potential distribution and range of the species, (2) the required habitat is not present within the planning area, or (3) none of proposed actions or alternative actions would occur in or immediately adjacent to existing populations or potential habitats, and thus would not affect the integrity of the populations or habitats [40 CFR §1508.8, FSM 2672.42(5)].

Species are given a determination of “Beneficial Impact” if they could be favorably affected by a particular action or alternative [40 CFR §1508.8, FSM 2672.42(5)].

A determination of “may detrimentally impact, but will not lead to a trend toward federal listing” is given for species that could be negatively affected by any of the alternatives [40 CFR §1508.8, FSM 2672.42(5)]. This acknowledges that the action could have negative impacts to the integrity of the populations or habitats, but due to (1) the complexity of the proposed action, (2) the differential impacts across the landscape, and (3) the lack of best available science, the degree and consequence of the negative impacts are not known with certainty. Additionally, this recognizes that even the most substantial impacts of the proposed action would not contribute to a trend toward listing the species under the Endanger Species Act.

Incomplete and Unavailable Information

Landscape scale analysis does not facilitate detailed site-specific plant investigations. Though we try to focus surveys in sensitive areas that would be impacted by proposed actions, most of the surveys were done before specific ground disturbing activities had been finalized. It is possible that activities may be implemented in areas that were not surveyed. Therefore, it is possible that there may potentially be impacts to undiscovered populations of rare plants.

Detection of rare plant locations is further complicated by the biology of species. There are eight sensitive fungi currently suspected on the Malheur National Forest (see Appendix A. Malheur National Forest rare plant list). Fungi only fruit under very specific moisture and temperature conditions. Furthermore, six of the suspected species are hypogeous, meaning they fruit underground. Therefore, it is difficult to locate species of fungi due to their ephemeral or hidden nature. It is possible there are undocumented populations of fungi in the planning area.

Some rare plant species do not produce above-ground plants every year. These plants include some *Botrychium spp.* (grape-ferns), and many annual species which are dependent upon sufficient early spring rains. Some of the annual sensitive species include *Phacelia minutissima* (least phacelia), *Mimulus evanescens* (disappearing monkey flower), *Muhlenbergia minutissima* (annual muhly grass), *Rotala ramosior* (lowland tooth-cup), and *Chaenactis xantiana* (desert chaenactis). It is therefore possible that surveys may not detect these plants in years when conditions do not favor germination.

Some species, such as the *Phacelia minutissima*, *Muhlenbergia minutissima*, *Botrychium spp.*, and some of our rare bryophytes are so tiny and difficult to find in dense vegetation that even expert botanists may overlook them during surveys. In our arid habitats, especially scablands, micro-lichens and bryophytes form a fragile living layer over the soil surface. This layer, or biological soil crust, can be exceedingly difficult to see. Several rare species in this habitat are cryptic and challenging to find. For these reasons, it is not possible to state with 100 percent certainty that all rare plant species would be detected during rare plant surveys. We currently do not have rare species of biological soil crust documented on the Forest.

There are no empirical studies on the impacts of logging, burning, or grazing to most of the rare plant species that occur on the Malheur National Forest. The strategy for management of known populations has generally been avoidance of activities that may impact populations. Therefore, all discussion of potential impacts to rare plant populations and habitat is based upon general experience and inferred responses based upon observations and studies of more common species.

Spatial and Temporal Context for Effects Analysis

Direct and Indirect Effects Boundaries

The spatial context for effects analysis includes locations for all documented rare plant occurrences and each of the proposed units of the action alternatives. The temporal context includes the timeframe when the proposed actions would occur and the foreseeable future after the operations cease.

Cumulative Effects Boundaries

Cumulative effects boundaries, both spatial and temporal, are the same as for direct and indirect effects boundaries, above.

Affected Environment

Existing Condition

A diversity of habitats were surveyed for vascular plants (trees, shrubs, forbs, and grasses), bryophytes (mosses), lichens and fungi in the planning area. Habitats include riparian and wetland areas, springs, meadows, rock outcrops, sagebrush step, scablands, aspen stands, and upland forests.

Two rare vascular species were located within the Cliff Knox planning area (Table 2). *Eleocharis bolanderi* (Bolander's spikerush) is known from 24 sites on the Malheur National Forest and covers an area of approximately 54 acres. The Cliff Knox planning area contains the highest known coverage of Bolander's spike-rush on the forest (41 acres). The species is ranked as critically imperiled in Oregon, meaning that within the state it is at very high risk of extinction or elimination due to restricted range, very few populations, and other factors (NatureServe 2020). *Elocharis bolanderi* is found in open habitat that is seasonally moist. On the Malheur National Forest System lands it is usually associated with lithosols which become dry by mid-summer. This habitat is not targeted for proposed actions and is unlikely to be impacted by the project.

Piptatheropsis exigua (little ricegrass) is a grass that is known from only this single site on the entire forest. It is vulnerable to extinction in Oregon. Its preference for rocky habitats can be protective because rocky areas are often excluded from proposed projects or avoided by project activities.

Table 2. Existing rare plant occurrences

Scientific Name (Common Name)	Conservation Status	Local Habitat Requirements
<i>Eleocharis bolanderi</i> (Bolander's spike-rush)	Globally vulnerable throughout range (G3); critically imperiled in Oregon (S1).	Open, vernal wet depressions; moist meadows, lithosols, intermittent streams.
<i>Piptatheropsis exigua</i> (Little ricegrass)	Globally secure (G5), but vulnerable to extinction in Oregon (S2)	Rocky slopes and outcrops.

Two populations of *Eleocharis bolanderi* (R6 sensitive plant) are documented within undeveloped lands: along the extreme eastern boundary of polygon 74 (greater than 1,000 acres) and in the southeast portion of polygon 36 (less than 1,000 acres). Rare plants identified within the project footprint are fully described in the Cliff Knox Project Rare Plants Report. Effects to rare plants from proposed project treatment activities would not differ based on the description of land (undeveloped). Management direction and project design criteria are required to ensure compliance and avoid adverse impacts and would be implemented during operations across all National Forest System lands. Therefore, the description of effects are not differentiated further in the analysis, and include proposed vegetation activities and the associated connected actions to complete project activities. Activities proposed within undeveloped areas greater than 1,000 acres are described in the undeveloped areas section of the Cliff Knox Final Environmental Impact Statement.

Desired Condition

The Malheur Forest Plan does not explicitly define any desired conditions for rare plants, but it does have a goal to “provide a diversity of habitats sufficient to maintain viable populations of all species.” Furthermore, the Region 6 2005 Preventing and Managing Invasive Plants Record of Decision (hereafter R6 2005 ROD) added the following desired future condition statement to the Malheur Forest Plan “... healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is provided for native organisms throughout the [Forest]” (USDA Forest Service 2005).

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Under the no action alternative, no disturbance from project activities would take place. Therefore selection of alternative 1 would have no direct impact to the integrity of sensitive species assumed present in the planning area.

Alternatives 2 and 3

Direct and Indirect Effects to Federally Listed, Proposed and Candidate Plant Species

There are no known populations or potential habitat for any federally listed, candidate, or proposed, plant species in the planning area. Therefore, this project would have no effect to any federally listed, proposed, or candidate plant species. Consultation with the U.S. Fish and Wildlife Service is therefore not required for this project for rare plants.

Direct and Indirect Effects to Known Rare Plant Populations

Known populations of rare plants would be buffered from ground disturbing activities. Some populations may be subject to prescribed burning. However, the project design criteria prescribe that a botanist be consulted before burning occurs in areas with known sensitive plant populations to evaluate conditions. These protections should adequately ensure that there are no direct or indirect impacts from project activities to the known populations of sensitive plants. Therefore, there would be no impact to known populations of sensitive plants from project activities associated with alternatives 2 and 3.

Cumulative Effects

Cumulative effects are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions” (40 CFR 1508.7). The geographic scale considered for cumulative effects is the planning area. This is because plant populations generally move slowly over time. The time scale for this cumulative effects analysis from 150 years ago (when Euro Americans arrived in the area) to 10 years into the future. It is not possible to anticipate Forest Service activities beyond this time.

Because there will be no direct or indirect effects from the proposed action and alternatives, no cumulative effects would occur.

In the past, present, and reasonably foreseeable future, there have been, and would continue to be, projects and activities within the planning area that may cause impacts to rare plants and their habitats. Projects and activities that create ground disturbance, change vegetative composition, and change domestic animal grazing patterns may potentially cause detrimental impacts to sensitive rare plant populations and habitats. These actions include road construction, timber harvest, fuels reduction treatments (landscape and pile burning, lopping and scattering of slash), fire suppression, recreation development, off-road vehicle use, mining, and livestock grazing. In addition, restoration efforts such as road decommissioning, and stream improvements may also potentially impact sensitive rare plant populations and habitat.

Livestock grazing has occurred in most of the planning area for many decades and has resulted in changes in plant communities, especially in non-forested and riparian areas. Grazing has a direct effect on plants through plant herbivory and trampling. Grazing can have an indirect effect on plant species by causing changes in shade, soil compaction, soil disturbance, changes in hydrology, smothering by cow pies, and alteration of nutrient cycling. Grazing in dry bunchgrass communities where biological crust species occur over fragile soils can be especially deleterious. The degree of impact to plant species from grazing is related to the timing, duration, and intensity of the grazing action, as well as the individual characteristics and habitat requirements of the species. Grazing would continue to occur in the planning area.

The historical abundance and distribution of rare species on the Forest is not known. Past activities have likely affected their current abundance and distribution. Beginning in approximately 1990, botanical surveys and biological evaluations were conducted for most Forest Service projects planned and implemented on the forest. As a result, activities conducted since 1990 have been designed to reduce impacts to rare species.

It is highly likely that historical activities, such as grazing, timber harvest, mining, road construction, and fire suppression have destroyed populations, and have altered habitats for sensitive plants. However, these historical effects are not quantifiable because the details of historical activities and the historical existing conditions of sensitive plants are not known.

Climate change effects may be considered as a component of cumulative impacts. Changes in climate influence vegetation, water, and disturbance frequencies, and these changes, in turn, influence one another. A change in one aspect causes a cascade of responses that in some cases counteract, and in others magnify the initial change. Such interactions make prediction of the likely effects of climate change difficult at the scale of the analysis area even if the nature of the climate change at the local scale were known. At this point one can be certain that changes would occur at a continental scale, yet we do not know the mode, timing, or magnitude of those changes

or environmental responses at the project scale. Until these changes are better understood, it is difficult to reliably predict the environmental outcomes of particular land-use activities. Species most at risk of climate change are those with small geographic ranges (e.g., local endemics, locally rare species), narrow physiological tolerances, limited dispersal abilities, strong interspecific dependencies, low genetic diversity, and those that have recently experienced population declines. Attempts to quantify the degree of change would be speculative at this point. Tools to predict the potential climatic changes as influenced by vegetation management activities over the next 10 to 15 years have yet to be devised, but it seems unlikely that measurable changes would occur relative to sensitive plant species over the life of this project.

Since 1990, protection and management of sensitive species and their habitats (in the form of project design criteria, avoidance, or other mitigation) have been included in the design of all projects (following Forest-wide Standards 56, 62, 65, 66, and Standards for Management Areas 3A and 3B in the Malheur Forest Plan; and in direction and policy set forth in the FSM 2670). This has, and would continue to, reduce the potential of cumulative effects to sensitive plant populations and habitats.

Direct and indirect effects to sensitive plant habitats have been described above. The determination of no impact was made for known populations of sensitive plants in the planning area. Since there would be no impact to these resources, there would be no cumulative effects to those resources.

A determination of may detrimentally impact, but would not lead to a trend toward federal listing was made for sensitive plant habitats that may occur in coniferous forest, aspen communities, and riparian dependent communities. Historically, there have most likely been detrimental impacts to sensitive plant habitat in these areas. Forest Service projects are designed to minimize impacts to these communities in the present and future. The potential for negative direct and indirect effects to these habitats from the proposed activities have been minimized through the use of project design criteria. There are no current plans to conduct vegetation management activities in this area beyond the scope of this project for the next ten years. Therefore, this project, foreseeable future projects, and those that have occurred in the recent past, are not likely to contribute toward cumulative detrimental impacts to sensitive plant species.

Rare Plant Habitats

Methodology

A pre-field review was conducted to determine what rare plants and rare plant habitats are known or possible in and near the planning area. The findings were used to help target specific areas for on-the-ground botanical surveys.

Information Sources

The pre-field review includes the following list of sources to inform surveyors of potential rare plants and rare plant habitats within and adjacent to the planning area.

- USFS Region 6 Sensitive Species List (<https://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/>)
- GIS mapping layers (vegetation, streams and wetlands, aerial imagery)
- Project GIS layers showing potential activity units

- “Field Guide to Sensitive Plants of the Malheur National Forest” (USDA Forest Service unpublished document, 2015) which includes associated habitats.
- Forest Service Natural Resource Manager database (USDA Forest Service 2015). This database includes information on known sensitive plant populations are documented. This database was queried to investigate where rare plant habitat might be found within or adjacent to the planning area.
- “Potential Vegetation Hierarchy for the Blue Mountains Section of Northeastern Oregon, Southeastern Washington, and West-central Idaho” (Powell 2007).

Rare plants are generally associated with particular habitats therefore targeting those rare plant habitats for surveys can increase chances of finding rare species. Surveys were conducted according to standard Forest Service procedures in the planning area using the intuitive control method (USDA Forest Service 2008). Habitats that were determined to have the highest probability of rare plant occurrence and likely to be disturbed were targeted as the first priority for surveys. (wetlands, riparian zones). Additional surveys were conducted in representative areas of special habitat types (scablands, rock outcrops) even if disturbance was not anticipated. Upland conifer stands that may be limited to proposed prescribed burning were generally not prioritized for survey. Due to the large size of the planning area, not all potential habitat areas were surveyed. Therefore, there is a possibility that there are additional undiscovered populations of rare plants within the planning area, in rare plant habitats. In this section we analyze impacts to rare plant habitat whether they are known to contain sensitive plants or not. Where rare plants are found, project design criteria for botany are applied. If necessary, additional mitigations for protection would be developed.

The following assumptions were used to guide the determination of environmental consequences (effects or impacts).

Habitats are given a “No Impact” determination if (1) they are not suspected in the planning area, (2) none of the proposed actions would occur in or immediately adjacent to potential habitats, and thus would not affect the integrity of the populations or habitats [40 CFR §1508.8, FSM 2672.42(5)].

Habitats are given a determination of “Beneficial Impact” if they could be favorably affected by a particular action or alternative [40 CFR §1508.8, FSM 2672.42(5)].

A determination of “May Detrimentially Impact, but will not lead to a trend toward federal listing” is given for habitats hosting species that could possibly be negatively affected by any of the alternatives [40 CFR §1508.8, FSM 2672.42(5)]. This acknowledges that the action could have negative impacts to the integrity of the populations or habitats, but due to (1) the complexity of the proposed action, (2) the differential impacts across the landscape, and (3) the lack of best available science, the degree and consequence of the negative impacts are not known with certainty. Additionally, this recognizes that even the most substantial impacts of the proposed actions would not contribute to a trend toward listing the species found in those habitats under the Endangered Species Act.

