

Topic 2 – Biodiversity and Viability

Botanical Resources

Threatened, Endangered, Proposed, Sensitive Plant Species and Plant Species at Risk

Introduction

Botanical resources include the abundance and distribution of different vascular and non-vascular native plant species. This section presents a more detailed analysis of the most rare elements of the flora—Threatened, Endangered, and Sensitive (TES) plant species.

Additionally, we include some discussion of watch list species, species at risk, rare and unique communities, and plant species of cultural and social importance.

The state of Utah has a remarkable diversity of native flora and is known for its large number of endemic and rare plant species. Indeed, only four other states (California, Florida, Texas, and Oregon) equal or exceed Utah in the total numbers of rare plant species (Shultz 1993; UDWR 1998a). The flora diversity of Utah is comprised of 2602 species and 393 infraspecific taxa (subspecies or varieties) (Welsh et al. 1993) of vascular plant species that are considered to be native. Many of these rare species, 247 taxa (157 species and 90 infraspecific taxa), are narrow endemics with their entire global distribution within the state of Utah (UDWR 1998b). Several of these species have their entire global distribution within the boundaries of the Wasatch-Cache National Forest (Cronquist et al. 1972; UDWR 1998b).

The richness of native plant species and unique flora of Utah and the Wasatch-Cache National Forest can best be explained by the wide diversity of habitats and wide range of geomorphology (UDWR 1998b). Habitats within the state of Utah and within the Wasatch-Cache National Forest range from semi-arid shrublands, to high mountain ranges that support coniferous forests, subalpine forests and grasslands, and true alpine communities (Cronquist et al. 1972). Many rare and endemic species are tied to unique soil types. The geomorphology of Middle Rocky Mountain Province and much of the Wasatch-Cache National Forest is comprised of the very dissimilar Uinta Mountains and Wasatch Range and the Bear River Range. The Uinta Range trends east-west and is practically devoid of igneous rock while the Wasatch Range trends north-south and is comprised of unusual assembly of igneous, sedimentary, and metamorphic rock (Stokes 1988). The Bear River Range of the Wasatch-Cache National Forest contains habitat for six rare endemic plant species, including one Threatened species. Some of these species are endemic to Logan Canyon and its tributaries while others are limited in distribution to portions of the range in northern Utah and southeastern Idaho (Glisson 1995a). These species are all closely associated with the dolomite and limestone geologic formations.

Laws, Policy, and Direction

Plant species that are federally listed as Threatened or Endangered, or that are proposed for listing, are protected under the Endangered Species Act (ESA, 1973) and Forest Service regulations (FSH 2609.25 and FSM 2670), as are candidate species and species of concern (those species with sufficient biological information and existing threats to warrant listing by the Fish and Wildlife Service). The National Forest Management Act (1976) and USDA Forest Service Policy require that Forest Service Lands be managed to maintain viable populations of all native plant and animal species. A viable population is defined as a population that has a large enough distribution of reproductive individuals to ensure the continued existence of the species throughout its existing range.

Sensitive species are similarly protected under the Regional Forester's Sensitive Species Program. For sensitive species, management efforts to maintain their population viability and preservation are already in place. The Forest Service management policy (FSH 2609.25, 1.25, 1988 and FSM 2670) ensures that for all TEPS plant species, the following measures will be taken: (1) biological evaluations will be written for all activities that may impact sensitive species and their habitat, (2) "effects" of activities will be determined as similar to those for threatened, endangered, or proposed species, and (3) sensitive species must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for federal listing. This Forest Service management policy will be employed at a species level in all alternatives to ensure its mandates are achieved and that sensitive species are conserved.

Additionally, special management direction can be designed and implemented for Threatened, Endangered, Proposed, and Candidate species (TEPS) to ensure their protection and recovery under all Forest Service management activities. Conservation Assessments, Strategies, and Agreements, and Recovery plans outline the current status of such species and detail management needs to promote conservation and recovery of all TES plants and plant species at risk. Many species currently found on the Wasatch-Cache National Forest have signed Conservation Strategies/Agreements and Recovery Plans (Threatened species) in place. All existing strategies and plans along with future plans for these plant species will be met and upheld to provide for viability, conservation, and recovery of these species.

