

Biological Evaluation Sensitive Plants

For Revised Land and Resource Management Plan

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for:

Shoshone National Forest
Rocky Mountain Region

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Biological Evaluation (Sensitive Plants) For Revised Land and Resource Management Plan Shoshone National Forest

Introduction

This biological evaluation (BE) discloses the potential influences of the Shoshone National Forest Revised Land Management Plan (Revised Forest Plan) on Forest Service Rocky Mountain Region (Region 2) sensitive species. The list of Region 2 regional forester sensitive species was updated on May 25, 2011.

The Forest Service Manual (FSM) directs the Forest Service to develop and implement management practices to ensure that sensitive species do not become threatened or endangered because of Forest Service actions (FSM 2670.22). Sensitive species are those plant and animal species identified by a regional forester for which population viability is a concern as evidenced by (a) significant current or predicted downward trends in population numbers or density or (b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5).

The FSM directs the Forest Service to prepare biological evaluations for projects, as part of the National Environmental Policy Act of 1969, to determine the potential effects from those projects on sensitive species and to ensure that Forest Service actions do not contribute to loss of viability of threatened, endangered, proposed, or sensitive plant and animal species, or contribute to a trend towards federal listing of any species under the Endangered Species Act (FSM 2672.41 and 2670.32). A biological evaluation is defined as a documented review of Forest Service programs or activities in sufficient detail to determine how an action or proposed action may affect any sensitive species (FSM 2670.5). A separate biological assessment was not needed due to the absence of any threatened, endangered and proposed plant species.

A review of information regarding distribution, habitat information, areas of known occupancy, population data, and fieldwork over the past several years has been incorporated. Sources of information include Wyoming Natural Diversity Database (WYNDD), the Rocky Mountain Herbarium, and Region 2 sensitive plant species conservation assessments and evaluations. Forest plant lists were derived from extensive botanical work conducted by the Rocky Mountain Herbarium and by WYNDD since the 1986 Forest Plan as amended. This work has resulted in approximately 50,000 voucher specimens representing approximately 1,688 vascular plant taxa. Recently started inventory work on the non-vascular (bryophytes) of the Shoshone National Forest (the Shoshone or Forest) has to date yielded approximately 200 taxa. Knowledge of fungi species on the Forest is limited.

Project Area

The project area is the Shoshone National Forest boundary; located in the middle Rocky Mountains in northwestern Wyoming (see figure 1).