Incomplete and Unavailable Information

Large landscape scale restoration projects do not allow for completely thorough investigations on the ground. Most surveys for this project were done before specific ground disturbing activities had been proposed. Surveys are prioritized by habitats most likely to host rare species. Dry, upland coniferous forests are some of the least likely places to find rare plants so these areas are

not as thoroughly surveyed as higher potential habitats such as the riparian dependent areas. It is possible that activities may be implemented in areas that were not surveyed, and thus there may be impacts to undiscovered populations of sensitive plants.

Spatial and Temporal Context for Effects Analysis

Direct and Indirect Effects Boundaries

The spatial context for effects analysis includes locations for all inventoried rare plant habitats, and each of the proposed units of the action alternatives. The temporal context includes the timeframe when the proposed actions would occur and the foreseeable future after the operations cease.

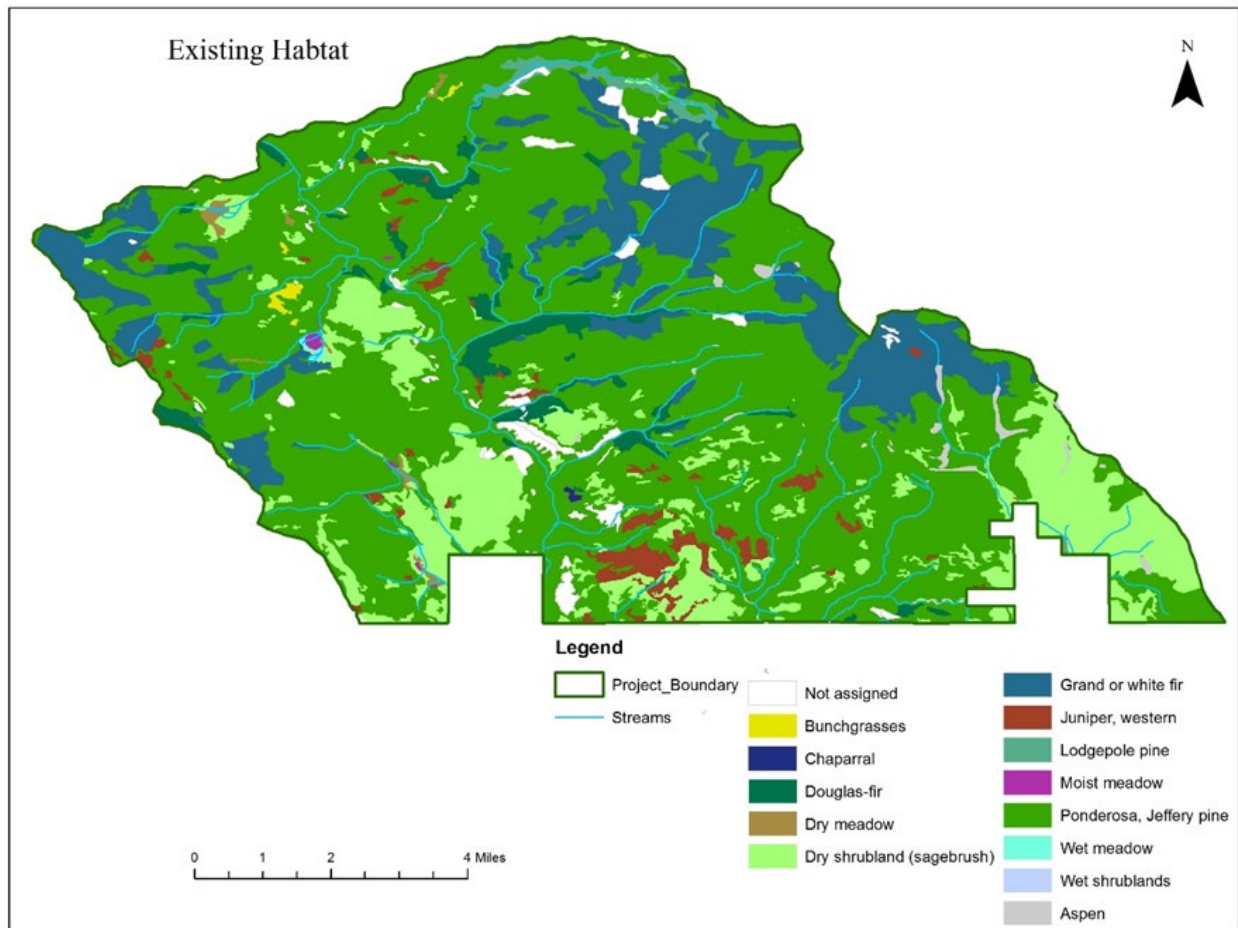
Cumulative Effects Boundaries

Cumulative effects boundaries, both spatial and temporal, are the same as for direct and indirect effects boundaries.

Affected Environment

Existing Condition

Major plant community types occurring within the planning area include upland coniferous forest, aspen stands, lithosols, sagebrush shrublands, grasslands, cliffs, rock outcrops, talus, and riparian dependent habitats. Some of the habitats are biodiversity hotspots because their unique environmental conditions have promoted occupation by unique and rare plants. Only generalized habitat maps are available for the planning area (1).

Figure 1. Generalized map of habitats within the planning area.

Upland forest cover in the planning area can be broadly described by both temperature and moisture regimes. These regimes include: Cold Dry, Cool Dry, Warm Dry, Hot Dry, Warm Moist, and Hot Moist. Forests are further described by the predominant tree species found at a site. The planning area includes forests dominated by Douglas-fir (*Pseudotsupa menziesii*), Lodge pole pine (*Pinus contorta*), Ponderosa pine (*Pinus ponderosa*), Grand fir (*Abies grandis*) as well as woodlands where Western Juniper (*Juniperus occidentalis*) dominates. Aspen stands are also a habitat found in the planning area.

Non-forested cover in the planning area includes dry meadows, sagebrush step, bunch grass meadows, wet meadows dominated by graminoids, wet meadows with shrubs, and moist meadows.

Rare species associated with these habitats can be found as Appendix B. Habitat groups and associated rare plant species.

The most sensitive plant communities and habitat types include lithosols (scablands), cliff/talus habitat, aspen stands, springs and seeps, and intermittent and perennial streams.

Lithosol

Lithosols are habitats with very shallow soils on poorly weathered basalt or andesitic bedrock. This habitat type has often been called scabland. While the soils can be saturated following spring snow melt, they dry quickly and are exposed to full sun for the entire growing season. Plants adapted to this harsh environment usually bloom and fruit early in the growing season. Basalt lithosols can be found in the dry upland shrubland and the dry upland herbland potential vegetation groups (potential vegetation groups are a way to categorize potential vegetation types, which are the plant communities that could be expected to develop in the absence of disturbance or anthropogenic influence). Basalt lithosols may also be found as small inclusions within a larger matrix of grassland and shrublands.

Given the low productivity and discontinuous fuels in this habitat group, fire has probably burned at low intensities and infrequently in this habitat type. In this scenario, when invaded with non-native grasses such as medusahead and African hair-grass, fuel levels can increase to a level where fire carries better, damaging and increasing mortality of native plants, and/or decreasing the quality of the native plant communities and sensitive species habitat.

There are several sensitive plant species that may occur in lithosol habitats, including *Eleocharis bolanderi* (Bolander's spikerush), *Eremothera pygmaea* (dwarf suncup), and *Erigeron cusickii* (Cusick's buckwheat). Many culturally important plant species occur in this habitat type as well including *Balsamorhiza sagittata* (arrowleaf balsamroot), *Lomatium nudicaule* (barestem biscuitroot), and *Perideridia gairdneri* (common yampah). Biological soil crusts a collection of lichens, bryophytes algae, micro-fungi and cyanobacteria that are extremely sensitive to ground disturbance, also occur in this habitat. *Texosporium sancti-jacobi* (woven spore lichen) is an extremely rare biological crust species that can be found growing in lithosol habitats.

Cliffs, rock outcrops, and talus

Cliffs and rock outcrops have vertical faces where generally unique species of plants are adapted. Talus is accumulated boulders and cobbles at the base of cliffs or on steep slopes. Because these habitats are largely composed of bedrock or accumulations of rock, they are assumed to be in good condition with a stable trend. The nature of this habitat group means it is resistant to management activities or has been avoided with most management activities. The main exception to this is when these areas are used for rock sources.

Some of the species adapted to live in this habitat type include *Cheilanthes feei* (Slender lipfern), *Encalypta brevipes* (candle snuffer moss), *Lophozia gillmanii* (Gillman's pawwort), *Pellaea bridgesii* (Bridge's cliffbrake), *Phlox multiflora* (flowery phlox), and *Pressia quadrata* (blister ribbon).

Fire is likely only carried at very low levels through this habitat type. Like lithosols, the native plant communities of cliffs, rock outcrops and talus slopes often lack sufficient fuel to carry fire.

Springs and seeps

Springs are points where groundwater emerges and flows. Groundwater also feeds seeps, but seeps do not produce perennial flow. Springs and seeps are typically small, but are well distributed on the Malheur National Forest. Fens are a unique habitat. Many springs are mapped in GIS. Seeps are generally less well documented on the Forest. Seeps and springs are often developed for cattle troughs. Many of these areas have been dewatered and/or trampled due to these developments historically. Many developed springs now have fences to protect the water

source. These areas provide important habitat for several sensitive mosses and liverworts such as *Elodium blandowii* (Blandow's feather moss), *Jungermannia polaris* (Arctic flapwort), *Meesia uliginosa* (Meesia moss), *Pseudocalliergon trifarium* (blunt water moss), *Splachnum ampullaceum* (purple-vented stink moss), and *Tomentypnum nitens* (tomentypnum moss).

It is unlikely that fire carried over these spring and seep habitats in the planning area due to their generally saturated soil and moist microclimate within the greater landscape. Future changes in climate that promote drying of these sites could combine with fire to have deleterious effects on sensitive species.

Aspen stands

Aspen is a widespread but uncommon species that is shade intolerant. Aspen stands have been declining in the Blue Mountains because regeneration has been greatly reduced by herbivory and competition from conifers (Shirley and Erikson 2001). Aspen conservation may include fencing, mechanical removal of conifers, burning, and methods to stimulate aspen sprouting. Frequent low severity fire that can kill young conifers and stimulate aspen suckering may be beneficial but stands with larger diameter, fire tolerant conifers often fail to promote aspen success. Some discretion should be made for cutting all the older conifers in aspen stands as large diameter conifers often host rare to uncommon calicioid lichens that are associated with old trees.

Intermittent and perennial streams

Intermittent streams are channelized areas where water only runs part of the year. Most of the moisture in these streams is derived from snowmelt runoff. These areas are classified as stream category 4 for riparian management standards and objectives. Perennial streams are channelized areas where water flows all year long. These areas are classified as stream category 1 (fish-bearing) or stream category 2 (non-fish bearing). These habitat types are generally quite narrow on the Malheur National Forest; they often extend upslope less than 100 feet above the water level. In flatter areas, they transition into moist and wet meadow types. Streams on most portions of the forest are dominated by riparian shrubs and trees.

Fire carries through riparian areas in varying intensities, dependent on fire behavior and availability of fuel (such as a thick riparian shrub component) along the water, and the topography of the valley bottom. Vegetation in riparian habitats after a fire often regenerate quickly because of availability of water and nutrients along the stream.

Desired Conditions

The Malheur Forest Plan does not explicitly define any desired conditions for rare plant habitats, but it does have a goal to “provide a diversity of habitats sufficient to maintain viable populations of all species.” Furthermore, the R6 2005 ROD added the following desired future condition statement to the Malheur Forest Plan: “... healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is provided for native organisms throughout the [Forest].”

Environmental Consequences

Direct and Indirect Effects

Impacts to forested and riparian and wetland habitats would be discussed at the broad habitat level. More specific habitats such as lithosols and cliffs would be discussed individually.

Alternative 1 – No Action

The no action alternative is most likely to impact aspen rare plant habitats, with no effect to other rare plant habitats. Landscape scale restoration efforts are used to return habitats to pre-European contact conditions. Years of fire suppression has resulted in increased cover of conifers in aspen stands, creating competition and reducing aspen seedling success. Without restoration actions that can reduce conifer competition and promote aspen regeneration such as commercial harvest, prescribed fire, mechanical root stimulation, removal of competing vegetation, protection of regeneration from herbivory, and regenerating aspen from seed aspen habitats are likely to continually decline (Shepard 2001).

Alternatives 2 and 3

Potential impacts to coniferous forest communities

Vegetation management actions that may have direct impacts to rare plants in upland coniferous forested habitats include commercial and non-commercial thinning, biomass removal, and associated yarding, slash piling, grinding, or scattering, application and control of prescribed fire and road treatments. Potential detrimental direct impacts include the destruction of rare plants from ground disturbance associated with cutting and yarding of trees, piling or scattering slash.

Prescribed fire or slash pile burning could scorch sensitive plant individuals within the fire area, and also may kill plants under and directly adjacent to slash piles. Fire line construction has the potential to directly kill or dislodge sensitive plants in the area that is denuded. Natural fire generally occurs in mid to late summer. Much of the prescribed fire is done in spring or early summer, when plants are actively growing. It is unknown if burning sensitive plants when they are actively growing would cause more mortality than when they may be senescent later in the summer. Road maintenance, decommissioning, and new construction can directly kill or displace sensitive plants.

Indirect effects could result from altering the hydrologic regime and changing light intensity. Vegetation management may also alter the interaction of herbivores and plants. By opening up the canopy of the forest, grasses and other palatable plants may increase. This may in turn increase grazing activity in the treated areas. Conversely, logging-created slash may impede travel by ungulates. Road work and new roads may also indirectly lead to an increase in grazing activity due to the increased ease of travel for animals on the roads. New and improved roads may also lead to increases in the amount of firewood collection, dispersed camping, and other recreation. Road maintenance activities contribute to the movement of invasive species along road shoulders and ditches, and to and from quarry and waste disposal areas. Invasive species may potentially outcompete or prevent the recruitment of new sensitive plant populations. Project design criteria are included that should help to reduce the chance of increasing invasive plant abundance in the planning area. Closure of temporary roads should help to reduce these impacts in the long term. The risk would only occur during the time that the sale is active, until the roads are reclosed or decommissioned.

Many of the areas proposed for vegetation treatment activities were not specifically surveyed for this project. Therefore, it must be assumed that undiscovered populations of sensitive plant species may be impacted. Since most sensitive plant species occur in specific habitat types, the probability that sensitive plant species may occur in the planning area in these upland general forested habitats is relatively low. None of the sensitive plant species that may occur in coniferous forest habitats on the Malheur National Forest are extremely rare on a global scale. Therefore,

even if project activities may impact individual plants or habitat, implementation of this alternative should not increase the need for Federal listing of any sensitive species. Therefore, the determination of effects for forested communities, and any rare plants that may occur there, for alternatives 2 and 3 is: may detrimentally impact, but would not lead to a trend toward federal listing.

Potential impacts to aspen communities

Treatments proposed in aspen stands include ground-based logging and prescribed burning. Ground-disturbing activities, such as tractor logging and grapple piling, have high potential to detrimentally impact any undiscovered populations of sensitive plants in this habitat type. Prescribed fire could potentially kill sensitive plants in this habitat.

Indirect effects of the aspen stand treatments may include changes in light and water relationships, as well as changes to ungulate grazing patterns. Indirect effects of fire include changes in plant species composition, increase in non-native invasive plants, and erosion. Protection of selected aspen stands from grazing through fences, cages, and piling of brush and trees, is also proposed. This should help reduce the impact of grazing animals in these stands. This element of aspen treatments may have a long term beneficial impact to any sensitive plants that may be present in aspen treatment areas.