Affected Environment

The affected areas for direct and indirect effects on TES plants and plant species at risk are the lands administered by the Wasatch-Cache National Forest. Management Areas will be highlighted in discussions, due to the significance of their contributions to Forest-wide populations. Several species have their entire distribution within the Wasatch-Cache Forest Boundaries and other plants are at the fringe of their natural range. The affected areas for cumulative effects on TEPS plants include national forest and other ownership lands within the Wasatch, Uinta, Bear River, and Stansbury Mountains and also consider the natural ranges of distribution for individual plant species.

Plant Types Within the Wasatch-Cache National Forest

Vascular Plants

Vascular plants comprise the largest and most dominant organisms within each major vegetation type. Included in this group are seed-bearing plants such as angiosperms (flowering plants) and gymnosperms (conifers), and spore-bearing plants such as ferns and fern allies. Vascular plants are primary producers, which utilize photosynthesis to generate carbohydrates. Animals and fungi in turn consume these carbohydrates. Additionally, vascular plants form the forest structure that provides substrate and habitat for other organisms, influence microclimates, and produce litter and decomposing wood, which contributes to organic matter and soil development. Many vascular plants exist in symbiotic relationships with fungi and other plants, thus enabling some species to be non-photosynthetic and providing the capability to fix nitrogen. In addition to their role in ecosystem functions, vascular plants provide many commercially important resources that include timber, paper, rope, medicines, foods, and ornamentals.

Non-vascular Plants

Bryophytes - Bryophytes (mosses, liverworts, and hornworts) are small, green non-vascular plants that reproduce by means of spores instead of seeds. Although small, they play an important role in water and nutrient cycles, and provide seed beds for many plants (Steele and Geier-Hayes 1995). Many play crucial roles in the hydrology of meadows and riparian areas. Bryophytes can be found in all types of environments with the exception of salt water. Throughout the Wasatch-Cache National Forest, bryophytes can be found on rock outcrops, in hanging gardens, and in wet meadows, bogs, and fens.

The worldwide bryoflora is comprised of approximately 15,000 to 18,000 (Merrill 1995) species of bryophytes. In North America, 1,320 species of moss (Anderson et al. 1990), and 525 species of liverworts and hornworts (Stotler and Crandall-Stotler 1977) have been documented. Currently, no comprehensive moss flora exists for Utah. In a recent study of bryophytes in the Columbia River Basin south of the Canadian border, Christy and Harpel (1997) noted 50 taxa endemic to western North America. Their study found that about half the total bryoflora had fewer than five known populations. This lack of distribution knowledge hindered the development of rarity rankings and pointed to the need for systematic collecting and taxonomic studies in the Western United States.

Bryophyte species usually are more widely distributed than vascular plant species. However, within a broad overall range, they may occur in very localized patterns in ecologically specific habitats. Several species of mosses including *Polytrichum juniperinum*, *Bryum* spp. *Grimmia* spp. and *Drepanocladus aduncus* are found widespread throughout the Wasatch-Cache National Forest (Kelly 2000). Other species have very limited distribution on the WCNF (i.e. *Grimmia alpicola* var. *latifolia* - found only on submerged granitic rock in Bells Canyon, *Metaneckera menziesii* - only known in City Creek Canyon on shaded limestone cliffs, and *Scouleria aquatica* - only known above Brighton). The distribution of liverworts throughout the Wasatch-Cache National Forest is less known because little floristic work for such species has been completed

within this geographic area. It is known however, that one liverwort species, *Ricciocarpus natans*, is common in Logan Canyon but infrequent elsewhere in the western US (Flowers 1945).

Lichens - Lichens are a unique combination of two different types of organisms, fungus and alga, growing together in a symbiotic relationship. Lichens are often sensitive indicators of air pollution. They play important roles in the cycling of water and nutrients and in relationships with many other plants and animals. Lichens also play an important role in soil formation due to their ability to fix nitrogen by changing atmospheric nitrogen into a chemical form that plants can use. A total of 18,000 to 20,000 lichen species have been documented worldwide with about 3,330 species documented for the United States and Canada. Lichens grow on rock, soil, trees, fallen logs and other surfaces.

A list of Lichens of Utah (Newberry 1991a) and Lichens of the High Uinta Wilderness (Newberry 1994) provide detailed information of species and distribution of lichens within these wide-ranging areas. Several species were reported for the first time in Utah including *Ascarospora nitida*, *Lecanora bicincta*, and *Solorina bispora*. All of these were identified for the first time from collections made on the Wasatch-Cache National Forest. Despite these floristic studies, a lack of baseline inventories documenting comprehensive lichen species presence, abundance, and geographic distributions point to the need for additional studies. Management of both lichens and bryophytes would benefit from further ecological studies and distribution data. Limited information currently on rare lichens and their distributions prevent the development of species-specific management. As such, these species were not analyzed in the effects analysis for the Wasatch-Cache Forest plan revision.