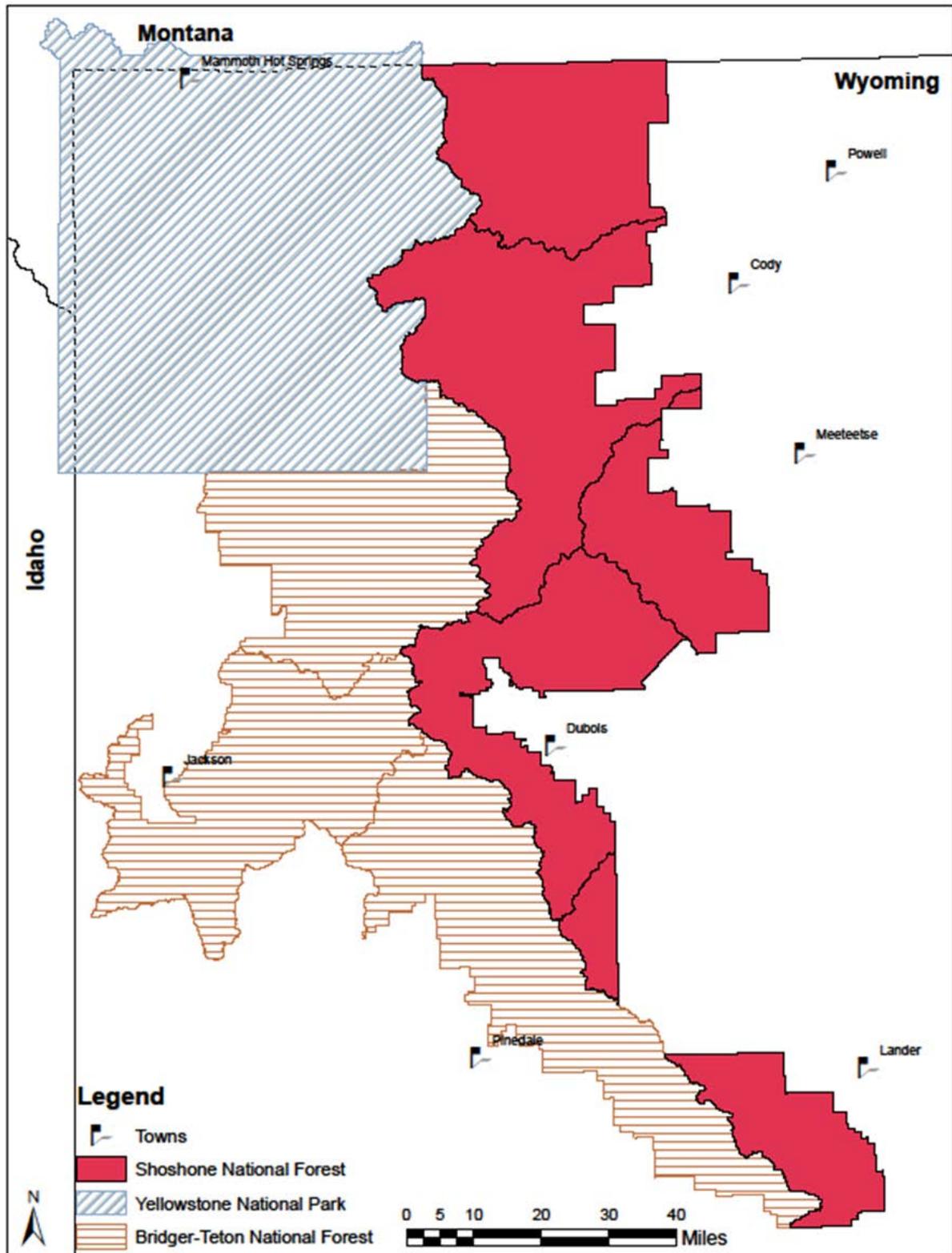


Figure 1. Shoshone National Forest, planning area boundary

The Shoshone consists of 2.4 million acres in Fremont, Hot Springs, Park, Sublette, and Teton Counties. The Shoshone National Forest is part of the Greater Yellowstone Area. The Greater Yellowstone Area consists of about 13 million acres of public lands managed by the USDA Forest Service, National Park Service, and U.S. Fish and Wildlife Service. It includes six national forests (Beaverhead-Deerlodge, Bridger-Teton, Caribou-Targhee, Custer, Gallatin, and Shoshone), three national parks (Grand Teton, Yellowstone, and John D. Rockefeller, Jr. Memorial Parkway), and two national wildlife refuges (National Elk Refuge and Red Rock Lakes). The Greater Yellowstone Area is one of the last remaining large, nearly intact ecosystems in the northern temperate zone.

On the Shoshone, terrain varies widely from sagebrush flats to rugged mountains because the Forest is situated on the western edge of the Great Plains and the eastern side of the continental divide. Elevations on the Shoshone range from 4,600 feet at the mouth of Clarks Fork Canyon to 13,804 feet on Gannett Peak, Wyoming's highest point. The higher mountains are snow-clad most of the year with immense areas of exposed rock interspersed with meadows and forests.

Most of the Shoshone is within the upper Missouri River Basin, subdivided by the Wind/Big Horn and Clarks Fork of the Yellowstone River basins. The southern tip of the Shoshone is in the Sweetwater drainage, which flows into the Platte River system. Principal rivers within the Shoshone boundary are the Clarks Fork of the Yellowstone River, North and South Forks of the Shoshone River, and the Greybull, Wind/Big Horn, and Popo Agie Rivers.

Annual precipitation varies with topography and elevation, ranging from 15 to 70 inches. The higher elevations receive from 30 to 40 percent of their annual precipitation during the winter in the form of snow, roughly 40 percent as rain and snow in the spring, and 20 to 30 percent as rain in the summer and fall.

Numerous geological formations and elevation extremes contribute to plant community and species diversity. Significant habitat for rare plants exists in the Swamp Lake Botanical Area, Line Creek Research Natural Area (RNA), and proposed special interest areas (SIAs) and RNAs. These special areas are an essential component to conservation of rare plants on the Forest.

Description of Proposal

The 1986 Shoshone National Forest Land and Resource Management Plan as amended (1986 Forest Plan as amended) is being revised. Since 1986, the Forest Plan has been amended 14 times. Forest plans provide broad guidance and information needed for project and activity decision-making. This Revised Forest Plan will guide relevant resource management programs, practices, uses, and protection measures. The associated environmental impact statement (EIS) examines potential environmental effects that could occur as a result of implementing projects associated with the Revised Forest Plan.

The key decisions made in this integrated plan for long-term management of Shoshone are:

- It establishes Forest-wide multiple-use goals and objectives.
- It establishes Forest-wide standards and guidelines applying to future activities and resource integration requirements.
- It establishes management area direction (management area prescriptions) applying to future activities in a management area.

- It meets the requirements for additional planning for special areas unless inconsistent with special area authorities.
- It designates land as suited or not suited for timber production and other resource management activities such as rangeland and recreation management.
- It establishes monitoring and evaluation requirements.
- It recommends the establishment of wilderness, wild and scenic rivers, and other special designations to Congress, as appropriate.

Alternatives

Six revision or issue topics (listed below) drove the development of the original six alternatives (A through F). A seventh alternative (G) was developed after public comment and has been selected as the preferred alternative. All of the alternatives were analyzed in this biological evaluation.

Issue 1. Recreation Uses and Opportunities.

Issue 2. Special Areas and Designations.

Issue 3. Vegetation Management.

Issue 4. Wildlife Habitat Management.

Issue 5. Minerals.

Issue 6. Commercial Livestock Grazing.

The seven alternatives are summarized below.

Alternative A (No Action)

Alternative A is the continuation of present management under the existing 1986 Forest Plan and its amendments. It meets requirements of the National Environmental Policy Act that a no-action alternative be considered. “No action” means that current management practices based on existing forest plans and other management decision documents would continue.

Alternative B

Preliminary proposed action. Alternative B provides a balanced response to the issues raised during revision, continues management that is working, and adjusts, to the extent possible, to be responsive to the issues raised by the public.

Alternative C

High wilderness and back country non-motorized recreation. Alternative C demonstrates the most amount of land allocated for wilderness, with no motorized use in remaining inventoried roadless areas.

Alternative D

Back country and non-motorized emphasis. Alternative D provides back country and non-motorized uses, while maintaining moderate to low levels of commodity production. This alternative also addresses issues raised by the public and conservation groups.

Alternative E

Commodity and motorized use emphasis. Alternative E provides commodity production and motorized use while addressing issues shared by the public, local industry, and motorized user groups

Alternative F

High commodity and motorized use emphasis. Alternative F demonstrates the highest level of commodity production and motorized use possible within parameters, such as designated wilderness, the grizzly bear primary conservation area, etc.

Alternative G

Preferred alternative. This alternative describes the Revised Forest Plan that responds to the identified purpose and need. This alternative is a modified version of alternative B and was developed in response to public comment received on the draft environmental impact statement. The alternative provides a diversity of forest uses and emphasizes active management of suitable timber lands, protects wildlife habitat, and maintains the dominant back country character of the Forest.