None of the sensitive plant species that may occur in these habitats is considered to be extremely rare on a global scale. Therefore, even if project activities may impact individual plants or habitat, implementation of this alternative should not increase the need for Federal listing of any sensitive species. In the short term, alternatives 2 and 3 may detrimentally impact, but would not lead to a trend toward federal listing for rare plants potentially found in aspen-dominated habitats.

Although there may be detrimental potential impacts to the habitat for the short term due to ground disturbance, the long-term impacts to these areas may actually be beneficial. This is due to the fact that the aspen would be stimulated to grow new stems, the competing conifers would be removed, and the stands would be protected from ungulate grazing. Because the aspen stands would be rejuvenated and protected from cattle grazing; in the long term, alternatives 2 and 3 should have beneficial impact to sensitive plant species that occur within aspen stands.

Potential impacts to lithosols, sagebrush shrublands, and grasslands

Since there are generally few commercially valuable trees in these habitat types, the main potential activity would be prescribed burning. Since these habitats have low fuel loads, and prescribed burning is usually done under low-intensity conditions, it is likely that fire would not kill most plants in these habitat types. In addition, the goal of sagebrush habitat improvement would discourage the intentional burning of sagebrush in these habitat types. Therefore, there is very little risk of detrimental impacts to these habitats due to burning.

Motorized equipment may be used to clear juniper and conifers in some lithosol areas. This would generally be done under winter conditions (over snow or frozen ground). This should reduce the chances of ground disturbance during the cutting and removal of the trees. The removal of shade and reduced water transpiration in these areas may improve the health of sagebrush and other plants in these habitat types.

Temporary road construction in these habitats may lead to detrimental direct effects such as plant excavation, and burial by dirt and gravel. Potential indirect effects of temporary road construction

include increased vehicle use, increases in non-native invasive plants, and changes in water movement across the landscape. Road decommissioning and temporary road construction is planned across limited areas in these habitat types. Areas with high potential habitat for sensitive plants may be surveyed for rare plants before project implementation. Project design criteria that protect unique habitats, including sensitive plant habitats, would provide a high level of protection to these habitats.

Bolander's spike rush is a sensitive plant that occurs in sagebrush and grassland areas. The documented population in the planning area would be designated as an area to protect, and a botanist would be consulted before prescribed fire is implemented in the population. The buffering standards for protection of "special" habitats should reduce the chance of impacts to any undocumented populations of this or other sensitive plant species in the planning area.

Because the project design criteria would protect lithosol, sagebrush shrubland, and grassland habitats in the planning area, the implementation of alternatives 2 and 3 would have no impact to lithosols, sagebrush shrublands, and grassland habitats, or to any sensitive species that may occur in these habitats.

Potential impacts to cliffs, rock outcrops, and talus

Very few human activities have potential for direct or indirect impacts to this habitat type. Prescribed fire generally does not burn in this habitat type, due to the low fuel levels. The main activity that may impact this habitat type is rock quarrying for use in temporary road construction. The removal of rocks could directly kill plants by excavating them. Quarrying may potentially indirectly impact this habitat by exposing roots of plants that are not directly removed. The action alternatives propose use of existing quarries, so no new quarries would be developed this project.

Project design criteria that protect "special" plant habitats would provide a high level of protection to these habitats. The project design criteria that states "Pre-implementation monitoring of selected high probability habitats for sensitive plants may be conducted in specific areas of proposed activities" would ensure that quarrying for road work does not impact undiscovered populations of sensitive plants in this habitat.

Because the project design criteria would protect cliffs, rock outcrops, and talus in the planning area, the implementation of alternatives 2 and 3 should have no impact to cliffs, rock outcrops, and talus habitats, or to any sensitive species that may occur there.

Potential impacts to riparian-dependent communities

The mechanisms for direct and indirect effects to riparian dependent communities are similar to upland coniferous forest communities, though we expect fewer impacts overall. No commercial thinning is planned in riparian areas, but other actions, including non-commercial thinning and prescribed burns would occur. See the discussion above related to potential direct and indirect impacts to coniferous forest communities for details of similar potential effects to riparian dependent communities.

To protect soil and water resources, most activities would be greatly restricted in riparian and wetland habitats. Many project design criteria are included that would help to reduce ground disturbance and negative impacts from prescribed fire in riparian-dependent communities. An important project design criteria prevents ignition and piling of slash within floodplains, riparian habitat conservation areas, and seeps, springs, and wet meadows. Other project design criteria

would also limit commercial activities, use of heavy equipment, log landings, and skidding in riparian habitat conservation areas. These project design criteria would provide important protection to sensitive plants that may occur in these habitats. Stream channel restoration, culvert replacement, and conifer overstory removal is proposed in some riparian and wetland areas. Unsurveyed portions of these proposed areas may be surveyed for sensitive plants before project implementation. If any sensitive plants are found, mitigations to protect the population would be implemented.

One of the documented sensitive plant species in the planning area occurs in riparian-dependent communities (peatlands). Known populations of sensitive plant species would be buffered from all ground disturbing activities, and a botanist would be consulted before prescribed fire is implemented in these populations. Many of the botanical surveys conducted for this project focused on riparian-dependent communities. However, not every acre of riparian dependent community was surveyed. Therefore, there may be undiscovered populations of sensitive plants in these areas.

None of the sensitive plant species that may occur in riparian dependent habitats is considered to be extremely rare on a global scale. Therefore, even if project activities may impact individual plants or habitat, implementation of this alternative should not increase the need for Federal listing of any sensitive species. Therefore, alternatives 2 and 3 may detrimentally impact, but would not lead to a trend toward federal listing in riparian dependent habitats.

Cumulative Effects

In the past, present, and reasonably foreseeable future, there have been, and would continue to be, projects and activities within the planning area that may cause impacts to sensitive plants and their habitats. Projects and activities that create ground disturbance, change vegetative composition, and change domestic animal grazing patterns may potentially cause detrimental impacts to sensitive plant populations and habitats. These actions include road construction, timber harvest, fuels reduction treatments (landscape and pile burning, lopping and scattering of slash), fire suppression, recreation development, mining, and livestock grazing. In addition, restoration efforts such as road decommissioning, and stream improvements may also potentially impact sensitive plant populations and habitat. Road construction and recreation developments have permanently altered native plant habitats in limited areas of the planning area.

Livestock grazing has occurred in most of the planning area for decades and has resulted in changes in plant communities, especially in non-forested and riparian areas. Grazing has a direct effect on plants through plant herbivory and trampling. Grazing can have an indirect effect on plant species by causing changes in shade, soil compaction, soil disturbance, smothering by cow pies, and alteration of nutrient cycling. The degree of impact to plant species from grazing is related to the timing, duration, and intensity of the grazing action, as well as the individual characteristics and habitat requirements of the species. Grazing would continue to occur in the planning area.

The historical abundance and distribution of sensitive species on the Forest is not known. Past activities have likely affected their current abundance and distribution. Beginning in approximately 1990, botanical surveys and biological evaluations were conducted for most Forest Service projects planned and implemented on the forest. As a result, activities conducted since 1990 have been designed to reduce impacts to sensitive species.

Summary of Environmental Effects

Table 3. Summary of resource indicators and measures by alternative

Resource element and resource indicator	Measure	Alternative 1	Alternatives 2 and 3
Known rare plant populations	Potential impacts to integrity of populations	No impact	No impact
Rare plant habitats			
Coniferous forest	Potential impact to habitat	No impact	May Detrimentially Impact
Aspen habitat	Potential impact to habitat	May Detrimentially impact	May Detrimentially Impact
Lithosols, sagebrush, shrublands, grasslands	Potential impact to habitat	No impact	No impact
Cliffs, outcrops, talus	Potential impact to habitat	No impact	No impact
Riparian habitat	Potential impact to habitat	No impact	May Detrimentially Impact

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

This project complies with Forest Service Policy (FSM 2670.32) to (1) review activities as part of the National Environmental Policy Act of 1969 to determine their potential effect on sensitive species, (2) avoid or minimize impacts to species whose viability has been identified as a concern, and (3) assure that decisions would not result in loss of species viability or create trends toward federal listing.

References

- NatureServe. 2020. NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available <https://explorer.natureserve.org/>. (Accessed: August 14, 2020).
- Powell, David C., 2007. Potential vegetation hierarchy for the Blue Mountains section of northeastern Oregon, southeastern Washington, and west-central Idaho (Vol. 709). US Department of Agriculture, Forest Service, Pacific Northwest Research Station. P. 87.
- Shepperd, Wayne D., 2001. Manipulations to regenerate aspen ecosystems. In Sustaining aspen in western landscapes: Symposium proceedings (pp. 355-366). USDA For. Serv. Proc.
- Shirley, Diane M. and Erickson, Vicky, 2001. Aspen restoration in the Blue Mountains of northeast Oregon. Sustaining aspen in western landscapes. RMRS-P-18. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, pp.101-115.
- USDA Forest Service. 2005. Pacific Northwest Region Invasive Plant Program Final Environmental Impact Statement and Record of Decision. U.S. Department of Agriculture, Forest Service.
- USDA Forest Service. 2009. Forest Service Manual (FSM 2670, Section 2672.4).
- USDA Forest Service. 2015. Field Guide to Sensitive Plants of the Malheur National Forest. Unpublished book developed using publicly available information and photos.
- USDA Forest Service. 2015. Natural Resource Manager (NRM) database. National Forest Service database for sensitive plant data management. Formerly known as NRIS.

Appendix A. Malheur National Forest rare plant list

Table A- 1. Fungi rare plant list

Scientific name	Habitat details
<i>Amanita armillariiformis</i>	In xeric habitats with Artemisia, mustards, cheat grass, bluegrass, aspen, Douglas-fir and scattered Salix.
<i>Amanita prairicola</i>	In eastern Oregon associated with Artemisia, Sarcobatus vermiculatus, Chrysothamnus nauseosus and Myosurus aristata.
<i>Hydnотrya michaelis</i>	Appears to grow in mid-montane to subalpine elevations coniferous forest.
<i>Pseudorhizina californica</i>	Growing on or adjacent well-rotted stumps and logs; on conifers and possibly on birch. May be on soil rich in brown rotted wood.
<i>Rhizopogon semireticulatus</i>	Mixed conifer forests that include Pinus ponderosa, Pinus contorta, Pseudotsuga menziesii, Larix occidentalis, and Abies lasiocarpa.
<i>Rhizopogon subclavatisporus</i>	In duff under conifers.
<i>Rhizopogon variabilisporus</i>	Coniferous Abies, Pinus and Picea mostly at high elevations. Fruits late summer.
<i>Sclerotinia veratri</i>	Not yet known from the PNW. Moist meadows and wet areas growing on stems of rotting Veratrum spp. just after spring snowmelt.

Table A- 2. Lichens rare plant list

Scientific name	Habitat details
<i>Collema curtisporum</i>	Epiphyte on Populus balsamifera ssp. trichocarpa trees at mid to high elevations.
<i>Peltula euploca</i>	Grows on noncalcareous rock, in exposed, dry, or shaded and damp habitats.
<i>Texosporium sancti-jacobi</i>	Arid to semi-arid shrub-steppe, grassland or savannah. Warm, dry sites w/silty or rocky soils. On flat to gentle north facing slopes in arid areas. Often on decomposing bunchgrass bases, dead Selaginella, or on mammal scat (rabbit).
<i>Thelenella muscorum</i> var. octospora	Component of biological crust communities in semi-arid shrub steppe and grasslands.

Table A- 3. Liverworts rare plant list

Scientific name	Habitat details
<i>Anastrophyllum minutum</i>	Peaty soil, at high elevations. Associated with other bryophytes in tight mats. On wet soil, rocky ledges, or on wet rocks in sub alpine or alpine zones. Usually on north-facing exposures.
<i>Anthelia julacea</i>	Arctic-alpine habitats. Terrestrial on peaty soil, in Oregon associated with ericaceous shrubs. On rock surfaces, wet rock surfaces, and dry soil. Sphagnum springs, edges of streams, in mires.
<i>Barbilophozia lycopodioides</i>	Peaty soil or decomposed organic detritus on damp ledges of rock outcrops and cliffs at higher elevations. Acid soil or soil-covered rocks. Not necessarily on mineral soil. Sites receive abundant snowfall.
<i>Harpanthus flotovianus</i>	Bogs and fens; mostly on humus, soil covered rocks, and decaying wood in forests. Site on Umatilla NF is in a sub-alpine meadow, surrounded by subalpine fir and spruce forest.

Scientific name	Habitat details
<i>Jungermannia polaris</i>	In permanent seeps, thin soil over calcareous rocks. In ultraoligotrophic lakes. Forming mats or hidden among other bryophytes, over peaty soils on damp ledges and crevices of rocks, sometimes along streams, or aquatic. Partial shade to full exposure.
<i>Lophozia gillmanii</i>	On peaty soil, usually on cliffs or ledges; obligate calciphile? Mossy, constantly-irrigated basic rock ledges and in mossy base-rich flushes and rocks by streams. On granite derived substrates on the Umatilla NF.
<i>Ptilidium pulcherrimum</i>	Forming low, dense mats at the base of trees, on decaying wood, among boulders in talus, ledges of cliffs, and rarely on soil, in cool moist habitats. Perennially moist tree bases, rotten logs, and on rocks, cliffs, and ledges.
<i>Tritomaria exsecta</i>	Damp mossy rocks and logs along creeks in coniferous forest.

Table A- 4. Mosses rare plants list

Scientific name	Habitat details
<i>Anoetangium aestivum</i>	Moist cliffs, humid cliff crevices, and overhanging rocks.
<i>Anomobryum julaceum</i>	Cliff crevices on soil, cliff crevices, on tussock tundra with seeps and late snow melt areas, and on granitic outcrops.
<i>Bruchia bolanderi</i>	On moist soil in wet meadows and mixed conifer forests at approximately 3500-6640' in elevation.
<i>Bryum calobryoides</i>	On protected to exposed rock at moderate to high elevations. Can also grow on moist soil.
<i>Elodium blandowii</i>	Bogs and marshes. In montane fens, usually with calcareous ground water. Sometimes under sedges or shrubs in mires. Bogs, fens, wet meadows, and stream sides. Shady sites to full sun. Wet boggy areas, seepage areas around alpine lakes.
<i>Encalypta brevipes</i>	Soil on ledges and in crevices on cliffs, igneous and siliceous substrates. Sites may be subject to frequent fog penetration.
<i>Entosthodon fascicularis</i>	On seasonally wet, exposed soil in seeps, or along intermittent streams. Grasslands, grassy balds, and rock outcrops. Usually hidden among grasses, other mosses, and litter.
<i>Meesia uliginosa</i>	Fens, bogs, rock fissures, moderate to high elevations. Forming tufts in medium to rich montane fens on saturated ground, or on tree roots or logs; usually in full sun. Sub-alpine to mixed conifer forests.
<i>Mnium blyttii</i>	Seepage areas along streamlets in subalpine and alpine areas and on calcareous, often humus-rich soil in mountains.
<i>Orthotrichum bolanderi</i>	Dry igneous and sedimentary rocks and faces of cliffs in areas with a Mediterranean climate. Forest types include <i>Pinus ponderosa</i> , <i>Pseudotsuga menziesii</i> associations.
<i>Orthotrichum euryphyllum</i>	Basalt rocks and outcrops around springs and streambeds. Primarily in dry <i>Juniperus occidentalis</i> , <i>Pinus ponderosa</i> , and <i>Artemisia tridentata</i> associations.
<i>Orthotrichum holzingeri</i>	On vertical calcareous rock surfaces and at the bases of <i>Salix</i> bushes just above rock that is frequently inundated by seasonally high water in dry coniferous forests.
<i>Orthotrichum pellucidum</i>	Insufficient knowledge on habitat. Found on both calcareous and non-calcareous rock boulders and cliff faces in very dry areas.
<i>Pseudocalliergon trifarium</i>	Forming lawns or intermixed with other bryophytes in medium to rich montane fens; grows submerged to emergent in pools or on saturated ground; usually in full sunlight. Fen pools may dry up in late summer.