Fungi/Cryptogamic Crusts

Fungi - Fungi are members of the plant kingdom that contain no chlorophyll and rely on organic material for nutrition and play an important role in decomposition and nutrient exchange. Some fungal species, such as the truffles, boletuses, chanterelles, and morels are important for recreational and commercial gatherers. Many fungi form symbiotic relationships, called mycorrhizal associations, with vascular plant roots underground, thus improving the ability of these vascular plants to exploit soil reserves for moisture and nutrients. Lack of knowledge on the role of fungal species in the ecosystem and difficulty of identification prevents the development of species-specific management. As such, these species were not analyzed in the effects analysis for the flora of Wasatch-Cache National Forest.

Cryptogamic Crusts – Cryptogamic crusts (also described as microbiotic, cryptobiotic, and microphytic crusts) are another very important ecosystem component. This biological soil crust is an association of algae, mosses, lichens, liverworts, cyanobacteria, and fungi. Cryptogamic crusts play a vital role in soil stabilization, nutrient cycling, soil moisture, and vascular plant interactions (St. Clair et al 1984; Eldridge 1993; Ladyman and Muldavin, 1996). They also play an important role in discouraging the dominance of annual weed growth (Belnap et al. 2001). These crusts are generally believed to protect the soil against erosion, and affect infiltration in semiarid and arid ecosystems (Eldridge 1993; Ladyman and Muldavin 1996). Crusts are integral components of rangeland systems, and their presence is often indicative of the condition and trend of these systems (Belnap 1992).

Cryptogamic crusts are often associated with potential vegetation types that include low sagebrush (includes mesic, mesic with juniper, and xeric), salt desert shrub, big sagebrush-warm and cool, and juniper (St. Clair et al 1984; USDA Forest Service and USDI Bureau of Land Management 1997). More than 20 percent of the Wasatch-Cache National Forest is comprised of these vegetation types. Anderson et al. (1982a) described the soil conditions one would expect these cryptogamic crusts to occur. The authors found that the amount of silt is positively correlated with these crusts, while surface rock and sand are higher on areas with less-developed crust. Kaltenecker and Wicklow-Howard (1994) found a negative relationship between cryptogamic crusts and herbaceous undergrowth in sagebrush communities. They found that cryptogamic crusts were less abundant in sagebrush communities that had high herbaceous cover.

In the Stansbury Mountains, sagebrush and juniper (some pinyon-juniper) communities that have invaded the sagebrush, have the greatest potential for abundant cryptogamic soil crusts because of their soils and herbaceous vegetation cover. Elsewhere on the forest, soils are either coarse or, where soils have a greater amount of fine soil materials, typically have a high amount of herbaceous undergrowth. We estimate that the Stansbury Mountains have approximately 33,000 acres of sagebrush and juniper communities. While some of these communities occur on sites that are either too coarse or have too great vegetation cover to support cryptogamic crusts, there are a large amount of acres that have the potential to support well-developed crusts.

Sagebrush communities occur in nearly all elevation zones throughout the forest and juniper communities, while most expansive on the Stansbury Mountains, occur throughout the Overthrust Mountains Ecological Section as well. Belnap (2002) stated that, while these crusts may be more abundant on the Stansbury Mountains, occur throughout the Forest. She noted that some form of crust cover would occur wherever light can reach the soil surface. Therefore, absolute cover of biological soil crusts is lower where vegetation cover is higher, but they remain an important component for soils in plant interspaces, even when those interspaces are small. Belnap went on to note that lichen and moss cover (two common components of biological soil crusts) will be higher on silty soils, but sandy soils have higher cover of cyanobacteria. She commented that cryptogamic crusts likely play a more important ecological role in the portion of the Stansbury Mountains where vascular plant cover is lower (pinyon-juniper, juniper, and sagebrush communities), but are also an important component throughout the forests, both from a soil protection/soil chemistry perspective and from a biodiversity viewpoint as well.