Table BE- 1. Acres of management areas by alternative (thousands of acres)

Mgmt Area	Description	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
1.1	Wilderness	1,359	1,359	1,359	1,359	1,359	1,359	1,359
1.1A	Glacier Addition	6,563	6,563	6,563	6,563	6,563	6,563	6,563
1.2	Recmnd Wilderness			584,734	165,587			
1.2A	Recmnd High Lakes Wilderness			15,224				
1.2B	Recmnd Dunoir Wilderness			28,879	28,879			
1.3	Back Country Non-motorized	455,554	358,127	106,890	395,123	327,549	203,587	265,777
1.5A	Clarks Fork Wild River	6,924	6,924	3,350	6,924	6,924	6,924	6,924
1.6A	High Lakes WSA	15,224	15,224		15,224	15,224	15,224	15,224
1.6B	Dunoir SMU	28,879	28,879			28,879	28,879	28,879
2.2A	Line Creek RNA	1,278	1,278	186	1,278	1,278	1,278	1,278
2.3	Proposed RNA	1,386	12,127	4,298	15,201			13,831
3.1A	Swamp Lake SIA	581	581	581	581	581	581	581
3.1B	Proposed Little Popo Agie SIA		1,714	1,714	31,714			1,714
3.1C	Proposed Sawtooth Peatbeds SIA		648		648			407

Table BE- 1. Acres of management areas by alternative (thousands of acres)

Mgmt Area	Description	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
3.3A	Back Country Motorized	185,936	64,243	4,948	8,333	90,500	175,296	80,098
3.3B	Back Country Winter Motorized		86,413	3,157	75,068	43,485	5	185,879
3.3C	Back Country Summer Motorized		72,735	4,936	11,500	98,030	4,563	46,596
3.5	Back Country Rec & Restoration		66,427					
3.5A	Back Country Restoration Motorized	0	0	0	0	0	0	29,213
3.5B	Back Country Restoration Winter Motorized	0	0	0	0	0	0	8,025
3.5C	Back Country Restoration Summer Motorized	0	0	0	0	0	0	13,311
3.5D	Back Country Restoration Non-motorized	0	0	0	0	0	0	14,573
4.2	Travel Corridor	164,447	100,883	82,588	100,883	103,422	103,901	99,729
4.3	Back Country Access Corridor		13,982	5,120	13,947	8,775	3,349	14,051
4.5A	Proposed Kirwin SIA	481	481	481	481	481		4,603
5.1	Managed Forests & Rangelands	157,215	173,116	72,298	168,350	253,717	528,146	173,190
5.2	Public Water Supply		12,868	6,841	7,953	12,868		12,868
5.4	Managed Big Game Crucial Winter Range	54,972	55,005	145,505	553,983	79,935	0	54,978
8.2	Ski-based Resort		1,145	1,145	1,145	1,145	1,145	1,145
	Totals	2,438						

Sensitive Plant Species

The rare plant species included in the analysis are those that are either listed under the Endangered Species Act, are on the Rocky Mountain Region (Region 2) Regional Forester's Sensitive Species list, or plant species of local concern. No threatened or endangered, plant

species are known to occur on the Shoshone. There is one candidate plant species on the Forest, whitebark pine. Because of its candidate status, it is listed as a Region 2 sensitive plant.

Distribution, habitat information, and population data for each species are available from the Wyoming Natural Diversity Database (WYNDD), the Rocky Mountain Herbarium, and Region 2 sensitive plant species conservation assessments and evaluations. Species Conservation Assessments, evaluations, and rationale documents can be found in the Revised Forest Plan project records and at the following website: <http://www.fs.fed.us/r2/projects/scp/>.

Forest plant lists were derived from extensive botanical work conducted by the Rocky Mountain Herbarium and by WYNDD since the 1986 Forest Plan as amended. This work has resulted in nearly 50,000 voucher specimens representing approximately 1,690 vascular plant taxa. Recently started inventory work on the non-vascular (bryophytes) of the Shoshone has to-date yielded approximately 200 taxa. Knowledge of fungi species on the Forest is limited. Information from the Rocky Mountain Herbarium on Wyoming plants is found at the following website <http://www.rmh.uwyo.edu>. WYNDD information on Wyoming rare plants is found at the following website: <http://www.uwyo.edu/wyndd/>.

Table BE- 2. Rocky Mountain Region sensitive plant species on the Shoshone National Forest (documented)

Common name(s)	Global/state ranking ¹	Habitat
Sphagnum moss <i>Sphagnum angustifolium</i>	G5/S1	Fens
Triangle globe moonwort <i>Botrychium ascendens</i>	G2G3/S1	Riparian
A Roundleaf orchid <i>Mercurialis rotundifolia</i>	G5/S1	Fens
Lesser paniced sedge <i>Carex diandra</i>	G5/S2	Fens
Livid sedge <i>Carex livida</i>	G5/S2	Fens
Chamisso's bristlegrass <i>Eriophorum chamissonis</i>	G5/S2	Fens
Slender bristlegrass <i>Eriophorum gracile</i>	G5/S2	Fens
Hall's fescue <i>Festuca hallii</i>	G4/S2	Calcareous montane grasslands

¹ Conservation status ranks estimate a species' risk of elimination. Status ranks are based on a 1 to 5 scale, 1 denoting a species is critically impaired and 5 denoting a species is secure. Species status is assessed at three geographic scales: global (G), national (N), and state/province (S). The overall status of a species is denoted by its G-rank, while its condition in a particular country is denoted by its N-rank, and its condition in a particular state/province is denoted by its S-rank. State rank is assigned by Wyoming Natural Diversity Database (WYNDD) biologists and denotes a species probability of elimination in Wyoming. Subspecies, varieties, or any other designation below the level of a global ranked species, receives a T-rank that denotes their conservation status. A species may receive a B- or N-rank that refers to the conservation status of the breeding (B) or non-breeding (N) population in a particular nation or state/province. (NatureServe, February 2012, WYNDD February 2012).