Scientific name	Habitat details
<i>Pseudoleskeella tectorum</i>	On rock, usually calcareous, in dry, open and exposed locations, occasionally on logs or soil usually in calcareous areas in the mountains.
<i>Ptilium crista-castrensis</i>	Cold Moist conifer forests. In Oregon found in cold air drainage site within Pinus contorta-Vaccinium scoparium forest.
<i>Schistidium cinclidodonteum</i>	Grows in large clumps on wet or dry rocks, or in soil in crevices of rocks and boulders, often along intermittent streams.
<i>Schistidium flaccidum</i>	Rock in open to shaded habitats at 4500-9600 feet elevation.
<i>Schistidium heterophyllum</i>	Rock in open to shaded from 900 to 3600 feet elevation.
<i>Schistidium tenerum</i>	Exposed dry rock outcrops and moist shaded soil in crevices at elevations between 5700 and 6700 feet.
<i>Schistostega pennata</i>	In soil on root wads of fallen trees; on damp, acidic rock, soil and decaying wood. On soil, in dark places, such as openings of caves and mine shafts, crevices, overhangs. Often pioneer on disturbed soil. In ID, on rootwads sometimes in sunny areas.
<i>Scouleria marginata</i>	Volcanic or granitic bedrock or large boulders along the margins of perennial river systems; frequently submerged but is usually exposed during periods of low water flow.
<i>Splachnum ampullaceum</i>	Forming green sod on old dung of herbivores, or on soil enriched by dung, in peatlands, fens, or other wetlands. On soil and decaying animal matter in wet places.
<i>Tetraphis geniculata</i>	On the cut ends and sides of well decayed logs and stumps (class 3-5), occasionally on peaty banks; moist coniferous forests. Rarely on rocks. In mature to late seral forests with closed canopies. Found from sea level to subalpine elevations.
<i>Tomentypnum nitens</i>	In medium to rich montane fens, forming loose to dense sods. Plants grow in slightly elevated sites within wetter areas (on logs, stumps, hummocks). Found in calcareous, and also, pumice rich soils.
<i>Tortella tortuosa</i> var. <i>tortuosa</i>	Calcareous rock or occasionally on dry soil in exposed locations.
<i>Tortula mucronifolia</i>	Forming small turfs or cushions on soil, calcareous soil, silt, tree roots, sheltered ledges and crevices of outcrops, cliffs. Reportedly calciphile, but on acid rocks as well. In cold forest and Populus riparian forests. Soil or rock.

Table A- 5. Vascular rare plants list

Scientific name	Habitat details
<i>Achnatherum hendersonii</i>	Basalt lithosols; shallow rocky soils, sometimes w/stiff sage, strict buckwheat, and Ponderosa pine surrounding. Can be in deeper-soiled areas than Wallowa ricegrass.
<i>Achnatherum wallowaense</i>	Basalt lithosols; shallow rocky soils, sometimes w/stiff sage, strict buckwheat, and Ponderosa pine surrounding.
<i>Artemisia arbuscula</i> ssp. <i>longicaulis</i>	Shallow, clay soils with low available water-holding capacity, aridic-mesic soils. Areas with 5-12 inches precipitation per year. Probably only on extreme southern end of Malheur NF.
<i>Astragalus diaphanus</i> var. <i>diurnus</i>	Shallow gravelly soil of sandbars or sandy banks of intermittent streams; often associated with juniper woodlands.
<i>Astragalus misellus</i> var. <i>misellus</i>	Dry grassland and sagebrush habitats.

Scientific name	Habitat details
<i>Astragalus tegetarioides</i>	Dry pine forest, sagebrush flats, on volcanic ash or basaltic substrates, cracks of welded tuff outcrops. In transition zone between sagebrush and ponderosa pine forest. Endemic to Emigrant Creek Ranger District (and west).
<i>Botrychium ascendens</i>	Moist meadows, riparian zones, moist roadsides, openings in cold forests. Often in calcareous soils, but not always. Lower montane, mesic coniferous forest, and grassy fields. Often on the drier edges of wet meadows.
<i>Botrychium crenulatum</i>	Local in marshy or springy areas. Moist meadows, riparian zones, moist roadsides, openings in cold forests. Often in calcareous soils, but not necessarily.
<i>Botrychium hesperium</i>	Grassy mountain slopes, snow fields, and road ditches, w/willows, and sand dunes. Moist meadows, riparian, moist roadsides, openings and edges of forests. Often on calcareous soils. Sometimes found in roadside ditches and at edges of lakes.
<i>Botrychium lineare</i>	Usually in and around the edges of wet meadows, in riparian areas, and moist roadside ditches. Forest types include moderate elevation mesic forests up to lodge pole pine and subalpine fir forests.
<i>Botrychium lunaria</i>	Open fields, occasionally forest in southern occurrences. Moist meadows, riparian zones, moist roadsides, openings and edges of cold forests.
<i>Botrychium montanum</i>	Dark, coniferous forests, usually near swamps and streams. Wet meadows, saturated soils. Often growing in a bed of mosses. This species tends to grow in wetter sites than the other Botrychiums.
<i>Botrychium paradoxum</i>	In snowfields, secondary growth of pastures. Moist meadows, riparian zones, moist roadsides. Montane to sub alpine grasslands or forb dominated meadows. In openings and on edges of cold coniferous forests.
<i>Botrychium pedunculatum</i>	Brushy secondary-growth habitats along streams and roadsides. Moist meadows, riparian zones, moist roadsides. Sometimes in openings or on edges of cold coniferous forest.
<i>Bupleurum americanum</i>	Sub-alpine talus slopes, rocky soils, dry meadows, ridge tops. Sometimes in a mosaic of open areas, and scrubby coniferous forest. Generally north to northwest aspect. Coarse gravel; granodiorite and basaltic lithosols.
<i>Calochortus longebarbatus</i> var. <i>longebarbatus</i>	On clay loams in vernal moist sites, notably within thin soiled swales and along stony drainages of open meadows, riparian zones, and floodplains. Moist meadows, stream edges, wet meadows. On soils derived from basalt.
<i>Calochortus longebarbatus</i> var. <i>peckii</i>	Grassy margins of wet meadows, and under pines. Wet to moist meadows. Along stream edges. Often partially shaded by Ponderosa pine. On basalt derived and volcanic ash soils.
<i>Calyptidium roseum</i>	Sagebrush desert to montane coniferous forest. Gravely to sandy soils, often in low moist swales among sagebrush. Often in alkaline soils. In areas w/low cryptogram cover. Historic Malheur National Forest site is in dry ponderosa pine site (wetter microsite?).
<i>Carex atherodes</i>	Wet sites that remain wet through summer; lake margins, meadows, marshes and ditches.
<i>Carex atosquama</i>	Alpine and supalpine grasslands, moist to mesic meadows, lake shorelines, and streamsides. Documented populations in Wallowas are mostly at base of limestone cliffs.
<i>Carex cordillerana</i>	Riparian terraces, mesic forests, with grand fir and Douglas-fir. Aspen forests. Rocky slopes, in leaf litter and duff. Also in rocky areas with juniper and mountain mahogany.
<i>Carex diandra</i>	Bogs and fens, floating peat mats, lake and pond shores, springs, seeps. Sometimes in brackish water. Groundwater dependent ecosystems, usually on peat soils. Wettest nonaquatic microsites in fens, pH usually between 6 and 8.

Scientific name	Habitat details
<i>Carex duriuscula</i>	Dry prairies, sagebrush steppe, and open forest.
<i>Carex idaho</i>	Flat to gently sloping meadows around headwater streams, springs. Often with <i>Carex praegracilis</i> and/or <i>Poa pratensis</i> . In ecotone between wetlands and uplands. Subirrigated soils that dry out in summer.
<i>Carex lasiocarpa</i>	Fens, bogs, lakeshores, streambanks, seepage areas, and wet meadows. In deep, organic acid soils with low to moderate nutrients. Sometimes forming floating mats.
<i>Carex media</i>	Montane to subalpine meadows, streambanks, seepage areas, bog margins. Mossy, moist forests.
<i>Carex micropoda</i>	Moist alpine meadows and snowmelt basins, areas irrigated by meltwater. In cracks between rocks on talus fields near alpine lakes. Mainly where heavy snow cover protects from extreme cold temperatures, prevents competition, and provides summer moisture.
<i>Carex nardina</i>	Dry alpine ridges and slopes, abrasion plateaus, dry tundra, heaths, and fellfields. Usually at, or above, timberline.
<i>Carex pelocarpa</i>	Dry alpine slopes, ridges, boulder fields, talus slopes, and on rocky stream sides in damp but well-drained soils, usually with no competing vegetation.
<i>Carex retrorsa</i>	Floodplains in forests, streamsides, lakeshores, swamps, wet thickets, wet meadows. Sandy riverbanks. Sites are wet in spring, but may dry out by late summer.
<i>Carex saxatilis</i>	Fens, bogs, lakeshores, wet tundra, roadside ditches, ponds, and slow moving streams; often in shallow water. Always at high elevations. In areas with peaty soils.
<i>Carex scirpoidea ssp. stenochlaena</i>	Moist meadows, streambanks, and rocky slopes. Beside waterfalls and on seepy cliffs. Somewhat acidic substrates.
<i>Carex subnigricans</i>	Moist rocky slopes and meadows, subalpine to alpine areas.
<i>Carex vernacula</i>	Alpine and subalpine wet meadows, rocky slopes, edges of headwater streams and lakeshores. Moist forest openings just below treeline.
<i>Chaenactis xantiana</i>	Dry, open places, deep, loose sandy soil or on dunes, less often on gravelly soil. In sagebrush steppe areas. Only suspected for Emigrant Creek RD.
<i>Cheilanthes feei</i>	Cliff crevices, especially on limestone. On dry limestone influenced cliffs (sometimes basalt), from low elevations in deep canyons to high in sub-alpine.
<i>Cicuta bulbifera</i>	Marsh edges, slow moving streams, lake margins, bogs, wet meadows and shallow standing water.
<i>Cryptogramma stelleri</i>	Sheltered calcareous cliff crevices and rock ledges, typically in coniferous or boreal forest. On wet cliffs, and ledges, along streams, under waterfalls. Limestone substrate. Shady sites. Usually north-facing aspects.
<i>Cymopterus nivalis</i>	Open rocky places. Moderate to high elevations. Found on volcanic tuffs and bald areas with less than 30% vegetation cover. <i>Artemisia arbuscula</i> is a common associate.
<i>Cypripedium fasciculatum</i>	Grand fir to ponderosa pine, and warm riparian forests; w/sub-alpine fir in Colorado. Generally in 60-100% shade. Often w/mountain lady's slipper. In damp to dry sites.
<i>Elatine brachysperma</i>	Growing on mudflats, shallow pools, and edges of ponds. Freely rooting in mud.
<i>Eleocharis bolanderi</i>	Vernally wet swales, along intermittent streams, wet depressions in moist meadows and lithosols. In slight depressions that hold snow later in the season than surrounding areas. Surrounding forest is usually ponderosa pine. Habitat and plants are dry by mid-summer.
<i>Eremothera pygmaea</i>	Dry plains and slopes with unstable soils or in gravel in steep talus, dry washes, banks, and road cuts. Open, bare ground. Sometimes w/big sage or bitterbrush.

Scientific name	Habitat details
<i>Eriogonum cusickii</i>	Rocky sagebrush desert. Barren flats and hills w/dry soil over weathered basalt and welded tuff. Associated species include low sage and juniper. Only suspected on Emigrant Creek RD.
<i>Eriogonum salicornioides</i>	On sparsely vegetated, open, ash deposits and clayey substrates, sometimes in disturbed areas. Saltbush, greasewood, and sagebrush communities; juniper woodlands possibly surrounding. Only suspected on Emigrant Creek Ranger District.
<i>Heliotropium curassavicum</i>	Wet ground, saline flats, and alkaline soils. Dried edges and centers of vernal pools. Low to moderate elevations. Probably only on Emigrant Creek RD.
<i>Ipomopsis tenuituba</i>	High elevation sagebrush and subalpine openings.
<i>Isoetes minima</i>	Vernal pools, lake margins, and seasonally wet seeps and swales.
<i>Kobresia myosuroides</i>	Tundra, grassland, heaths, bare rocky, dry to wet ground. Moist meadows, seeps, riparian areas. Often above timberline; high elevations only.
<i>Listera borealis</i>	Sandbars and wet bottomlands.
<i>Lomatium erythrocarpum</i>	Ridges, fine argillite talus, open slopes. Mostly on steep slopes, with very little vegetation. Often w/alpine knotweed (<i>Aconogonon phytolaccaefolium</i>). Most populations are south or east facing. High elevations.
<i>Luina serpentina</i>	Open, rocky sites with poor soil development. Usually on steep slopes, above small tributaries. In dry shrub, open juniper, ponderosa pine, and Douglas-fir forest areas.
<i>Lupinus lepidus</i> var. <i>cusickii</i>	Residual soils from ancient lakebeds, volcanic ash and clay soils. Barren tuffaceous or gravelly clay bluffs and gullied riverbanks. Plants often in eroded drainage channels.
<i>Lycopodium complanatum</i>	Dry open coniferous or mixed dry to wet forest slopes, or in riparian areas. Often on rotting logs, or in thick duff. Reportedly also in meadows and on open ridge tops.
<i>Mimulus evanescens</i>	Vernally moist sites and fluctuating banks of intermittent streams or pools in sagebrush-juniper zone. Amid heavy gravel and boulders at one site. In ecotone between uplands and graminoids at water's edge. Low, wet fields also.
<i>Muhlenbergia minutissima</i>	Sandy soils on riverbanks, moist meadows, pond shores and edges of reservoirs. Open, rocky and apparently dry slopes also. Open, more or less disturbed, sandy slopes, and seeps.
<i>Myosurus sessilis</i>	Vernally wet sites and alkali flats.
<i>Ophioglossum pusillum</i>	Seasonally wet areas in pastures, old fields, roadside ditches, bogs, fens, wet meadows, flood plains, moist woods, grassy swales, dry or damp sand, dry hillsides, seasonally wet, acidic soil.
<i>Pellaea bridgesii</i>	Rocky slopes and cliffs, on granitic substrate. Talus slopes, scree, rock outcrops; often on southern exposures on argillite in Wallowa and Blue Mountains.
<i>Peltolepis quadrata</i>	Forming small mats on moist, exposed to shady soil or on ledges and crevices on talus slopes and outcrops. Usually calciphile, also igneous & ultramafic rocks. Cold forest to white bark pine types.
<i>Penstemon deustus</i> var. <i>variabilis</i>	Dry foothills and lowlands on open dry thin soils.
<i>Phacelia minutissima</i>	Moist, open places, streambanks, meadows, ephemeral moist swales. Vernallly moist openings in ponderosa pine or Douglas-fir forest. Often with <i>Veratrum</i> . In aspen in WA.
<i>Phlox hendersonii</i>	Alpine fell fields, open gravelly slopes and ridges. Glacial moraines. Exposed, rocky places.