Kaltenecker and Wicklow-Howard (1994) noted that use by domestic livestock and off road vehicles (ORVs) result in the disturbance and compaction of surface soils and have a negative effect on these crusts. In addition to their greater potential for erosion, these crusts, which play an important role in contributing nitrogen to arid and semi-arid ecosystems. These authors also noted that fire could destroy cryptogamic crusts. The recovery rate from any of these disturbances was dependent on the severity of disturbance. Johansen and others (1984), as referenced in Kaltenecker and Wicklow-Howard (1994) noted that these crusts could recover fully within five years of fire if no other disturbances occurred. Anderson and others (1982b) described a rapid recovery rate in 14 – 18 years following protection from grazing. During the next 20 years, the rate of recovery showed only slight increases in cryptogamic and algal cover.

The rate of recovery following ORV use was not described by any of these authors, but would likely be at least as slow as that described for livestock impacts.

Threatened, Endangered, Candidate, and Proposed Plant Species

Federal land-managing agencies are responsible for implementing the ESA within their authorities. These responsibilities include, but are not limited to, efforts to promote the conservation and recovery of listed species and provisions to conserve the ecosystems upon which listed species depend. The U.S. Fish and Wildlife Service (USFWS) monitors and prescribes management for federally listed threatened and endangered plant species. The National Forest Management Act (1976) and Forest Service policy (FSH 2609.25 and FSM 2670 and FSM 2609) require that Forest Service land be managed to maintain populations of all existing native animal and plant species at or above minimum viable populations levels. A viable population is the maintenance of enough individuals throughout their range to perpetuate the existence of the species in natural, self-sustaining populations.

The USDA Forest Service, in implementing the ESA, must ensure efforts to promote the conservation and recovery of listed species and provisions to conserve the ecosystems upon which listed species depend. Table B-1 provides a list of those species that have state or federal status as Threatened or Proposed. Additionally, we have identified those species that have been identified as imperiled and may warrant listing as Threatened or Endangered by the Utah Native Plant Society and the Utah Natural Heritage Program (Utah Rare Plant Meeting Results 2000). There are no plants currently listed as endangered on the Wasatch-Cache National Forest.

Table B-1 Threatened, Candidate, and species likely to be Proposed as Threatened or Endangered on the Wasatch-Cache National Forest

Scientific Name	Common Name	Status	Distribution
<i>Primula maguirei</i> L. O. Williams	Maguire's Primrose	Threatened	Logan Canyon Endemic
<i>Spiranthes diluvialis</i> Sheviak	Ute ladies'-tresses	Threatened	Potential Habitat – through the Wasatch-Cache National Forest
<i>Viola frank-smithii</i> N. Holmgren	Frank Smith's Violet	Sensitive ¹	Logan Canyon Endemic
<i>Dodecatheon dentatum</i> Hook var. <i>utahense</i> N.H. Holmgren	Wasatch Shooting Star, Utah Shooting Star	Sensitive ¹	Salt Lake County Endemic
<i>Draba maguirei</i> C.L. Hitchc. var. <i>burkei</i> C.L. Hitchc.	Burke's Draba	Sensitive ¹	Northeastern Utah Endemic
<i>Botrychium lineare</i> W.H. Wagner	Slender Moonwort	Candidate	Colorado, Oregon, Montana, Washington, (Historical sites in California, Idaho, Montana, Utah, Nevada and Quebec and New Brunswick, Canada)

¹Likely to be proposed, as Threatened or Endangered, because of rarity and/or because of potential threats

The Utah Native Plant Society and Utah Conservation Data Center identified three Intermountain Region Sensitive species, *Viola frank-smithii*, *Dodecatheon dentatum* var. *utahense*, and *Draba maguirei* var. *burkei*, (Utah Rare Plant Meeting Results 2000) that have sufficient threats and

conservation needs to be proposed as Threatened species. These species have not been formally petitioned or listed with the US Fish and Wildlife Service. However, these species could be listed in the foreseeable future and within the 10-year planning period. As listed species, special management efforts and conservation measures would be required under the ESA. Due to their current conservation needs and threats, these species will be examined separately from the other Intermountain Region Sensitive species. For each, we have provided detailed information regarding status, habitat information, threats, current condition, and management efforts. Threats are defined as those activities, Forest Service or otherwise, or natural conditions that currently or potentially have negative effects on the viability of the TES plants and plant species at risk or their habitat. Threats listed are not all-inclusive, but focus on those that have the most potential to adversely affect plant and habitat recovery, and the persistence of known populations.