Table BE- 2. Rocky Mountain Region sensitive plant species on the Shoshone National Forest (documented)

Common name(s)	Global/state ranking ¹	Habitat
Simple bog sedge <i>Kobresia simpliciuscula</i>	G5/S1	Fens
Wyoming tansymustard <i>Descurainia torulosa</i>	G5/S2	Volcanic rocky slopes and shrubland
English sundew <i>Drosera anglica</i>	G5/S2	Fens
Fremont's bladderpod <i>Lesquerella fremontii</i>	G2/S2	Calcareous rocky slopes and ridges
Kotzebue's grass of Parnassus <i>Parnassia kotzebuei</i>	G5/S2	Alpine
Absaroka Range beardtongue <i>Penstemon absarokensis</i>	G2/S2	Volcanic rocky slopes and montane shrubland
Greenland primrose <i>Primula egaliksensis</i>	G4/S1	Fens
Absaroka goldenweed <i>Pyrrocoma carthamoides</i> var. <i>subsquarrosa</i>	G4G5T2T3/S2	Calcareous montane grasslands
Tranquil goldenweed <i>Pyrrocoma clementis</i> var. <i>villosa</i>	G3G4/T2	Granitic montane grasslands
Entire-leaf goldenweed <i>Pyrrocoma integrifolia</i>	G3?/S1	Granitic montane grasslands
Ice cold buttercup <i>Ranunculus gelidus</i> ssp. <i>grayi</i>	G5/S1	Alpine
Barratt's willow <i>Salix barrattiana</i>	G5/S1	Alpine
Sageleaf willow <i>Salix candida</i>	G5/S2	Fens
Myrtle leaf willow <i>Salix myrtilifolia</i>	G5/S1	Fens
Shoshone carrot <i>Shoshonea pulvinata</i>	G2G3/S2	Calcareous Rocky slopes and ridges
North Fork Easter daisy <i>Townsendia condensate</i> var. <i>anomola</i>	G4T2/S2	Volcanic rocky slopes and shrubland
Lesser bladderwort <i>Utricularia minor</i>	G5/S2	Fens
Whitebark pine <i>Pinus albicaulis</i>	G3G4/S3	Subalpine Forests

The conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global, N = National, and S = Subnational). The numbers have the following meaning:

- 1 = critically imperiled
- 2 = imperiled
- 3 = vulnerable
- 4 = apparently secure
- 5 = secure.

For example, G1 would indicate that a species is critically imperiled across its entire range (i.e., globally). In this sense, the species as a whole is regarded as being at very high risk of extinction. A rank of S3 would indicate the species is vulnerable and at moderate risk within a particular state or province, even though it may be more secure elsewhere.

Significant habitat for rare plants exists in the Swamp Lake Botanical Area, Line Creek Research Natural Area, and proposed special interest areas and research natural areas. These special areas are an essential component for conserving rare plants on the Shoshone.

Environmental Consequences

Potential threats are defined as activities (Forest Service or otherwise) or natural conditions that currently or potentially have negative effects on the diversity of rare plant communities or their habitat. Threats can be divided into the following three types: direct (e.g., livestock grazing – trampling, herbivory; recreational activities – ORV, over snow travel, hiking and associated trampling), alteration of ecological factors (e.g., fire exclusion, insects, and disease), and habitat reduction (e.g., oil and gas exploration, road construction and reconstruction).

Rare Plant Habitat Groupings and General Effects

To efficiently disclose anticipated effects of alternatives, the 26 Region 2 sensitive plants were grouped into seven general habitat associations. These habitat groups include the following: fens / riparian; calcareous montane grasslands; Calcareous rocky slopes and ridges; volcanic rocky slopes / montane shrublands; granitic montane grasslands; alpine; and subalpine / krumholtz forests. Brief descriptions of the seven habitat groups follow.

Fens and riparian habitat

Fens are a type of wetland that occupy only a small percentage of the landscape, but represent an important element of biological diversity. Because of their water-holding capability and unique characteristics, fens provide very stable habitats and often support several globally rare plant and invertebrate species and unique species assemblages. In the Rocky Mountain Region, fens are usually ground-water driven and are dominated by wetland plants. Fens are generally characterized by their stable presence on the landscape for thousands of years and associated plant and animal communities that may be relics from historic glaciation periods. Because the rate of accumulation of peat in fens is so slow and the species associated with fens are so unique, these ecosystems are difficult to reclaim and are essentially irreplaceable.

Thirteen Region 2 sensitive plant species are restricted to fen and other riparian habitats. Fen habitats can be further characterized by different plant communities and species, different substrates, different pH, and different abiotic processes. In numerous cases, sensitive plant species co-occur at known fen sites and the stressors and ecological processes that influence their habitats apply to all of them. Riparian vegetation across the Forest is also diverse and ecologically complex. Trianglelobe moonwort appears to be most associated with tall willow habitat in the Absaroka Range. Fen and riparian habitat can be found across the Forest. Proposed and existing RNAs and SIAs offering protection of outstanding examples of this habitat include; Line Creek RNA, Swamp Lake Botanical Area; proposed Sawtooth Peatbeds Geological Area and Little Popo Agie Moraine Geological Areas; and proposed Lake Creek and Beartooth Butte RNAs.

Several management activities and risks may have effects on rare plants in this habitat. They include management actions that alter hydrologic regimes; alterations to riparian plant community succession through vegetation manipulation; changes to natural disturbance regimes such as flooding; management activities that affect water quality, such as road construction, reconstruction and maintenance activities that result in runoff; livestock use; sedimentation from timber harvest activities; invasive plants and their control; off-highway vehicle use around wet margins; and recreation use.

The Forest Service regional and national best management practice directives provide a high level of protection for rare plants in fens and other riparian habitat. Those protections are in effect for all the alternatives. Probably the most substantial risk to this habitat that has not been mitigated by these protections is the risk of a wildfire burning a large area and affecting either the hydrologic regime or nutrient inputs into these habitats.

Calcareous montane grasslands habitat

Two Region 2 sensitive plants occur in calcareous montane grasslands. These grasslands, which are dominated by Idaho fescue, are found at the north end of the Forest on soils derived from limestone geological formations. This includes areas on Bald Ridge, Rattlesnake Mountain, and Logan Mountain. Proposed research natural areas offering protection of outstanding examples of this habitat include Arrow Mountain, Pat O'Hara, and Bald Ridge.

Several management activities and risks may have effects on rare plants in this habitat. These include disturbance associated with recreation use, trail construction, road maintenance, and maintenance of administrative sites. Livestock grazing levels may have an effect on plant numbers. Invasion of exotic plant species may affect some sites.