Scientific name	Habitat details
<i>Phlox multiflora</i>	Basalt cliffs, rocky outcrops and bluffs, rocky openings and wooded rocky areas in dry forest. Sometimes on loose substrate as well as cracks in cliffs and rock outcrops. Highest elevation in OR is 4,800 ft., however found higher up in Rocky Mountains.
<i>Pilularia americana</i>	In mud around edges of shallow vernal pools.
<i>Pinus albicaulis</i>	Subalpine, usually near timberline. Usually fairly dry sites with thin, rocky, cold soils.
<i>Piptatheropsis exigua</i>	Rocky slopes and rock outcrops. Only one site on Malheur National Forest.
<i>Pleuropogon oregonus</i>	Open, wet meadows, marshes, and riparian areas. Grows in areas of standing or flowing water early in season. Documented sites not near forested habitats. Sluggish water in depressions and sloughs, irrigation ditches.
<i>Potamogeton diversifolius</i>	Aquatic; shallow creeks and ponds. Shallow water, ditches, ponds, lakes.
<i>Potamogeton foliosus</i>	Warm shallow lakes, springs, streams and rivers.
<i>Rorippa columbiae</i>	Wet to vernal moist sites; meadows, fields, playas, lakeshores, intermittent stream beds, banks of perennial streams, along irrigation ditches, river bars and deltas.
<i>Rotala ramosior</i>	Damp areas in fine silt and sand, wet swampy places, mudflats, lake and pond margins, and along free-flowing river reaches.
<i>Salix farriae</i>	Wet meadows, stream banks, moderate to high elevations.
<i>Salix wolfii</i> var. <i>idahoensis</i>	Riparian, wet meadows, waterfalls, stream-sides, moist shrub lands; moderate to high elevations.
<i>Saxifraga adscendens</i> ssp. <i>oregonensis</i>	Rock crevices, glacial moraines, alpine meadows, along streams. Damp cliffs where soil has accumulated. High elevations only. Sites in Wallowas are on limestone, reported also on quartzite and gneiss in Idaho. Needs some amount of moisture.
<i>Senecio sphaerocephalus</i>	Moderate elevation wet meadows.
<i>Stanleya confertiflora</i>	Dry plains and low sand or clay hills. On barren clay and diatomaceous soils in sagebrush habitats. Tuffaceous sedimentary rocks on geology layer. Sometimes with juniper.
<i>Thelypodium eucosmum</i>	Under and around western juniper, ponderosa pine, and Douglas-fir trees; in canyons, seasonal creek drainages, and seeps/springs. Also found in vernal moist areas in ponderosa pine forests and in sage. Restricted to serpentine and ultramafic soils.
<i>Thelypodium howellii</i> ssp. <i>howellii</i>	Moist plains or river valley.
<i>Trifolium douglasii</i>	Moist or mesic meadows, prairie remnants, along riparian areas along streams. In swales, along intermittent streams, and in vernal wet areas.
<i>Triglochin palustris</i>	Meadows, mud flats and gravelly stream margins; often where brackish or alkaline.
<i>Trollius albiflorus</i>	Open, wet places, more or less acidic soils, montane to alpine. Seeps, springs, and vernal wet swales in spruce/fir forest.
<i>Utricularia minor</i>	Aquatic plant. Shallow ponds, slow-moving streams, and wet sedge or rush meadows. Often w/bulrush and other bladderworts. Occurs in low-nutrient lakes and peat bogs.

Appendix B. Habitat groups and associated rare plant species

Table B- 1. Dry upland coniferous forests and upland woodlands

Scientific name	Common name	Habitat details
<i>Amanita armillariiformis</i>		In xeric habitats with Artemisia, mustards, cheat grass, bluegrass, aspen, Douglas-fir and scattered Salix.
<i>Astragalus tegetarioides</i>	Deschutes milkvetch	Dry pine forest, sagebrush flats, on volcanic ash or basaltic substrates, cracks of welded tuff outcrops. In transition zone between sagebrush and ponderosa pine forest. Endemic to Emigrant Creek Ranger District (and west).
<i>Calyptridium roseum</i>	rosy calyptridium	Sagebrush desert to montane coniferous forest. Gravely to sandy soils, often in low moist swales among sagebrush. Often in alkaline soils. In areas w/low cryptogram cover. Historic Malheur National Forest site is in dry ponderosa pine site (wetter microsite?).
<i>Carex cordillerana</i>	cordilleran sedge	Riparian terraces, mesic forests, with grand fir and Douglas-fir. Aspen forests. Rocky slopes, in leaf litter and duff. Also in rocky areas with juniper and mountain mahogany.
<i>Eriogonum salicornioides</i>	playa or saltwort buckwheat	On sparsely vegetated, open, ash deposits and clayey substrates, sometimes in disturbed areas. Saltbush, greasewood, and sagebrush communities; juniper woodlands possibly surrounding. Only suspected on Emigrant Creek Ranger District.
<i>Luina serpentina</i>	colonial luina	Open, rocky sites with poor soil development. Usually on steep slopes, above small tributaries. In dry shrub, open juniper, ponderosa pine, and Douglas-fir forest areas.
<i>Muhlenbergia minutissima</i>	annual or little-seed muhly grass	Sandy soils on riverbanks, moist meadows, pond shores and edges of reservoirs. Open, rocky and apparently dry slopes also. Open, more or less disturbed, sandy slopes, and seeps.
<i>Phacelia minutissima</i>	least or dwarf phacelia	Moist, open places, streambanks, meadows, ephemerally moist swales. Vernal moist openings in ponderosa pine or Douglas-fir forest. Often with Veratrum. In aspen in WA.
<i>Phlox multiflora</i>	many-flowered phlox	Basalt cliffs, rocky outcrops and bluffs, rocky openings and wooded rocky areas in dry forest. Sometimes on loose substrate as well as cracks in cliffs and rock outcrops. Highest elevation in OR is 4,800 ft., however found higher up in Rocky Mountains.
<i>Rhizopogon semireticulatus</i>		Mixed conifer forests that include Pinus ponderosa, Pinus contorta, Pseudotsuga menziesii, Larix occidentalis, and Abies lasiocarpa.
<i>Schistidium cinclidodonteum</i>	schistidium moss	Grows in large clumps on wet or dry rocks, or in soil in crevices of rocks and boulders, often along intermittent streams.
<i>Texosporium sancti-jacobi</i>	woven spore lichen	Arid to semi-arid shrub-steppe, grassland or savannah. Warm, dry sites w/silty or rocky soils. On flat to gentle north facing slopes in arid areas. Often on decomposing bunchgrass bases, dead Selaginella, or on mammal scat (rabbit).
<i>Thelypodium eucosmum</i>	arrow-leaf thelypody	Under and around western juniper, ponderosa pine, and Douglas-fir trees; in canyons, seasonal creek drainages, and seeps/springs. Also found in vernal moist areas in ponderosa pine forests and in sage. Restricted to serpentine and ultramafic soils.

Table B- 2. Cold and moist upland coniferous forests

Scientific name	Common name	Habitat details
<i>Barbilophozia lycopodioides</i>	giant fourpoint, maple liverwort	Peaty soil or decomposed organic detritus on damp ledges of rock outcrops and cliffs at higher elevations. Acid soil or soil-covered rocks. Not necessarily on mineral soil. Sites receive abundant snowfall.
<i>Botrychium ascendens</i>	upward-lobed moonwort	Moist meadows, riparian zones, moist roadsides, openings in cold forests. Often in calcareous soils, but not always. Lower montane, mesic coniferous forest, and grassy fields. Often on the drier edges of wet meadows.
<i>Botrychium crenulatum</i>	crenulate moonwort	Local in marshy or springy areas. Moist meadows, riparian zones, moist roadsides, openings in cold forests. Often in calcareous soils, but not necessarily.
<i>Botrychium hesperium</i>	western moonwort	Grassy mountain slopes, snow fields, and road ditches, w/willows, and sand dunes . Moist meadows, riparian, moist roadsides, openings and edges of forests. Often on calcareous soils. Sometimes found in roadside ditches and at edges of lakes.
<i>Botrychium lineare</i>	slender moonwort	Usually in and around the edges of wet meadows, in riparian areas, and moist roadside ditches. Forest types include moderate elevation mesic forests up to lodge pole pine and subalpine fir forests.
<i>Botrychium lunaria</i>	common moonwort	Open fields, occasionally forest in southern occurrences. Moist meadows, riparian zones, moist roadsides, openings and edges of cold forests.
<i>Botrychium montanum</i>	mountain moonwort	Dark, coniferous forests, usually near swamps and streams. Wet meadows, saturated soils. Often growing in a bed of mosses. This species tends to grow in wetter sites than the other Botrychiums.
<i>Botrychium paradoxum</i>	twin-spiked moonwort	In snowfields, secondary growth of pastures. Moist meadows, riparian zones, moist roadsides. Montane to sub alpine grasslands or forb dominated meadows. In openings and on edges of cold coniferous forests.
<i>Botrychium pedunculosum</i>	stalked moonwort	Brushy secondary-growth habitats along streams and roadsides. Moist meadows, riparian zones, moist roadsides. Sometimes in openings or on edges of cold coniferous forest.
<i>Bryum calobryoides</i>	Bryum moss	On protected to exposed rock in mid to upper elevation where it can also grow on moist soil.
<i>Cypripedium fasciculatum</i>	clustered lady's-slipper	Grand fir to ponderosa pine, and warm riparian forests; w/sub-alpine fir in Colorado. Generally in 60-100% shade. Often w/mountain lady's slipper. In damp to dry sites.
<i>Hydnотrya michaelis</i>		Appears to grow in mid-montane to subalpine elevations coniferous forest.
<i>Listera borealis</i>	northern twayblade	In moist, rich humus of mossy coniferous forest, swamps, often along cold streams, acidic soils. Most known sites are in older forests. Associated tree species include spruce, true firs, and Douglas-fir. Moderate elevations.
<i>Lycopodium complanatum</i>	ground-cedar	Dry open coniferous or mixed dry to wet forest slopes, or in riparian areas. Often on rotting logs, or in thick duff. Reportedly also in meadows and on open ridge tops.
<i>Meesia uliginosa</i>	Meesia moss	Fens, bogs, rock fissures, moderate to high elevations. Forming tufts in medium to rich montane fens on saturated ground, or on tree roots or logs; usually in full sun. Sub-alpine to mixed conifer forests.
<i>Pseudorhizina californica</i>	umbrella false morel	Growing on or adjacent well rotted stumps and logs; on conifers and possibly on birch. May be on soil rich in brown rotted wood.

Scientific name	Common name	Habitat details
<i>Ptilidium pulcherrimum</i>	blunt water moss, worm moss	Forming low, dense mats at the base of trees, on decaying wood, among boulders in talus, ledges of cliffs, and rarely on soil, in cool moist habitats. Perennially moist tree bases, rotten logs, and on rocks, cliffs, and ledges.
<i>Schistidium cinclidodonteum</i>	schistidium moss	Grows in large clumps on wet or dry rocks, or in soil in crevices of rocks and boulders, often along intermittent streams.
<i>Schistostega pennata</i>	schistostega moss	In soil on root wads of fallen trees; on damp, acidic rock, soil and decaying wood. On soil, in dark places, such as openings of caves and mine shafts, crevices, overhangs. Often pioneer on disturbed soil. In ID, on rootwads sometimes in sunny areas.
<i>Tetraphis geniculata</i>	tetraphis moss	On the cut ends and sides of well decayed logs and stumps (class 3-5), occasionally on peaty banks; moist coniferous forests. Rarely on rocks. In mature to late seral forests with closed canopies. Found from sea level to subalpine elevations.
<i>Tortula mucronifolia</i>	mucron-leaf tortula moss	Forming small turfs or cushions on soil, calcareous soil, silt, tree roots, sheltered ledges and crevices of outcrops, cliffs. Reportedly calciphile, but on acid rocks as well. In cold forest and Populus riparian forests. Soil or rock.
<i>Trollius albiflorus</i>	American globeflower	Open, wet places, more or less acidic soils, montane to alpine. Seeps, springs, and vernal wet swales in spruce/fir forest.

Table B- 3. Warm riparian forest (aspen, cottonwood), shrublands, and wetlands

Scientific name	Common name	Habitat details
<i>Calochortus longebarbatus</i> var. <i>longebarbatus</i>	long-bearded sego-lily	On clay loams in vernal moist sites, notably within thin soiled swales and along stony drainages of open meadows, riparian zones, and floodplains. Moist meadows, stream edges, wet meadows. On soils derived from basalt.
<i>Calochortus longebarbatus</i> var. <i>peckii</i>	Peck's long-bearded sego-lily	Grassy margins of wet meadows, and under pines. Wet to moist meadows. Along stream edges. Often partially shaded by Ponderosa pine. On basalt derived and volcanic ash soils.
<i>Carex cordillerana</i>	cordilleran sedge	Riparian terraces, mesic forests, with grand fir and Douglas-fir. Aspen forests. Rocky slopes, in leaf litter and duff. In rocky areas with juniper and mountain mahogany on Malheur National Forest. Near ephemeral streams in steep ravines in Hells Canyon NRA.
<i>Carex idaho</i>	Idaho or Parry's sedge	Flat to gently sloping meadows around headwater streams, springs. Often with <i>Carex praegracilis</i> and/or <i>Poa pratensis</i> . In ecotone between wetlands and uplands. Subirrigated soils that dry out in summer.
<i>Carex retrorsa</i>	retrorse sedge	Floodplains in forests, streamsides, lakeshores, swamps, wet thickets, wet meadows. Sandy riverbanks. Sites are wet in spring, but may dry out by late summer.
<i>Cypripedium fasciculatum</i>	clustered lady's-slipper	Grand fir to ponderosa pine, and warm riparian forests; w/sub-alpine fir in CO. Generally found in 60-100% shade. Often w/mtn. lady's slipper. In damp to dry sites. Seeps/springs, riparian zones.
<i>Eleocharis bolanderi</i>	Bolander's spike-rush	Vernally wet swales, along intermittent streams, wet depressions in moist meadows and lithosols. In slight depressions that hold snow later in the season than surrounding areas. Surrounding forest is usually ponderosa pine. Habitat and plants are dry by mid-summer.
<i>Enthosthodon fascicularis</i>	banded cord-moss, Hasselquist's hyssop	On seasonally wet, exposed soil in seeps, or along intermittent streams. Grasslands, grassy balds, and rock outcrops. Usually hidden among grasses, other mosses, and litter.