Primula maguirei (Maguire's Primrose)

Maguire's Primrose was first collected in Logan Canyon, Utah in 1911 and was formally described as a new species in 1936 (Williams 1936). The US Fish and Wildlife Service officially listed *Primula maguirei* as Threatened in August 1985 (US Fish and Wildlife Service 1985). Currently, a total of 14 element occurrences of *P. maguirei* have been identified within a corridor of Logan Canyon approximately 19 km long and less than 1 km wide. The total global population of *P. maguirei* is estimated at 3000 individuals (US Fish and Wildlife Service 1990). Reproduction is thought to be strictly sexual, and *P. maguirei* is likely an obligate outbreeding species based upon the heterostylous floral structure (Richards 1993). Bees and flies have been observed visiting *P. maguirei* flowers, but specific pollinators have not been determined (Padgett 1986). Successful conservation of this species will require protecting occupied habitat and pollinator requirements in and around populations.

The narrow distribution and small population size of *P. maguirei* is likely best explained by its unique habitat requirements and need for calcareous substrates. There is no evidence to suggest that the range of *P. maguirei* is any more restricted at present than as indicated by historical botanical records (USDI USFWS 1990; Glisson 1995a; Wolf and Sinclair 1997). It is more likely a relict species that formerly had wider ranges when climatic conditions in North America were wetter and cooler. Current research and phylogenetic analyses of *Primula* spp. add support to this hypothesis (Richards 1993; Wolf and Sinclair 1997). The role of human intervention in the restricted range of this species is unknown. Potential and actual habitat within the canyon and along the canyon floor may have been significantly impacted by human activity due to development (USDI USFWS 1990).

Habitat – *Primula maguirei* is categorized as a mesophytic calciphile and is restricted to cool, moss-covered shallow soils on dolomite cliffs and boulders of the Laketown and Fish Haven Dolomite formations (USDI USFWS 1990, Glisson 1995a). Populations of *P. maguirei* are restricted to an elevational range of 1400 to 1800 meters (4,600 to 5,900 feet) along the lower canyon walls of Logan Canyon (Padgett 1986). Plants are often found in cracks or crevices or amidst well-developed mats of moss and is most often found in areas of cool, moist microclimates. Apparent differences in the moisture regimes of up canyon and down canyon populations have been documented (Padgett 1990). Extensive surveys of potentially suitable habitat (additional outcrops of Fish Haven and Laketown Dolomites) have been conducted in

adjacent drainages and in other portions of the Bear River Range of northern Utah and southern Idaho. No additional populations of *P. maguirei* have been located (Franklin, 1990).

Threats – The most significant threats facing *Primula maguirei* and its habitat are recreational rock climbing activities, the proposed realignment and expansion of U.S. Highway 89 in Logan Canyon, and horticultural collection (USDI USFWS 1990; Glisson 1995a; UDWR 1998a). Climbing activity in Logan Canyon has increased dramatically in recent years. The climbing community has participated in conservation efforts with the USDA Forest Service to identify potential conflict areas and to educate climbers about the presence of this species. With the understanding of the local climbing community, 21 climbs have been formally closed to ensure protection of this species (Glisson 1995a). A local climbing guide discusses the presence of *P. maguirei* and urges the cooperation of climbers to further protect this species and its habitat (Monsell 1998). The Record of Decision for the expansion of US Highway 89 identifies preventative measures that will be implemented to minimize potential impacts to the *P. maguirei* populations, which include limited vegetation removal, dust-suppression, and construction timing to prevent impacts during flowering (Glisson 1995a). The USDA Forest Service is responsible for ensuring that preventative measures are employed and that population viability is maintained.

Current Management – The US Fish and Wildlife Service prepared a Recovery Plan for *Primula maguirei* (1986) that has been in effect since 1990. The general provisions of the Recovery Plan include inventorying suitable habitat, conducting minimum viable population studies, managing activities that could affect populations or habitats, and developing techniques for artificially propagating plants for possible population expansion or establishment. Additionally, a Conservation Strategy for the Bear River Range Endemics, which includes *P. maguirei*, was prepared and signed in 1995 (Glisson 1995a). The general provisions of this conservation strategy include implementation of population biology monitoring studies to assess stability, trends, impacts from climbing and grazing activities, and autecology of all endemics. Direct provisions for *P. maguirei* include the development and implementation of specific research aimed at determining habitat dynamics, germination requirements, and phylogenetic relationships within and between populations. A progress report and amendment to the Conservation Strategy and Action Plan is currently in draft form. This amendment will provide new information and proposed changes to the existing strategy and will enhance conservation and recovery efforts for *P. maguirei* and the other Bear River Range Endemics. Additional efforts would include: finalizing a formal policy to address rock climbing; increasing genetic, germination and pollination research; and completing Conservation Agreements in consultation with US Fish and Wildlife Service.