Calcareous rocky slopes and ridges habitat

Two Region 2 sensitive plants occur in calcareous rocky slopes and ridges. This habitat is found on soils derived from limestone geologic formations. On the north end of the Shoshone this includes areas on Bald Ridge, Rattlesnake Mountain, and Logan Mountain. On the south end of the Forest, this habitat is found on sedimentary geologic formations along the flanks of the Wind River mountain range. Proposed research natural areas offering protection of outstanding examples of this habitat include: Arrow Mountain, Pat O'Hara, and Bald Ridge. Of these three research natural areas, only the proposed Bald Ridge Research Natural Area provides protection for the largest known population of *Shoshonea*, a species endemic to the northeast portion of the Greater Yellowstone Area.

Several management activities may have effects on rare plants in this habitat. These include disturbance associated with recreation use, trail construction, maintenance of roads, maintenance and use of administrative sites. Probably the most substantial risk to the plants in this habitat is the risk of a wildfire or prescribed fire burning a large area and precipitating the invasion of exotic plant species, particularly cheatgrass, which may affect rare plant survival. Chemical control of invasive plants also may have a negative effect.

Volcanic rocky slopes and montane shrublands habitat

Three Region 2 sensitive plants occur in volcanic rocky slopes and montane grasslands. This habitat is found on soils derived the various formations in the Absaroka volcanics. This habitat occupies large areas of the central portion of the Shoshone. Proposed research natural areas offering protection of outstanding examples of this habitat include Grizzly Creek and Sheep Mesa.

Several management activities and risks may have effects on rare plants in this habitat. These include disturbance associated with recreation use, trail construction, and maintenance of roads and administrative sites. Invasion of exotic plant species, particularly cheatgrass, may affect plant survival after wild and prescribed fire. Spotted knapweed and Dalmatian toadflax spread may threaten habitat, and chemical control efforts may have a negative effect.

Granitic montane grasslands habitat

Two Region 2 sensitive plants are associated with granitic montane grasslands. The habitat for this species is found in granitic uplands of the Wind River Range. The proposed Roaring Fork Research Natural Area offers protection of an outstanding example of this habitat.

Several management activities and risks may have effects on rare plants in this habitat. These include disturbance associated with recreation use, trail construction, livestock grazing, and maintenance of roads and administrative sites.

Alpine habitat

Three Region 2 sensitive plants occur in alpine grasslands. This habitat is found at elevations generally greater than 9,800 feet. This habitat exists on almost a quarter of the Forest and with a few exceptions (Beartooth, Phelps, and Carter mountains) is mostly wilderness. Line Creek Research Natural Area and the proposed Sheep Mesa, Beartooth Butte, Roaring Fork, Arrow Mountain, and Pat O'Hara research natural areas offer protection of outstanding examples of this habitat.

Several management activities and risks may affect rare plants in this habitat. These include disturbance associated with recreation use, trail construction, off-highway vehicle use, livestock grazing, and maintenance of roads.

Subalpine and krumholtz forest habitat

Subalpine forests occur generally above 8,500 feet in elevation across the Forest. One candidate/Region 2 sensitive plant occurs in subalpine forests and krumholtz habitat. Whitebark pine is a common five-needle pine in the Greater Yellowstone Area. Within subalpine forests, whitebark pine gradually becomes more common with increasing elevations. It is not as common on calcareous substrates. Krumholtz forests are found at upper tree line in harsh wind-blown environments.

Whitebark pine is threatened by bark beetle infestations, white pine blister rust, altered fire regimes, and climate change across its range. The whitebark pine strategy for the Greater Yellowstone Area (GYCC 2011) provides guidance to land managers for the management of whitebark pine across the Greater Yellowstone ecosystem. Line Creek Research Natural Area and the proposed Sheep Mesa, Beartooth Butte, Roaring Fork, Arrow Mountain, Lake Creek, and Pat O'Hara research natural areas offer protection of outstanding examples of this habitat.

Effects on this habitat include timber harvest, wildfire, prescribed fire, road and trail construction, and other activities that could directly impact populations through vegetation and/or ground disturbance. Some of these actions actually may have overall beneficial effects to whitebark pine.

Direct and Indirect Effects

At the scale of the entire Shoshone National Forest, it is important to realize the difficulties associated with assessing the impacts of broad Revised Forest Plan direction for 26 Region 2 sensitive plants. Plant species may be rare due to evolutionary history, basic population ecology, historic or current human activities, or more likely, a complex combination of these factors. Human activities may or may not be responsible for the current distribution and abundance of the rare plant species. However, an important assumption in this analysis is that certain management actions may contribute or detract from the availability or quality of habitats that support rare plant species.

For each of the resource areas described below, the environmental consequences for rare plant habitat are discussed and then compared by alternative, based on key indicators of disturbance for each type of activity. In general, alternatives proposing greater levels of disturbance activities increase the potential for impacts to rare plant populations. The exception is whitebark pine where disturbance processes can be a beneficial effect and may aid in restoring this species.

Effects from Timber Harvesting: Mechanical activities include vegetation management treatments, whether for restoration or to meet timber production objectives. Activities such as logging can have impacts to plants and plant habitat through canopy removal, soil disturbance and erosion, and stream sedimentation. In addition, mechanical activities for vegetation treatment may require road building. Roads can increase access to and fragment habitat, thus providing an avenue for invasive plant species. Roads can be placed on ridge tops, in riparian areas, or through rocky slopes, which are important habitats for a number of species. Reconstruction and maintenance of existing roads can directly or indirectly affect plant populations by introducing competitive weeds and altering availability of light, nutrients, and moisture.

Most timber harvesting activity on the Forest is in subalpine forests. As discussed below in fire, the restoration of historical fire regimes and restoration of conditions toward historic range of variability that provide a range of seral stages may benefit some Region 2 sensitive plant species, particularly whitebark pine in the long term.

Alternatives that include more timber harvest activity have more potential to negatively affect rare plant habitat. Acres of timber harvest range from 6,030 acres in alternative C, where the potential impact is lowest, to 12,200 acres in alternative F where the potential impact is highest. Alternatives A, B, D, and G are at the lower end of the range established by alternatives C and F. Though timber harvest can negatively affect rare plant habitat, the acres of timber harvest activity is small compared to total Forest acres, and any negative effects would be addressed by applying design criteria for maintaining rare plant habitat.