Scientific name	Common name	Habitat details
<i>Lycopodium complanatum</i>	ground-cedar	Dry open coniferous or mixed dry to wet forest slopes, or in riparian areas. Often on rotting logs, or in thick duff. Reportedly also in meadows and on open ridge tops.
<i>Mimulus evanescens</i>	disappearing monkey-flower	Vernally moist sites and fluctuating banks of intermittent streams or pools in sagebrush-juniper zone. Amid heavy gravel and boulders at one site. In ecotone between uplands and graminoids at water's edge. Low, wet fields also.
<i>Muhlenbergia minutissima</i>	annual or little-seed muhly grass	Sandy soils on riverbanks, moist meadows, pond shores and edges of reservoirs. Open, rocky and apparently dry slopes also. Open, more or less disturbed, sandy slopes, and seeps.
<i>Phacelia minutissima</i>	least or dwarf phacelia	Moist, open places, streambanks, meadows, ephemeral moist swales. Vernallly moist openings in ponderosa pine or Douglas-fir forest. Often with <i>Veratrum</i> . In aspen in WA.
<i>Pleuropogon oregonus</i>	Oregon semaphore grass	Open, wet meadows, marshes, and riparian areas. Grows in areas of standing or flowing water early in season. Documented sites not near forested habitats. Sluggish water in depressions and sloughs, irrigation ditches.
<i>Rotala ramosior</i>	lowland toothcup	Damp areas in fine silt and sand, wet swampy places, mudflats, lake and pond margins, and along free-flowing river reaches.
<i>Schistidium cinclidodonteum</i>	schistidium moss	Grows in large clumps on wet or dry rocks, or in soil in crevices of rocks and boulders, often along intermittent streams.
<i>Thelypodium eucosmum</i>	arrow-leaf thelypody	Under and around western juniper, ponderosa pine, and Douglas-fir trees; in canyons, seasonal creek drainages, and seeps/springs. Also found in vernallly moist areas in ponderosa pine forests and in sage. Restricted to serpentine and ultramafics on the Malheur National Forest.
<i>Tortula mucronifolia</i>	mucron-leaf tortula moss	Forming small turfs or cushions on soil, calcareous soil, silt, tree roots, sheltered ledges and crevices of outcrops, cliffs. Reportedly calciphile, but on acid rocks as well. In cold forest and <i>Populus</i> riparian forests. Soil or rock.
<i>Trifolium douglasii</i>	Douglas' clover	Moist or mesic meadows, prairie remnants, along riparian areas along streams. In swales, along intermittent streams, and in vernallly wet areas.

Table B- 4. Cold riparian forest, shrublands, springs, and wetlands (excluding peatland only species)

Scientific name	Common name	Habitat details
<i>Anastrophyllum minutum</i>	tiny notchwort liverwort	Peaty soil, at high elevations. Associated with other bryophytes in tight mats. On wet soil, rocky ledges, or on wet rocks in sub alpine or alpine zones. Usually on north-facing exposures.
<i>Anthelia julacea</i>	alpine silverwort liverwort	Arctic-alpine habitats. Terrestrial on peaty soil, in Oregon associated w/ericaceous shrubs. On rock surfaces, wet rock surfaces, and dry soil. Sphagnum springs, edges of streams, in mires.
<i>Botrychium ascendens</i> <i>crenulatum</i> <i>hesperium</i> <i>lineare</i> <i>paradoxum</i> <i>pedunculatum</i>	moonworts	Moist meadows, riparian zones, moist roadsides, openings in cold forests. Often in calcareous soils, but not always. Lower montane, mesic coniferous forest, and grassy fields. Often on the drier edges of wet meadows.

Scientific name	Common name	Habitat details
<i>Botrychium montanum</i>	mountain moonwort	Dark, coniferous forests, usually near swamps and streams. Wet meadows, saturated soils. Often growing in a bed of mosses. This species tends to grow in wetter sites than the other Botrychiums.
<i>Carex retrorsa</i>	retrorse sedge	Floodplains in forests, streamsides, lakeshores, swamps, wet thickets, wet meadows. Sandy riverbanks. Sites are wet in spring, but may dry out by late summer.
<i>Carex scirpoidea ssp. stenochlaena</i>	Alaskan single-spiked sedge	Moist meadows, streambanks, and rocky slopes. Beside waterfalls and on seepy cliffs. Somewhat acidic substrates.
<i>Cypripedium fasciculatum</i>	clustered lady's-slipper	Grand fir to ponderosa pine, and warm riparian forests; w/sub-alpine fir in CO. Generally found in 60-100% shade. Often w/mtn. lady's slipper. In damp to dry sites. Seeps/springs, riparian zones.
<i>Entosthodon fascicularis</i>	banded cord-moss, Hasselquist's hyssop	On seasonally wet, exposed soil in seeps, or along intermittent streams. Grasslands, grassy balds, and rock outcrops. Usually hidden among grasses, other mosses, and litter.
<i>Harpanthus flotovianus</i>	great mountain flapwort liverwort	Bogs and fens; mostly on humus, soil covered rocks, and decaying wood in forests. Site on Umatilla NF is in a sub-alpine meadow, surrounded by subalpine fir and spruce forest.
<i>Helodium blandowii</i>	Blandow's feather moss, wet plume moss	Bogs, fens, and marshes. In montane fens, usually with calcareous ground water. Sometimes under sedges or shrubs in mires. Wet meadows, and stream sides. Shady sites to full sun. Seepage areas around alpine lakes.
<i>Jungermannia polaris</i>	Arctic flapwort (liverwort)	In permanent seeps, thin soil over calcareous rocks. In ultraoligotrophic lakes. Forming mats or hidden among other bryophytes, over peaty soils on damp ledges and crevices of rocks, sometimes along streams, or aquatic. Partial shade to full exposure.
<i>Listera borealis</i>	northern twayblade	In moist, rich humus of mossy coniferous forest, swamps, often along cold streams, acidic soils. Most known sites are in older forests. Associated tree species include spruce, true firs, and Douglas-fir. Moderate elevations.
<i>Lophozia gillmanii</i>	Gillman's pawwort (liverwort)	On peaty soil, usually on cliffs or ledges; obligate calciphile? Mossy, constantly-irrigated basic rock ledges and in mossy base-rich flushes and rocks by streams. On granite derived substrates on the Umatilla NF.
<i>Lycopodium complanatum</i>	ground-cedar	Dry open coniferous or mixed dry to wet forest slopes, or in riparian areas. Often on rotting logs, or in thick duff. Reportedly also in meadows and on open ridge tops.
<i>Ophioglossum pusillum</i>	adder's-tongue	Seasonally wet areas in pastures, old fields, roadside ditches, bogs, fens, wet meadows, flood plains, moist woods, grassy swales, dry or damp sand, dry hillsides, seasonally wet, acidic soil.
<i>Preissia quadrata</i>	blister ribbon, narrow mushroom-headed liverwort	On soil w/little organic matter, typically on ledges or cliffs. On the Malheur National Forest in peaty fen. Shaded creeks, seeps, splash zones. Terrestrial, on damp mineral soil; reportedly a strict calciphile, but not in Columbia Gorge. In thin soil over calcareous rocks.
<i>Pseudorhizina californica</i>	umbrella false morel	Growing on or adjacent well-rotted stumps and logs; on conifers and possibly on birch. May be on soil rich in brown rotted wood.
<i>Ptilidium pulcherrimum</i>	blunt water moss, worm moss	Forming low, dense mats at the base of trees, on decaying wood, among boulders in talus, ledges of cliffs, and rarely on soil, in cool moist habitats. Perennially moist tree bases, rotten logs, and on rocks, cliffs, and ledges.
<i>Salix farriae</i>	Farr's willow	Wet meadows, stream banks, moderate to high elevations.

Scientific name	Common name	Habitat details
<i>Salix wolfii</i> var. <i>idahoensis</i>	Wolf's willow	Riparian, wet meadows, waterfalls, stream-sides, moist shrub lands; moderate to high elevations.
<i>Schistidium cinclidodonteum</i>	schistidium moss	Grows in large clumps on wet or dry rocks, or in soil in crevices of rocks and boulders, often along intermittent streams.
<i>Schistostega pennata</i>	schistostega moss	In soil on root wads of fallen trees; on damp, acidic rock, soil, and decaying wood. In dark places, such as openings of caves and mine shafts, crevices, overhangs. Often pioneer on disturbed soil. In Idaho, on root wads; sometimes in sunny areas.
<i>Splachnum ampullaceum</i>	purple-vased stink moss, small capsule dung moss	Forming green sod on old dung of herbivores, or on soil enriched by dung, in peatlands, fens, or other wetlands. On soil and decaying animal matter in wet places.
<i>Tetraphis geniculata</i>	tetraphis moss	On the cut ends and sides of well decayed logs and stumps (class 3-5), occasionally on peaty banks; moist coniferous forests. Rarely on rocks. In mature to late seral forests with closed canopies. Found from sea level to subalpine elevations.
<i>Tomentypnum nitens</i>	tomentypnum moss	In medium to rich montane fens, forming loose to dense sods. Plants grow in slightly elevated sites within wetter areas (on logs, stumps, hummocks). Found in calcareous, and also, pumice rich soils.
<i>Tortula mucronifolia</i>	mucron-leaf tortula moss	Forming small turfs or cushions on soil, calcareous soil, silt, tree roots, sheltered ledges and crevices of outcrops, cliffs. Reportedly calciphile, but on acid rocks as well. In cold forest and Populus riparian forests. Soil or rock.
<i>Trifolium douglasii</i>	Douglas' clover	Moist or mesic meadows, prairie remnants, along riparian areas along streams. In swales, along intermittent streams, and in vernal wet areas.
<i>Tritomaria exsecta</i>	notchwort	Damp mossy rocks and logs along creeks in coniferous forest.
<i>Trollius albiflorus</i>	American globeflower	Open, wet places, more or less acidic soils, montane to alpine. Seeps, springs, and vernal wet swales in spruce/fir forest.

Table B- 5. Subalpine wetland and riparian areas

Scientific name	Common name	Habitat details
<i>Anastrophyllum minutum</i>	tiny notchwort liverwort	Peaty soil, at high elevations. Associated with other bryophytes in tight mats. On wet soil, rocky ledges, or on wet rocks in sub alpine or alpine zones. Usually on north-facing exposures.
<i>Anthelia julacea</i>	alpine silverwort liverwort	Arctic-alpine habitats. Terrestrial on peaty soil, in Oregon associated w/ericaceous shrubs. On rock surfaces, wet rock surfaces, and dry soil. Sphagnum springs, edges of streams, in mires.
<i>Barbilophozia lycopodioides</i>	giant fourpoint, maple liverwort	Peaty soil or decomposed organic detritus on damp ledges of rock outcrops and cliffs at higher elevations. Acid soil or soil-covered rocks. Not necessarily on mineral soil. Sites receive abundant snowfall.
<i>Botrychium ascendens</i>	upward-lobed moonwort	Moist meadows, riparian zones, moist roadsides, openings in cold forests. Often in calcareous soils, but not always. Lower montane, mesic coniferous forest, and grassy fields. Often on the drier edges of wet meadows.
<i>Botrychium crenulatum</i>	crenulate moonwort	Local in marshy or springy areas. Moist meadows, riparian zones, moist roadsides, openings in cold forests. Often in calcareous soils, but not necessarily.

Scientific name	Common name	Habitat details
<i>Botrychium hesperium</i>	western moonwort	Grassy mountain slopes, snow fields, and road ditches, w/willows, and sand dunes. Moist meadows, riparian, moist roadsides, openings and edges of forests. Often on calcareous soils. Sometimes found in roadside ditches and at edges of lakes.
<i>Botrychium lineare</i>	slender moonwort	Usually in and around the edges of wet meadows, in riparian areas, and moist roadside ditches. Forest types include moderate elevation mesic forests up to lodge pole pine and subalpine fir forests.
<i>Botrychium lunaria</i>	common moonwort	Open fields, occasionally forest in southern occurrences. Moist meadows, riparian zones, moist roadsides, openings and edges of cold forests.
<i>Botrychium montanum</i>	mountain moonwort	Dark, coniferous forests, usually near swamps and streams. Wet meadows, saturated soils. Often growing in a bed of mosses. This species tends to grow in wetter sites than the other Botrychiums.
<i>Botrychium paradoxum</i>	twin-spiked moonwort	In snowfields, secondary growth of pastures. Moist meadows, riparian zones, moist roadsides. Montane to sub alpine grasslands or forb dominated meadows. In openings and on edges of cold coniferous forests.
<i>Botrychium pedunculosum</i>	stalked moonwort	Brushy secondary-growth habitats along streams and roadsides. Moist meadows, riparian zones, moist roadsides. Sometimes in openings or on edges of cold coniferous forest.
<i>Carex atosquama</i>	brass-fruit sedge	Alpine and supalpine grasslands, moist to mesic meadows, lake shorelines, and streamsides. Documented populations in Wallows are mostly at base of limestone cliffs.
<i>Carex lasiocarpa</i>	slender woolly sedge	Fens, bogs, lakeshores, streambanks, seepage areas, and wet meadows. In deep, organic acid soils with low to moderate nutrients. Sometimes forming floating mats.
<i>Carex media</i>	Scandinavian sedge	Montane to subalpine meadows, streambanks, seepage areas, bog margins. Mossy, moist forests.
<i>Carex micropoda</i>	timberline sedge	Moist alpine meadows and snowmelt basins, areas irrigated by meltwater. In cracks between rocks on talus fields near alpine lakes. Mainly where heavy snow cover protects from extreme cold temperatures, prevents competition, and provides summer moisture.
<i>Carex pelocarpa</i>	dusky-seed sedge	Dry alpine slopes, ridges, boulder fields, talus slopes, and on rocky stream sides in damp but well-drained soils, usually with no competing vegetation.
<i>Carex saxatilis</i>	limestone or russet sedge	Fens, bogs, lakeshores, wet tundra, roadside ditches, ponds, and slow moving streams; often in shallow water. Always at high elevations. In areas with peaty soils.
<i>Carex scirpoidea ssp. stenochlaena</i>	Alaskan single-spiked sedge	Moist meadows, streambanks, and rocky slopes. Beside waterfalls and on seepy cliffs. Somewhat acidic substrates.
<i>Carex subnigricans</i>	dark mountain sedge	Moist rocky slopes and meadows, subalpine to alpine areas.
<i>Carex vernacula</i>	foetid or native sedge	Alpine and subalpine wet meadows, rocky slopes, edges of headwater streams and lakeshores. Moist forest openings just below treeline.
<i>Cryptogramma stelleri</i>	Steller's rock-brake	Sheltered calcareous cliff crevices and rock ledges, typically in coniferous or boreal forest. On wet cliffs, and ledges, along streams, under waterfalls. Limestone substrate. Shady sites. Usually north-facing aspects.