***Spiranthes diluvialis* (Ute Ladies'-tresses Orchid)**

Ute ladies'-tresses orchid was named in 1984 and federally listed as threatened on January 17, 1992 under the Endangered Species Act as amended. *Spiranthes diluvialis* populations are found in relatively low-elevation riparian, spring, and lakeside wetland meadows in these general areas of the interior western United States: Populations have been found near the base of the eastern slope of the Rocky Mountains in SE Wyoming and north-central and central Colorado; in the upper Colorado River Basin; along the Wasatch Front and westward in the eastern Great Basin, in north-central and eastern Utah and extreme eastern Nevada. In 1994, the range was expanded

north by discoveries in central Wyoming and western Montana and in 1996, *S. diluvialis* was discovered in southeast Idaho, along the Snake River. The largest known population is found to the just south of the Wasatch-Cache National Forest in Diamond Fork Canyon on the Uinta National Forest. Reproduction is strictly sexual, with ground- and log-nesting bumblebees as the primary pollinators (Sipes and Tepedino 1995, Pierson and Tepedino 2000). Successful conservation of this orchid will require protecting suitable habitat and pollinator habitat in and around orchid populations.

Habitat - *Spiranthes diluvialis* is endemic to moist soils in mesic or wet meadows near springs, lakes, and perennial streams. The elevation range of known habitat in Utah 4,900 to 7,000 feet, but has been found as low as 1500 feet in surrounding states. Most of the occurrences are along riparian edges, gravel bars, old oxbows, and moist-to-wet meadows along perennial streams and rivers, although some localities are near freshwater lakes or springs. *S. diluvialis* appears to be well adapted to disturbances caused by water movement through flood plains over time. Populations are often found on point bars and other recently created riparian habitat. This orchid species appears to require permanent sub-irrigation, with the water table holding steady throughout the growing season and into late summer and early autumn. *S. diluvialis* occurs primarily in areas where the vegetation is relatively open.

Potential habitat for *Spiranthes diluvialis* can be found throughout the Wasatch-Cache National Forest, but occupied habitat has not yet been discovered. Extensive surveys for *S. diluvialis* were completed on the Wasatch-Cache and Uinta National Forests in 1992 (Stone 1993). Field surveys were focused on perennial streams draining out through the Wasatch Mountains, usually at elevations below 6,500 feet. No significant botanical finds were made for *S. diluvialis* on the Wasatch-Cache National Forest in this fairly comprehensive survey. Subsequent surveys each year following this study to present have also resulted in no significant botanical finds of this Threatened species (Padgett 2000b).

Factors in the life history and demography of this species often make it difficult to locate. Populations appear to fluctuate dramatically from year to year, making it difficult to assess population status and distribution. The genus *Spiranthes* also undergoes a dormant period that may last 7-10 years, apparently with no evidence of above ground structures. Currently, the factors involved in dormancy and the triggering mechanisms required are unknown. In order to locate this species, potential habitat must be surveyed every year before ground-disturbing activities take place.

Threats – *S. diluvialis* is found infrequently and in scattered locations. Threats include livestock grazing, trampling due to hiking and undeveloped recreation, exotic weed invasion, alterations of the hydrologic regime due to controlled flooding, dewatering of streams, loss of pollinators, and development (Stone 1994, US Fish and Wildlife Service 1995). Because it prefers open, early seral riparian areas, its management may be in direct conflict with rare fish habitat management that emphasizes undisturbed climax conditions.

Current Management - The US Fish and Wildlife Service has prepared a Draft Recovery Plan (US Fish and Wildlife Service 1995) and developed actions designed to restore populations and remove threats. The general provisions of the Recovery Plan include: obtaining information on

life history, demographics, habitat requirements, and watershed process; managing watersheds to perpetuate or enhance viable populations; and protecting and managing populations in wet meadow, seep and spring habitats.

The following is from Federal Register (1992):

Except for two small populations in wetlands near Utah Lake, all known historic populations of this species (*S. diluvialis*) along the Wasatch Front in the populated north-central area of Utah are presumed extinct, as are all other known historic populations in the eastern Great Basin and two of the four known populations in Colorado. It is believed that alteration of riparian habitat caused the extinction of these populations. With the exception of the two Utah Lake populations, recent attempts to locate the Wasatch Front and eastern Great Basin populations were unsuccessful (Coyner 1989,1990).