Alternatives A, B, D, E, F, and G would have similar beneficial effects on restoring whitebark pine habitat. Alternative C would have the least beneficial effect in the restoration of this species.

Effects from Roads and Trails Management: Roads or trail use, maintenance, and construction can contribute to the spread of noxious weeds, and increase areas to soil disturbance that may affect rare plant habitat.

Habitat areas of particular concern include calcareous rocky slopes and ridges and calcareous montane grasslands. Existing system roads pass through habitat of Fremont's bladder pod, Shoshone carrot, Hall's fescue, and Absaroka goldenweed. Increased use and subsequent maintenance may affect habitat.

Alternatives with more miles of road and trail construction have more potential to negatively affect rare plant habitat. Miles for motorized roads and trails are projected to increase in all actions alternatives but alternative C, where miles decrease. The greatest increase would be in alternative F where road miles increase by 4 miles and motorized trail miles increase by 60 miles. Non-motorized trail miles are projected to remain constant across all alternatives. Though new construction, reconstruction, and maintenance activities associated with roads and trails can negatively affect rare plant habitat, the acres of land impacted by these activities would be small compared to total Forest acres, and any negative effects would be addressed by applying design criteria for maintaining rare plant habitat.

Effects from Disturbance Processes (fires and fuels management and insect and disease mortality): A factor that is important to some rare plants is the timing of burns. For example, the use of prescribed fire in the spring has potential impacts to some rare plants. In general, these plants are not adapted to fire at this time of year and spring burning can interfere with flowering, fruiting, and other physiological impacts; and could affect life history patterns with pollinators. However, those risks have to be weighed against the trade-offs in the event that prescribed burning could not take place at another time of year and, therefore, a higher risk occurs that an uncharacteristically intense wildfire occurs. In general, most plant species would benefit by restoring more historical fire regimes. For those rare plants that thrive in open areas created by fires, using fire to help restore a more natural fire regime could benefit those species in the long term. There are also impacts to plants associated with wildfire suppression activities, such as fire line construction and other mechanical activities, reforestation following fire, and the increased potential for the spread of noxious weeds.

Wild and prescribed fires can pose risks to rare plants in fen and riparian habitats, particularly when the fires are uncharacteristic. Rare plants at Swamp Lake Botanical Area and the proposed Peatbeds Geological Area are particularly susceptible.

Prescribed and wildfire impacts to the calcareous montane grasslands, rocky slopes and ridges, and volcanic rocky slopes and montane shrublands habitats can and has led to the spread of cheatgrass and Dalmatian toadflax. Rare plant competition with invasive species may lead to population declines. Increased chemical control methods may also impact rare plants in these habitats.

Fire may have beneficial effects to the restoration of whitebark pine by setting back successional stages by removing spruce and fir.

All of the alternatives use fire as a tool to accomplish management goals and objectives. The alternatives have different management emphasis areas, and as such, the use and emphasis of fire vary by alternative.

White pine blister rust is having an impact on whitebark pine. This disease is affecting large acreages of whitebark pine, and in conjunction with bark beetle epidemics, is killing large numbers of trees. This combined impact is accelerating the reduction of whitebark pine in some areas. Restoration activities for whitebark pine are included in all alternatives, but it will be many years until the scope and effectiveness is at a point where the trend can be reversed.

Alternatives that include more hazardous fuels reduction activity have more potential to negatively affect rare plant habitat. Acres of hazardous fuels reduction activity range from 35,000 acres in alternative C, where the potential impact is lowest, to 39,700 acres in alternative F where the potential impact is highest. Alternatives A, B, D, and G are at the lower end of the range established by alternatives C and F. Though hazardous fuels reduction activity timber harvest can negatively affect rare plant habitat, the acres of timber harvest reduction activity is small compared to total forest acres and any negative effects would be addressed by applying design criteria for maintaining rare plant habitat.

All alternatives would have similar effects on the restoration of whitebark pine habitat.

Effects from Livestock Grazing: Direct livestock or big game grazing effects are from herbivory and trampling. Indirect effects become detrimental to rare plants when grazing exceeds

capacity and results in habitat decline from loss of ground cover, lowered ecological condition, or introduction of invasive species.

Fens and riparian habitat are resilient but can be altered by grazing beyond capacity. Trampling and introduction of invasive species such as Canada thistle are concerns in some fens containing rare plants. The Sawtooth Peatbeds proposed special interest area is particularly susceptible to trampling. Exposed vegetation on peat is easily displaced and results in erosion of an irreplaceable resource.

Rare plants in the volcanic montane shrub habitat are not directly affected by herbivory. Both sensitive species in this habitat are forbs that occupy rocky sites. Indirect effects become detrimental when grazing exceeds capacity and results in habitat decline from loss of ground cover, lowered ecological condition, or introduction of invasive species.

Calcareous montane grasslands habitat are part of several active grazing allotments. Hall's fescue may decrease with heavy grazing pressure (Anderson 2006). Potential over utilization around water developments may affect habitat. Effects of grazing on Hall's fescue have not yet been studied on the Shoshone.

In alpine habitats, hoof action causing trampling and displacement of thin alpine soils potentially may have a negative effect on rare plant habitat. Increased animal unit months (AUMs) may lead to more incidental use of alpine habitat.

In considering the alternatives, alternatives E and F have more emphasis on active grazing management than the others, while alternative C has the least. Alternatives A, B, D, and G are similar in AUMs. In general, it is assumed that the greater number of AUMs, the greater the potential of impact on rare plant habitat.

Alternatives that include more commercial livestock grazing have more potential to negatively affect rare plant habitat. Acres of commercial livestock grazing AUMs range from 31,309 AUMs in alternative C, where the potential impact is lowest, to 70,212 AUMs in alternative F, where the potential impact is highest, followed by alternative E with 67,057 AUMs. Alternatives A, B, D, and G would be the existing level of 55,881 AUMs.

Though livestock grazing can negatively affect rare plant habitat, negative effects may be addressed by applying design criteria for maintaining rare plant habitat.