Scientific name	Common name	Habitat details
<i>Harpanthus flotovianus</i>	great mountain flapwort liverwort	Bogs and fens; mostly on humus, soil covered rocks, and decaying wood in forests. Site on Umatilla NF is in a sub-alpine meadow, surrounded by subalpine fir and spruce forest.
<i>Helodium blandowii</i>	Blandow's feather moss, wet plume moss	Bogs and marshes. In montane fens, usually with calcareous ground water. Sometimes under sedges or shrubs in mires. Bogs, fens, wet meadows, and stream sides. Shady sites to full sun. Wet boggy areas, seepage areas around alpine lakes.
<i>Jungermannia polaris</i>	Arctic flapwort (liverwort)	In permanent seeps, thin soil over calcareous rocks. In ultraoligotrophic lakes. Forming mats or hidden among other bryophytes, over peaty soils on damp ledges and crevices of rocks, sometimes along streams, or aquatic. Partial shade to full exposure.
<i>Kobresia myosuroides</i>	Bellard's kobresia	Tundra, grassland, heaths, bare rocky, dry to wet ground. Moist meadows, seeps, riparian areas. Often above timberline; high elevations only.
<i>Lophozia gillmanii</i>	Gillman's pawwort (liverwort)	On peaty soil, usually on cliffs or ledges; obligate calciphile? Mossy, constantly-irrigated basic rock ledges and in mossy base-rich flushes and rocks by streams. On granite derived substrates on the Umatilla NF.
<i>Lycopodium complanatum</i>	ground-cedar	Dry open coniferous or mixed dry to wet forest slopes, or in riparian areas. Often on rotting logs, or in thick duff. Reportedly also in meadows and on open ridge tops.
<i>Peltolepis quadrata</i>	shieldscale liverwort	Forming small mats on moist, exposed to shady soil or on ledges and crevices on talus slopes and outcrops. Usually calciphile, also igneous & ultramafic rocks. Cold forest to white bark pine types.
<i>Preissia quadrata</i>	blister ribbon, narrow mushroom-headed liverwort	On soil w/little organic matter, typically on ledges or cliffs. On Malheur National Forest in peaty fen. Shaded creeks, seeps, splash zones. Terrestrial, on damp mineral soil; reportedly a strict calciphile, but not in Columbia Gorge. In thin soil over calcareous rocks.
<i>Pseudocalliergon trifarium</i>	blunt water moss, worm moss	Forming lawns or intermixed with other bryophytes in medium to rich montane fens; grows submerged to emergent in pools or on saturated ground; usually in full sunlight. Fen pools may dry up in late summer.
<i>Ptilidium pulcherrimum</i>	blunt water moss, worm moss	Forming low, dense mats at the base of trees, on decaying wood, among boulders in talus, ledges of cliffs, and rarely on soil, in cool moist habitats. Perennially moist tree bases, rotten logs, and on rocks, cliffs, and ledges.
<i>Salix farriae</i>	blunt water moss, worm moss	Wet meadows, stream banks, moderate to high elevations.
<i>Salix wolfii</i> var. <i>idahoensis</i>	Wolf's willow	Riparian, wet meadows, waterfalls, stream-sides, moist shrub lands; moderate to high elevations.
<i>Saxifraga adscendens</i> ssp. <i>oregonensis</i>	wedge-leaved saxifrage	Rock crevices, glacial moraines, alpine meadows, along streams. Damp cliffs where soil has accumulated. High elevations only. Sites in Wallowas are on limestone, reported also on quartzite and gneiss in Idaho. Needs some amount of moisture.
<i>Schistidium cinclidodonteum</i>	schistidium moss	Grows in large clumps on wet or dry rocks, or in soil in crevices of rocks and boulders, often along intermittent streams.
<i>Tortula mucronifolia</i>	mucron-leaf tortula moss	Forming small turfs or cushions on soil, calcareous soil, silt, tree roots, sheltered ledges and crevices of outcrops, cliffs. Reportedly calciphile, but on acid rocks as well. In cold forest and Populus riparian forests. Soil or rock.
<i>Trollius albiflorus</i>	American globeflower	Open, wet places, more or less acidic soils, montane to alpine. Seeps, springs, and vernal wet swales in spruce/fir forest.

Table B- 6. Subalpine dry areas plant

Scientific name	Common name	Habitat details
<i>Anastrophyllum minutum</i>	tiny notchwort liverwort	Peaty soil, at high elevations. Associated with other bryophytes in tight mats. On wet soil, rocky ledges, or on wet rocks in sub alpine or alpine zones. Usually north-facing exposures.
<i>Anthelia julacea</i>	alpine silverwort liverwort	Arctic-alpine habitats. Terrestrial on peaty soil, in Oregon associated with ericaceous shrubs. On rock surfaces, wet rock surfaces, and dry soil. Sphagnum springs, edges of streams, in mires.
<i>Barbilophozia lycopodioides</i>	giant fourpoint, maple liverwort	Peaty soil or decomposed organic detritus on damp ledges of rock outcrops and cliffs at higher elevations. Acid soil or soil-covered rocks. Not necessarily on mineral soil. Sites receive abundant snowfall.
<i>Botrychium ascendens</i>	upward-lobed moonwort	Moist meadows, riparian zones, moist roadsides, openings in cold forests. Often in calcareous soils, but not always. Lower montane, mesic coniferous forest, and grassy fields. Often on the drier edges of wet meadows.
<i>Botrychium crenulatum</i>	crenulate moonwort	Local in marshy or springy areas. Moist meadows, riparian zones, moist roadsides, openings in cold forests. Often in calcareous soils, but not necessarily.
<i>Botrychium hesperium</i>	western moonwort	Grassy mountain slopes, snow fields, and road ditches, w/willows, and sand dunes . Moist meadows, riparian, moist roadsides, openings and edges of forests. Often on calcareous soils. Sometimes found in roadside ditches and at edges of lakes.
<i>Botrychium lineare</i>	slender moonwort	Usually in and around the edges of wet meadows, in riparian areas, and moist roadside ditches. Forest types include moderate elevation mesic forests up to lodge pole pine and subalpine fir forests.
<i>Botrychium lunaria</i>	common moonwort	Open fields, occasionally forest in southern occurrences. Moist meadows, riparian zones, moist roadsides, openings and edges of cold forests.
<i>Botrychium paradoxum</i>	twin-spiked moonwort	In snowfields, secondary growth of pastures. Moist meadows, riparian zones, moist roadsides. Montane to sub alpine grasslands or forb dominated meadows. In openings and on edges of cold coniferous forests.
<i>Botrychium pedunculosum</i>	stalked moonwort	Brushy secondary-growth habitats along streams and roadsides. Moist meadows, riparian zones, moist roadsides. Sometimes in openings or on edges of cold coniferous forest.
<i>Bryum calobryoides</i>	Bryum moss	On protected to exposed rock at moderate to high elevations. Can also grow on moist soil.
<i>Bupleurum americanum</i>	American thorough-wax	Sub-alpine talus slopes, rocky soils, dry meadows, ridge tops. Sometimes in a mosaic of open areas, and scrubby coniferous forest. Generally north to northwest aspect. Coarse gravel; granodiorite and basaltic lithosols.
<i>Carex media</i>	Scandinavian sedge	Montane to subalpine meadows, streambanks, seepage areas, bog margins. Mossy, moist forests.
<i>Carex micropoda</i>	timberline sedge	Moist alpine meadows and snowmelt basins, areas irrigated by meltwater. In cracks between rocks on talus fields near alpine lakes. Mainly where heavy snow cover protects from extreme cold temperatures, prevents competition, and provides summer moisture.
<i>Carex nardina</i>	spikenard sedge	Dry alpine ridges and slopes, abrasion plateaus, dry tundra, heaths, and fellfields. Usually at, or above, timberline.

Scientific name	Common name	Habitat details
<i>Carex pelocarpa</i>	dusky-seed sedge	Dry alpine slopes, ridges, boulder fields, talus slopes, and on rocky streamsides in damp but well-drained soils, usually w/no competing vegetation.
<i>Carex subnigricans</i>	dark mountain sedge	Moist rocky slopes and meadows, subalpine to alpine areas.
<i>Carex vernacula</i>	foetid or native sedge	Alpine and subalpine wet meadows, rocky slopes, edges of headwater streams and lakeshores. Moist forest openings just below treeline.
<i>Cheilanthes feei</i>	Fee's lip fern	Cliff crevices, especially on limestone. On dry limestone influenced cliffs (sometimes basalt), from low elevations in deep canyons to high in sub-alpine.
<i>Cymopterus nivalis</i>	snowline cymopterus	Open rocky places. Moderate to high elevations. Found on volcanic tuffs and bald areas with less than 30% vegetation cover. <i>Artemisia arbuscula</i> is a common associate.
<i>Encalypta brevipes</i>	candle snuffer moss, stubby extinguisher moss	Soil on ledges and in crevices on cliffs, igneous and siliceous substrates. Sites may be subject to frequent fog penetration.
<i>Harpanthus flotovianus</i>	great mountain flapwort liverwort	Bogs and fens; mostly on humus, soil covered rocks, and decaying wood in forests. Site on Umatilla NF is in a sub-alpine meadow, surrounded by subalpine fir and spruce forest.
<i>Jungermannia polaris</i>	Arctic flapwort (liverwort)	In permanent seeps, thin soil over calcareous rocks. In ultraoligotrophic lakes. Forming mats or hidden among other bryophytes, over peaty soils on damp ledges and crevices of rocks, sometimes along streams, or aquatic. Partial shade to full exposure.
<i>Kobresia myosuroides</i>	Bellard's kobresia	Tundra, grassland, heaths, bare rocky, dry to wet ground. Moist meadows, seeps, riparian areas. Often above timberline; high elevations only.
<i>Lomatium erythrocarpum</i>	red-fruited desert-parsley	Ridges, fine argillite talus, open slopes. Mostly on steep slopes, with very little vegetation. Often w/alpine knotweed (<i>Aconogonon phytolaccaefolium</i>). Most populations are south or east facing. High elevations.
<i>Lophozia gillmanii</i>	Gillman's pawwort (liverwort)	On peaty soil, usually on cliffs or ledges; obligate calciphile? Mossy, constantly-irrigated basic rock ledges and in mossy base-rich flushes and rocks by streams. On granite derived substrates on the Umatilla NF.
<i>Lycopodium complanatum</i>	ground-cedar	Dry open coniferous or mixed dry to wet forest slopes, or in riparian areas. Often on rotting logs, or in thick duff. Reportedly also in meadows and on open ridge tops.
<i>Peltolepis quadrata</i>	shieldscale liverwort	Forming small mats on moist, exposed to shady soil or on ledges and crevices on talus slopes and outcrops. Usually calciphile, also igneous & ultramafic rocks. Cold forest to white bark pine types.
<i>Phlox hendersonii</i>	Henderson's phlox	Alpine fell fields, open gravelly slopes and ridges. Glacial moraines. Exposed, rocky places.
<i>Pinus albicaulis</i>	whitebark pine	Subalpine, usually near timberline. Usually fairly dry sites with thin, rocky, cold soils.
<i>Preissia quadrata</i>	blister ribbon, narrow mushroom-headed liverwort	On soil w/little organic matter, typically on ledges or cliffs. On Malheur National Forest in peaty fen. Shaded creeks, seeps, splash zones. Terrestrial, on damp mineral soil; reportedly a strict calciphile, but not in Columbia Gorge. In thin soil over calcareous rocks.
<i>Ptilidium pulcherrimum</i>	blunt water moss, worm moss	Forming low, dense mats at the base of trees, on decaying wood, among boulders in talus, ledges of cliffs, and rarely on soil, in cool

Scientific name	Common name	Habitat details
		moist habitats. Perennially moist tree bases, rotten logs, and on rocks, cliffs, and ledges.
<i>Saxifraga adscendens</i> ssp. <i>oregonensis</i>	wedge-leaved saxifrage	Rock crevices, glacial moraines, alpine meadows, along streams. Damp cliffs where soil has accumulated. High elevations only. Sites in Wallowas are on limestone, reported also on quartzite and gneiss in Idaho. Needs some amount of moisture.
<i>Schistidium cinclidodonteum</i>	schistidium moss	Grows in large clumps on wet or dry rocks, or in soil in crevices of rocks and boulders, often along intermittent streams.
<i>Tortula mucronifolia</i>	mucron-leaf tortula moss	Forming small turfs or cushions on soil, calcareous soil, silt, tree roots, sheltered ledges and crevices of outcrops, cliffs. Reportedly calciphile, but on acid rocks as well. In cold forest and Populus riparian forests. Soil or rock.

Table B- 7. Lithosols (scablands)

Scientific name	Common name	Habitat details
<i>Achnatherum hendersonii</i>	Henderson's ricegrass	Basalt lithosols; shallow rocky soils, sometimes w/stiff sage, strict buckwheat, and Ponderosa pine surrounding. Can be in deeper-soiled areas than Wallowa ricegrass.
<i>Achnatherum wallowaense</i>	Wallowa ricegrass	Basalt lithosols; shallow rocky soils, sometimes w/stiff sage, strict buckwheat, and Ponderosa pine surrounding.
<i>Eleocharis bolanderi</i>	Bolander's spike-rush	Vernally wet swales, along intermittent streams, wet depressions in moist meadows and lithosols. In slight depressions that hold snow later in the season than surrounding areas. Surrounding forest is usually ponderosa pine. Habitat and plants are dry by mid-summer.
<i>Eremothera pygmaea</i>	dwarf evening-primrose	Dry plains and slopes with unstable soils or in gravel in steep talus, dry washes, banks, and road cuts. Open, bare ground. Sometimes w/big sage or bitterbrush.
<i>Eriogonum cusickii</i>	Cusick's buckwheat	Rocky sagebrush desert. Barren flats and hills w/dry soil over weathered basalt and welded tuff. Associated species include low sage and juniper. Only suspected on Emigrant Creek RD.
<i>Texosporium sancti-jacobi</i>	woven spore lichen	Arid to semi-arid shrub-steppe, grassland or savannah. Warm, dry sites w/silty or rocky soils. On flat to gentle north facing slopes in arid areas. Often on decomposing bunchgrass bases, dead Selaginella, or on mammal scat (rabbit).

Table B- 8. Barren unusual soils

Scientific name	Common name	Habitat details
<i>Artemisia arbuscula</i> ssp. <i>longicaulis</i>	Lahontan sagebrush	Shallow, clay soils with low available water-holding capacity, aridic-mesic soils. Areas with 5-12 inches precipitation per year. Probably only on extreme southern end of Malheur National Forest.
<i>Chaenactis xantiana</i>	desert chaenactis	Dry, open places, deep, loose sandy soil or on dunes, less often on gravelly soil. In sagebrush steppe areas. Only suspected for Emigrant Creek RD.
<i>Eriogonum cusickii</i>	Cusick's buckwheat	Rocky sagebrush desert. Barren flats and hills w/dry soil over weathered basalt and welded tuff. Associated species include low sage and western juniper.
<i>Eriogonum salicornioides</i>	playa or saltwort buckwheat	On sparsely vegetated, open, ash deposits and clayey substrates, sometimes in disturbed areas. Saltbush, greasewood, and sagebrush communities; juniper woodlands possibly surrounding.

Scientific name	Common name	Habitat details
<i>Heliotropium curassavicum</i>	salt heliotrope	Wet ground, saline flats, and alkaline soils. Dried edges and centers of vernal pools. Low to moderate elevations. Probably only on Emigrant Creek RD.
<i>Lupinus lepidus</i> var. <i>cusickii</i>	Cusick's lupine	Residual soils from ancient lakebeds, volcanic ash and clay soils. Barren tuffaceous or gravelly clay bluffs and gullied riverbanks. Plants often in eroded drainage channels.
<i>Stanleya confertiflora</i>	biennial stanleya	Dry plains and low sand or clay hills. On barren clay and diatomaceous soils in sagebrush habitats. Tuffaceous sedimentary rocks on geology layer. Sometimes with juniper.
<i>Thelypodium eucosmum</i>	arrow-leaf thelypody	Under and around western juniper, ponderosa pine, and Douglas-fir trees; in canyons, seasonal creek drainages, and seeps/springs. Also found in vernal moist areas in ponderosa pine forests and in sage. Restricted to serpentine and ultramafic derived soils on Malheur National Forest.