While the potential for additional impacts to this species are limited, Wasatch-Cache personnel will continue to survey potential habitat before ground-disturbing activities take place.

***Dodecatheon dentatum* var. *utahense* (Utah Shooting Star, Wasatch Shooting Star)**

Dodecatheon dentatum var. *utahense* is a Salt Lake County, Utah endemic. It was described as a new taxon in 1994 (Holmgren) and is apparently restricted to Big Cottonwood Canyon in the central Wasatch Range. Little work to determine life-history characteristics, demography, or pollination requirements for this taxon has been completed (Padgett 2000b).

Habitat – *Dodecatheon dentatum* var. *utahense* is endemic to shady, moist cracks and crevices of rock outcrops, often in the spray of waterfalls (Holmgren 1994). The elevation range of known habitat is 2000 to 2900 m (6,400 to 9,500 feet). Four known populations have been identified in Big Cottonwood Canyon within an area of approximately 3 miles square (Welsh et al. 1993). Many surrounding seeps have been surveyed for the presence of *D. dentatum* var. *utahense*, though no new populations have been located. All of the surrounding seeps that were examined were higher in elevation and were above shading trees (Stevens and Padgett 1999).

Threats – Recreational impacts pose the greatest threat to *D. dentatum* var. *utahense* populations. All known locations are found along trails or in the vicinity of high recreational use areas. Hikers, picnickers, and climbers frequent the areas in which these populations currently exist. Soil instability along some trailside populations is so great that even minimal use and light walking along the trail causes the uprooting of plants (UDWR 1998a). Based upon the high use of the area, and the extreme impacts from picnic area use, hiking, and climbing this species is thought to be critically imperiled sufficient to warrant proposed listing as Threatened under the ESA (Utah Rare Plant Meeting Results 2000).

Current Management - *Dodecatheon dentatum* var. *utahense* is currently be considered for addition to the Region 4 Sensitive Species list for the Wasatch-Cache National Forest and is on the Utah Natural Heritage Program Tracking list (UDWR 1998a). It currently has no designation or proposed legal protection with the US Fish and Wildlife Service. Currently, no preventative

measures (i.e. fences, barriers) have been taken to exclude picnickers, hikers, or climbers from the fragile populations (Padgett 2000b).

***Viola frank-smithii* (Frank Smith's Violet)**

Frank Smith's Violet was first discovered in May 1989 by botanist Frank Smith and was formally described as a new species in 1992 by Holmgren (1992). *Viola frank-smithii* is known to occur only in the lower to middle portion of Logan Canyon and several of its main side canyons in the Bear River Range of northern Utah (Glisson 1995a). There are currently 11 known element occurrences that comprise a total global population of approximately 10,000 individuals (Stone 1994). Little is known about the life-history characteristics of *V. frank-smithii*, although it is thought to be a short-lived, sexually reproducing perennial species. Pollinators are likely required for seed set (Glisson 1995a).

Habitat - *Viola frank-smithii* is one of the few rock-dwelling violets known in North America (Holmgren 1992). It is endemic to cliffs and near-vertical outcrops of carbonate rock, specifically Limestone and Fish Haven and Laketown Dolomites. The elevation range of known habitat is 1646 to 2073 m (5,400 to 6,800 feet) with most populations occurring on cool, northerly exposures that are shaded for the majority of the day (Stone 1994). Surrounding vegetation, including Douglas fir and maples also provide additional shading for the microsites in which *V. frank-smithii* is found. Rock outcrops and aspects other than steep, north-facing slopes appear to be too warm and dry to support populations of *V. frank-smithii*. *Viola frank-smithii* is found in distinct microhabitats similar to that of *Primula maguirei* and these species are often found in close proximity (UDWR 1998a).

Threats – Not unlike *Primula maguirei*, the most significant threats to *Viola frank-smithii* and its habitat are recreational rock climbing activities, the proposed realignment and/or expansion of U.S. Highway 89, and horticultural collection (Welsh et al. 1993, Glisson 1995a, UDWR 1998b). As previously stated climbing activity in Logan Canyon has increased dramatically in recent years and has resulted in the removal of plants in areas where *P. maguirei* and *V. frank-smithii* are found. Efforts by the USDA Forest Service and the local climbing community have focused on education and the conservation of these species (Monsell 1998). As with *P. maguirei*, the Record of Decision for the Expansion of US Highway 89 identifies preventative measures that will be implemented to minimize potential impacts to the *V. frank-smithii* populations, which include limited vegetation removal, dust-suppression, and construction timing to prevent impacts during flowering (Glisson 1995a). The USDA Forest Service is responsible for ensuring that preventative measures for *V. frank-smithii* are employed at the same level of care as defined for *P. maguirei* and that population viability is maintained.