Effects from Recreation: Recreation impacts can include trampling, both by hikers and off-highway use. Road building and the development of campgrounds and other facilities used by recreationists also contribute to plant impacts, as these developments make more areas accessible and concentrate use. Dispersed camping and recreation have similar impacts, which are more difficult to monitor. Other recreational impacts include off-road use, which can also disturb soil, affecting both habitat and proposed habitat. Roads and trails for recreational use can contribute to the spread of noxious weeds, and increase the accessibility of areas to disturbance. Livestock as well as native ungulates may have impacts relating to trampling and herbivory. Snow compaction by heavy snowmobile use has been shown to have negative effects on fen habitat.

Fens / riparian, calcareous montane grasslands, calcareous rocky slopes and ridges, volcanic rocky slopes / montane shrublands, granitic montane grasslands, alpine, and subalpine / krumholtz forests habitats to some degree have the potential to be affected by concentrated areas of recreational activities.

In general, it is assumed that the greater the motorized recreation use, the greater the potential impact on rare plant habitat. In considering the alternatives, alternatives E and F have more emphasis on motorized recreation, and alternatives A, C, and D have the least use associated with motorized recreation. Alternatives B and G fall in between the extremes.

Effects from Noxious and Invasive Species: Introduced, invasive plant species can displace rare species through competitive displacement. Indirect impacts include herbicide spraying and mechanical ground disturbance to control noxious weeds once they gain a foothold. Competition from invasive non-native species and noxious weeds can result in the loss of habitat, loss of pollinators, and decreased rare plant species viability. Roads, trails, livestock, and canopy reduction can provide ideal pathways for introducing non-native species. Indirectly, herbicide spraying can destroy populations of native pollinators by contaminating nesting materials and pollen resources, further decreasing the viability and reproductive success of rare species.

Fens / riparian, calcareous montane grasslands, calcareous rocky slopes and ridges, volcanic rocky slopes / montane shrublands, granitic montane grasslands rare plant habitats are most susceptible to noxious weed invasion. The vectors for potential spread are many and may be linked to increased disturbance, which may come from fire, timber harvesting, recreation, wildlife, livestock, mineral development, and road and trail corridors.

Alternatives E and F, with their emphasis on active management, would be expected to have the greatest impacts on weeds, and at the other end of the spectrum, alternatives C and D would be expected to have the least impact. Alternatives A, B, and G fall between those two extremes.

Effects from Mineral and Energy Development: Mining directly adjacent to wetlands, or within streams or floodplains that are connected to wetlands, can reduce water availability/flow, sedimentation, and/or pollution.

In considering the various alternatives, reasonably foreseen mining activities are low to very low and similar across alternatives. Consequently, effects to rare plant resources would be the same across alternatives.

Effects from Oil and Gas Development: Road construction and pad site disturbance associated with oil and gas development have the potential to remove rare plants and their habitat.

In considering the various alternatives, reasonably foreseen mining activities are low to very low and similar across alternatives. Consequently, effects to rare plant resources would be the same across alternatives.

Effects from Wilderness Recommendation for Designation: Wilderness designations generally increase the level of protection to rare plants and their habitat. Where trail construction, recreational livestock, and authorized special use permits may directly affect rare plants and their habitat, research natural areas in wilderness offer more protection options for rare plant habitat. The exception is for whitebark pine—wilderness limits beneficial management options for planting, thinning, and prescribed fire.

In considering the alternatives, alternatives C and D include the most recommended wilderness designation, which may lead to greater protection of rare plant habitat. Alternatives A, B, E, F, and G would not recommend increasing designated wilderness, which may lead to less potential protection for rare plant habitat. The opposite is true in the case of whitebark pine habitat restoration.

Effects from Research Natural Areas and Special Interest Area Allocation: Research natural area and special interest area designations generally increase the level of protection to rare plants and their habitat. The exception in special designation is in wilderness where trail construction, recreational livestock, and authorized special use permits may directly affect rare plants and their habitat. In research natural areas and special interest areas those activities may be limited, depending on their effect to rare plant habitat and other plant communities.

Rare plant habitat in calcareous montane grasslands, rocky slopes, and ridges would be most affected by alternatives A, B, E, and F. These alternatives do not include Bald Ridge and Pat O’Hara proposed research natural areas. These two research natural areas are central to two of the three largest populations of *Shoshonea* in the world; all three are on the Shoshone. Alternatives that do not recognize Bald Ridge and Pat O’Hara research natural areas may increase the risk of eventual listing of some rare plants. These areas and the other proposed research natural areas or special interest areas are an essential and complementary component to conservation of rare plants on the Forest, the Greater Yellowstone Area, nationally, and globally.

In considering the alternatives, alternatives C, D, and G place more emphasis on special area designation, which leads to greater protection of rare plant habitat. Alternatives A, E, and F would involve less designated areas, and subsequently, less protection for rare plant habitat. Alternative B does not include Pat O’Hara and Bald Ridge research natural areas and would not protect needed rare plant habitat for calcareous montane grasslands, rocky slopes, and ridges.

Summary of Effects to Resource

The greater the disturbance, the greater the probability of an adverse effect to rare plant habitat. This effect is mitigated by rare plant surveys, pertinent project design features, and best management practices. The exception is whitebark pine, where an increase of disturbance by management may have a Forest- and range-wide beneficial effect.

Not designating Bald Ridge and Pat O’Hara proposed research natural areas will have the greatest effect on protection of rare plant populations found in calcareous montane grasslands, rocky slopes, and ridges habitat.

Overall, potential effects to rare plants would be least under alternatives C, D, and G and greatest under alternatives F and E, with alternatives A and B falling between.

Cumulative Effects

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

Past actions that have added elements of protection to rare plants and their habitat on the Forest include the designation of the Swamp Lake Botanical Special Interest Area and the Line Creek Research Natural Area. Forest plan management area standards and guidelines provide direction for management. In proposed connected actions, Sawtooth Peatbeds Geological Special Interest Area and Little Popo Agie Moraine Geological Special Interest Area, and eight proposed research natural areas will provide protection to maintain high quality occurrences of Region 2 sensitive plant species and their habitat over time. The combination of these proposed actions is important to preserve rare plant habitat for their contributions to biological diversity at Forest, Greater Yellowstone Area, Forest Service region, and national levels.