Table B- 9. Sagebrush steppe

Scientific name	Common name	Habitat details
<i>Amanita prairicola</i>		In eastern Oregon associated with <i>Artemisia</i> , <i>Sarcobatus vermiculatus</i> , <i>Chrysothamnus nauseosus</i> and <i>Myosurus aristata</i> .
<i>Artemisia arbuscula</i> ssp. <i>longicaulis</i>	Lahontan sagebrush	Shallow, clay soils with low available water-holding capacity, aridic-mesic soils. Areas with 5-12 inches precipitation per year. Probably only on extreme southern end of Malheur National Forest.
<i>Astragalus tegetarioides</i>	Deschutes milkvetch	Dry pine forest, sagebrush flats, on volcanic ash or basaltic substrates, cracks of welded tuff outcrops. In transition zone between sagebrush and ponderosa pine forest. Endemic to Emigrant Creek Ranger District (and west).
<i>Calyptridium roseum</i>	rosy calyptridium	Sagebrush desert to montane coniferous forest. Gravelly to sandy soils, often in low moist swales among sagebrush. Often in alkaline soils. In areas w/low cryptogram cover. Historic Malheur National Forest site is in dry ponderosa pine site (wetter microsite?).
<i>Chaenactis xantiana</i>	desert chaenactis	Dry, open places, deep, loose sandy soil or on dunes, less often on gravelly soil. In sagebrush steppe areas. Only suspected for Emigrant Creek Ranger District.
<i>Eleocharis bolanderi</i>	Bolander's spike-rush	Vernally wet swales, along intermittent streams, wet depressions in moist meadows and lithosols. In slight depressions that hold snow later in the season than surrounding areas. Surrounding forest is usually ponderosa pine. Habitat and plants are dry by mid-summer.
<i>Eremothera pygmaea</i>	dwarf evening-primrose	Dry plains and slopes with unstable soils or in gravel in steep talus, dry washes, banks, and road cuts. Open, bare ground. Sometimes w/big sage or bitterbrush.
<i>Eriogonum cusickii</i>	Cusick's buckwheat	Rocky sagebrush desert. Barren flats and hills w/dry soil over weathered basalt and welded tuff. Associated species include low sage and western juniper.
<i>Eriogonum salicornioides</i>	playa or saltwort buckwheat	On sparsely vegetated, open, ash deposits and clayey substrates, sometimes in disturbed areas. Saltbush, greasewood, and sagebrush communities; juniper woodlands possibly surrounding.
<i>Stanleya confertiflora</i>	biennial stanleya	Dry plains and low sand or clay hills. On barren clay and diatomaceous soils in sagebrush habitats. Tuffaceous sedimentary rocks on geology layer. Sometimes with juniper.

<i>Texosporium sancti-jacobi</i>	woven spore lichen	Arid to semi-arid shrub-steppe, grassland or savannah. Warm, dry sites w/silty or rocky soils. On flat to gentle north facing slopes in arid areas. Often on decomposing bunchgrass bases, dead Selaginella, or on mammal scat (rabbit).
<i>Thelenella muscorum</i> var. <i>octospora</i>	Chromatochlamys lichen	Component of biological crust communities in semi-arid shrub steppe and grasslands.
<i>Thelypodium eucosmum</i>	arrow-leaf thelypody	Under and around western juniper, ponderosa pine, and Douglas-fir trees; in canyons, seasonal creek drainages, and seeps/springs. Also found in vernal moist areas in ponderosa pine forests and in sage. Restricted to serpentine and ultramafic rocks on Malheur National Forest.

Table B- 10. Low to moderate elevation cliffs, rock outcrops, and talus

Scientific name	Common name	Habitat details
<i>Bryum calobryoides</i>	Bryum moss	On protected to exposed rock at moderate to high elevations. Can also grow on moist soil.
<i>Carex cordillerana</i>	cordilleran sedge	Riparian terraces, mesic forests, with grand fir and Douglas-fir. Aspen forests. Rocky slopes, in leaf litter and duff. In rocky areas with juniper and mountain mahogany on Malheur National Forest. Near ephemeral streams in steep ravines in Hells Canyon National Recreation Area.
<i>Carex scirpoidea</i> ssp. <i>stenochlaena</i>	Alaskan single-spiked sedge	Moist meadows, streambanks, and rocky slopes. Beside waterfalls, and on seepy cliffs. Somewhat acidic substrates.
<i>Cheilanthes feei</i>	Fee's lip fern	Cliff crevices, especially on limestone. On dry limestone influenced cliffs (sometimes basalt), from low elevations in deep canyons to high in sub-alpine.
<i>Cryptogramma stelleri</i>	Steller's rock-brake	Sheltered calcareous cliff crevices and rock ledges, typically in coniferous or boreal forest. On wet cliffs, and ledges, along streams, under waterfalls. Limestone substrate. Shady sites. Usually north-facing aspects.
<i>Encalypta brevipes</i>	candle snuffer moss, stubby extinguisher moss	Soil on ledges and in crevices on cliffs, igneous and siliceous substrates. Sites may be subject to frequent fog penetration.
<i>Enthosthodon fascicularis</i>	banded cord-moss	On seasonally wet, exposed soil in seeps, or along intermittent streams. Grasslands, grassy balds, and rock outcrops. Usually hidden among grasses, other mosses, and litter.
<i>Eremothera pygmaea</i>	dwarf evening-primrose	Dry plains and slopes with unstable soils or in gravel in steep talus, dry washes, banks, and road cuts. Open, bare ground. Sometimes w/big sage or bitterbrush.
<i>Jungermannia polaris</i>	Arctic flapwort (liverwort)	In permanent seeps, thin soil over calcareous rocks. In ultraoligotrophic lakes. Forming mats or hidden among other bryophytes, over peaty soils on damp ledges and crevices of rocks, sometimes along streams, or aquatic. Partial shade to full exposure.
<i>Lophozia gillmanii</i>	Gillman's pawwort (liverwort)	On peaty soil, usually on cliffs or ledges; obligate calciphile? Mossy, constantly-irrigated basic rock ledges and in mossy base-rich flushes and rocks by streams. On granite derived substrates on the Umatilla NF.
<i>Luina serpentina</i>	colonial luina	Open, rocky sites with poor soil development. Usually on steep slopes, above small tributaries. In dry shrub, open juniper, ponderosa pine, and Douglas-fir forest areas.
<i>Muhlenbergia minutissima</i>	annual or little-seed muhly grass	Sandy soils on riverbanks, moist meadows, pond shores and edges of reservoirs. Open, rocky and apparently dry slopes also. Open, more or less disturbed, sandy slopes, and seeps.

Scientific name	Common name	Habitat details
<i>Pellaea bridgesii</i>	Bridge's cliff-brake	Rocky slopes and cliffs, on granitic substrate. Talus slopes, scree, rock outcrops; often on southern exposures on argillite in Wallowa and Blue Mountains.
<i>Phlox multiflora</i>	many-flowered phlox	Basalt cliffs, rocky outcrops and bluffs, rocky openings and wooded rocky areas in dry forest. Sometimes on loose substrate as well as cracks in cliffs and rock outcrops. Highest elevation in OR is 4,800 ft., however found higher up in Rocky Mountains.
<i>Preissia quadrata</i>	blister ribbon, narrow mushroom-headed liverwort	On soil w/little organic matter, typically on ledges or cliffs. On MAL NF in peaty fen. Shaded creeks, seeps, splash zones. Terrestrial, on damp mineral soil; reportedly a strict calciphile, but not in Columbia Gorge. In thin soil over calcareous rocks.
<i>Ptilidium pulcherrimum</i>	blunt water moss, worm moss	Forming low, dense mats at the base of trees, on decaying wood, among boulders in talus, ledges of cliffs, and rarely on soil, in cool moist habitats. Perennially moist tree bases, rotten logs, and on rocks, cliffs, and ledges.
<i>Schistidium cinclidodonteum</i>	schistidium moss	Grows in large clumps on wet or dry rocks, or in soil in crevices of rocks and boulders, often along intermittent streams.
<i>Schistidium flaccidum</i>	Toothless goblet grimmia	Rock in open to shaded habitats at 4500-9600 feet elevation.
<i>Schistidium heterophyllum</i>	Heteropholous schistidium	Rock in open to shaded from 900 to 3600 feet elevation.
<i>Schistidium tenerum</i>	schistidium moss	Exposed dry rock outcrops and moist shaded soil in crevices at elevations between 5700 and 6700 feet.
<i>Schistostega pennata</i>	schistostega moss	In soil on root wads of fallen trees; on damp, acidic rock, soil and decaying wood. On soil, in dark places, such as openings of caves and mine shafts, crevices, overhangs. Often pioneer on disturbed soil. In ID, on rootwads sometimes in sunny areas.
<i>Tetraphis geniculata</i>	tetraphis moss	On the cut ends and sides of well decayed logs and stumps (class 3-5), occasionally on peaty banks; moist coniferous forests. Rarely on rocks. In mature to late seral forests with closed canopies. Found from sea level to subalpine elevations.
<i>Tortula mucronifolia</i>	mucron-leaf tortula moss	Forming small turfs or cushions on soil, calcareous soil, silt, tree roots, sheltered ledges and crevices of outcrops, cliffs. Reportedly calciphile, but on acid rocks as well. In cold forest and Populus riparian forests. Soil or rock.

Table B- 11. Aquatic habitats

Scientific name	Common name	Habitat details
<i>Elatine brachysperma</i>	short-seeded waterwort	Growing on mudflats, shallow pools, and edges of ponds. Freely rooting in mud.
<i>Heliotropium curassavicum</i>	salt heliotrope	Wet ground, saline flats, alkaline soils. Dried edges and centers of vernal pools. Low to moderate elevations.
<i>Jungermannia Polaris</i>	Arctic flapwort (liverwort)	In permanent seeps, thin soil over calcareous rocks. In ultraoligotrophic lakes. Forming mats or hidden among other bryophytes, over peaty soils on damp ledges and crevices of rocks, sometimes along streams, or aquatic. Partial shade to full exposure.
<i>Pleuropogon oregonus</i>	Oregon semaphore grass	Open, wet meadows, marshes, and riparian areas. Grows in areas of standing or flowing water early in season. Documented sites not near forested habitats. Sluggish water in depressions and sloughs, irrigation ditches.

Scientific name	Common name	Habitat details
<i>Potamogeton diversifolius</i>	diverse-leaf pondweed	Aquatic; shallow creeks and ponds. Shallow water, ditches, ponds, lakes.
<i>Pseudo-calliergon trifarium</i>	blunt water moss, worm moss	Forming lawns or intermixed with other bryophytes in medium to rich montane fens; grows submerged to emergent in pools or on saturated ground; usually in full sunlight. Fen pools may dry up in late summer.
<i>Rotala ramosior</i>	lowland toothcup	Damp areas in fine silt and sand, wet swampy places, mudflats, lake and pond margins, and along free-flowing river reaches.
<i>Utricularia minor</i>	lesser bladderwort	Aquatic plant. Shallow ponds, slow-moving streams, and wet sedge or rush meadows. Often w/bulrush and other bladderworts. Occurs in low-nutrient lakes and peat bogs.

Table B- 12. Peatlands (including fens)

Scientific name	Common name	Habitat details
<i>Anastrophyllum minutum</i>	tiny notchwort liverwort	Peaty soil, at high elevations. Associated with other bryophytes in tight mats. On wet soil, rocky ledges, or on wet rocks in sub alpine or alpine zones. Usually on north-facing exposures.
<i>Anthelia julacea</i>	alpine silverwort liverwort	Arctic-alpine habitats. Terrestrial on peaty soil, in Oregon associated w/ericaceous shrubs. On rock surfaces, wet rock surfaces, and dry soil. Sphagnum springs, edges of streams, in mires.
<i>Barbilophozia lycopodioides</i>	giant fourpoint, maple liverwort	Peaty soil or decomposed organic detritus on damp ledges of rock outcrops and cliffs at higher elevations. Acid soil or soil-covered rocks. Not necessarily on mineral soil. Sites receive abundant snowfall.
<i>Botrychium montanum</i>	mountain moonwort	Dark, coniferous forests, usually near swamps and streams. Wet meadows, saturated soils. Often growing in a bed of mosses. This species tends to grow in wetter sites than the other Botrychiums.
<i>Carex diandra</i>	lesser panicled sedge	Bogs and fens, floating peat mats, lake and pond shores, springs, seeps. Sometimes in brackish water. Groundwater dependent ecosystems, usually on peat soils. Wettest nonaquatic microsites in fens, pH usually between 6 and 8.
<i>Carex lasiocarpa</i>	slender woolly sedge	Fens, bogs, lakeshores, streambanks, seepage areas, and wet meadows. In deep, organic acid soils with low to moderate nutrients. Sometimes forming floating mats.
<i>Carex media</i>	Scandinavian sedge	Montane to subalpine meadows, streambanks, seepage areas, bog margins. Mossy, moist forests.
<i>Carex saxatilis</i>	limestone or russet sedge	Fens, bogs, lakeshores, wet tundra, roadside ditches, ponds, and slow moving streams; often in shallow water. Always at high elevations. In areas with peaty soils.
<i>Carex scirpoidea ssp. stenochlaena</i>	Alaskan single-spiked sedge	Moist meadows, streambanks, and rocky slopes. Beside waterfalls and on seepy cliffs. Somewhat acidic substrates.
<i>Harpanthus flotovianus</i>	great mountain flapwort liverwort	Bogs and fens; mostly on humus, soil covered rocks, and decaying wood in forests. Site on Umatilla NF is in a sub-alpine meadow, surrounded by subalpine fir and spruce forest.
<i>Helodium blandowii</i>	Blandow's feather moss, wet plume moss	Bogs, fens, and marshes. In montane fens, usually with calcareous ground water. Sometimes under sedges or shrubs in mires. Wet meadows, and stream sides. Shady sites to full sun. Seepage areas around alpine lakes.

Scientific name	Common name	Habitat details
<i>Meesia uliginosa</i>	Meesia moss	Fens, bogs, rock fissures, moderate to high elevations. Forming tufts in medium to rich montane fens on saturated ground, or on tree roots or logs; usually in full sun. Sub-alpine to mixed conifer forests.
<i>Preissia quadrata</i>	blister ribbon, narrow mushroom- headed liverwort	On soil w/little organic matter, typically on ledges or cliffs. On MAL NF in peaty fen. Shaded creeks, seeps, splash zones. Terrestrial, on damp mineral soil; reportedly a strict calciphile, but not in Columbia Gorge. In thin soil over calcareous rocks.
<i>Pseudo-calliergon trifarium</i>	blunt water moss, worm moss	Forming lawns or intermixed with other bryophytes in medium to rich montane fens; grows submerged to emergent in pools or on saturated ground; usually in full sunlight. Fen pools may dry up in late summer.
<i>Splachnum ampullaceum</i>	purple-vased stink moss, small capsule dung moss	Forming green sod on old dung of herbivores, or on soil enriched by dung, in peatlands, fens, or other wetlands. On soil and decaying animal matter in wet places.
<i>Tomentypnum nitens</i>	tomentypnum moss	In medium to rich montane fens, forming loose to dense sods. Plants grow in slightly elevated sites within wetter areas (on logs, stumps, hummocks). Found in calcareous, and also, pumice rich soils.