Climate Change

Cumulative effect stressors common to all rare plant habitat groups that is beyond Forest Service control include climate change. Potential climate change on the Forest has been described in Rice et al. (2012). Predicted climate shifts may result in changes in kind, amount, and distribution of precipitation, in turn, affecting rare plant habitat. Of particular concern is the effect on whitebark pine, alpine, lower-elevation grassland and shrubland, and riparian and fen habitats. In the subalpine / krumholtz zone, whitebark pine is predicted to retreat from lower-elevation ranges and either marginally exist at the highest elevations of the Forest or be extirpated. Alpine vegetation is predicted to decrease in extent and increase in fragmentation, resulting in refugia alpine habitat. Lower-elevation grassland and shrubland habitat will become drier and habitat will shift upward in elevation. This will create the potential for cheatgrass and other noxious weed spread on the landscape. Wetland (fen and riparian) habitat may be reduced in extent or lost (Rice et al. 2012). Climate change has the greatest potential of affecting the currently designated 26 sensitive plants due to the predicted effects on rare plant habitat.

Climate change combined with wild and prescribed fire activity in volcanic rocky slopes / montane shrublands, calcareous montane grasslands, calcareous rocky slopes and ridges habitat in all alternatives may lead to a type conversion to cheatgrass and other noxious weeds. This, in turn, may lead to a loss of Forest rare plants and their habitat, which increases the risk of future listing.

Climate change combined with increased livestock grazing in alpine grasslands and wetlands in alternatives E and F may lead to the loss of rare plants and their habitat, which increases the risk of future listing.

Research Natural Areas

Research natural area and special interest area designations are important considerations in evaluating the status of rare plant species, as recognized by the Forest Service, USFWS, or State natural heritage programs. Research natural area and special interest area designations are among the regulatory mechanisms (factor D) considered in determining global and state ranks of rare plants. Establishment of research natural areas and special interest areas can help avert threats to plant species conservation by supporting long-term viability of species by consistent management (factor A). They are a proactive approach to potentially keep rare plants from being considered under the Endangered Species Act.

Alternatives A, E, and F have the least research natural areas proposed. Alternative B does not include two proposed research natural areas that are critical to rare plant conservation. Some rare plants may have an increased risk of being listed if proposed research natural areas are not established. Alternatives C, D, and G include all of the proposed research natural areas and would have the greatest positive effect on rare plants.

Determinations and Rationale

The overall determination for most species in this plan is “**May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward federal listing.**” For whitebark pine, the determination is the same, but some management elements would have a “**Beneficial impact**” for the species across its range.

Fens / riparian habitat-related sensitive species

Implementation of any of the alternatives for the Revised Forest Plan **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a**

trend toward federal listing for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest as described above. These species include: sphagnum moss, triangle globe moonwort, roundleaf orchid, lesser panicled sedge, livid sedge, Chamisso's bristlegrass, slender bristlegrass, simple bog sedge, English sundew, Greenland primrose, sageleaf willow, myrtle leaf willow, and lesser bladderwort.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented on areas that contain proposed habitat for these species, and if any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Calcareous rocky slopes and ridges habitat-related sensitive species

Implementation of any of the alternatives for the Revised Forest Plan **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing** for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest as described above. These species include: Shoshone carrot and Fremont's bladderpod.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented on areas that contain proposed habitat for these species, and if any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Calcareous montane grasslands habitat-related sensitive species

Implementation of any of the alternatives for the Revised Forest Plan **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing** for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest as described above. These species include: Hall's fescue and Absaroka goldenweed.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented on areas that contain proposed habitat for these species, and if any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Alpine habitat-related sensitive species

Implementation of any of the alternatives for the Revised Forest Plan **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a**

trend toward federal listing for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest, as described above. These species include: Kotzebue’s grass of Parnassus, ice cold buttercup, and Barratt’s willow.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented on areas that contain proposed habitat for these species, and if any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Volcanic rocky slopes and montane shrubland habitat-related sensitive species

Implementation of any of the alternatives for the Revised Forest Plan **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing** for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest, as described above. These species include: North Fork Easter daisy, Wyoming tansymustard, and Absaroka Range beardtongue.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented on areas that contain proposed habitat for these species, and if any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Granitic montane grasslands habitat-related sensitive species

Implementation of any of the alternatives for the Revised Forest Plan **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing** for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest, as described above. These species include: tranquil goldenweed and entire-leaf goldenweed.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented on areas that contain proposed habitat for these species, and if any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Subalpine forests and krumholtz habitat-related sensitive species

Implementation of any of the alternatives for the Revised Forest Plan **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing** for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest, as described above. These species include: whitebark pine.

Some management elements of habitat restoration will have a “**Beneficial impact**” for the species across its range, but the determination remains the same due to the potential loss of individual plants of whitebark pine in these projects.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone National Forest, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented on areas that contain proposed habitat for these species, and if any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Summary of conservation measures for sensitive plant species

The Shoshone National Forest has been actively managing for sensitive and rare plant species for at least the past two decades. Work since the 1986 Forest Plan as amended implementation focused on a Forest-wide floristic inventory by the Rocky Mountain Herbarium and the establishment of research natural areas and special interest areas that would protect areas of important rare plant biodiversity. The floristic work was completed in 2011. The establishment of research natural areas and special interest areas is part of the current Revised Forest Plan effort.

Future work needs to address:

- Mapping distributions of Region 2 sensitive and Forest plants of local concern.
- Inventory of bryophytes and fungi. Work is just starting to understand their environmental and taxonomic diversity.
- Monitoring once species are determined to be rare; it is important to learn about their habitat and environmental influences. This is work that needs to be addressed in the next planning cycle.

The whitebark pine strategy for the Greater Yellowstone Area (GYCC 2011) provides guidance to land managers for the conservation of whitebark pine across the Greater Yellowstone ecosystem.