Current Management – A Conservation Strategy for the Bear River Range Endemics, which includes *Viola frank-smithii* was prepared and signed in 1995 (Glisson 1995a). This conservation strategy includes provisions that would promote implementation of population biology monitoring studies to assess stability, trends, impacts from climbing and grazing activities, and autecology of all endemics. Additionally, this strategy provides direct provisions for *V. frank-smithii*, which include the development and implementation of specific research aimed at determining habitat dynamics, germination requirements, and pollination, seed set, and dispersal requirements. A progress report and amendment to the Conservation Strategy and

Action Plan is currently in draft Form. This amendment will provide new information and proposed changes to the existing strategy. Completing Conservation Agreements in consultation with US Fish and Wildlife Service and establishing an interagency Technical Team to oversee implementation of the Conservation Strategy and Action Plan will further enhance conservation and recovery efforts for all the Bear River Range Endemics.

***Draba maguirei* var. *burkei* (Burke's Draba)**

Maguires draba was described for the Bear River Range and the northern Wasatch Mountains of Northern Utah. It was further divided into two varieties (*Draba maguirei* var. *maguirei* and *Draba maguirei* var. *burkei*). Subsequent taxonomic and phylogenetic research has shown that variety *burkei* is a distinct species (Windham and Beilstein 1998) and will be elevated to the species level. Efforts to publish Burke's draba as a new species are currently being made (Padgett 2000b). A total of 13 populations are known, ranging from the Wellsville Mountains, Strawberry Peak, and James Peak (Padgett 2000b). Burke's draba appears to require a cross-pollination to set seed, though a pollen vector has not been determined for this taxon (Windham and Beilstein 1998).

Habitat – Burke's draba populations occur on ledges and in crevices of exposed carbonate and quartzite outcrops and on the adjacent rock loam soils in Douglas fir and mixed conifer communities. The elevation range for this taxon is 1650 to 2975 m (5,400 to 9,765 feet). Lower elevation populations appear to be confined to steep slopes with shady north and easterly aspects while higher elevation populations appear to occur on all aspects. Plants appear to prefer open filtered light in protected microhabitats and in association with semi-barren herbaceous plant communities (USDA USDI 2002).

Threats – The Snowbasin population, the largest known population of Burke's draba, has had the greatest impacts and threats to population viability. Many plants have been removed from near Mt. Allen in order to build a ski run for 2002 Olympics men's downhill event. Additionally, a large number of plants in this population were destroyed as a result of rock overburden being placed over a large portion of the population during a road construction project for the City of Ogden's communication site (Padgett 2000b). The other known potential threats to Burkes draba are from recreational activities and from mountain goats recently transplanted near Willard Peak. Recreational impacts include hiking, trail use, and rock scrambling. Impacts from the mountain goats include trampling and other physical damage. Plants appear to be too diminutive to be eaten (Padgett 1998).

Current Management – *Draba maguirei* var. *burkei* is currently a Sensitive species on the Region 4 Sensitive Species list for the Wasatch-Cache National Forest and is on the Utah Natural Heritage Program Tracking list (UDWR 1998a). It currently has no designation or proposed legal protection with the US Fish and Wildlife Service. Due to the existing threats to this taxon and its conservation needs, it was suggested by the Utah Native Plant Society (2000) that *D. maguirei* var. *burkei*'s status be elevated to Threatened with the US Fish and Wildlife Service. Forest Service ecologist, biologists, and managers are currently preparing a Conservation Assessment and Strategy for *Draba maguirei* var. *burkei* (USDA USDI 2002). This Conservation Assessment and Strategy outlines management objectives that upon implementation will maintain the viability of populations, provide research opportunities to

determine life history, demography, ecology, and factors contributing to rarity, and establish monitoring protocols for Burke's draba.

***Botrychium lineare* (Slender Moonwort)**

The Federal Register (USDI ISFWS 2002a) describes *Botrychium lineare* (Slender Moonwort) in the following manner:

Botrychium lineare is a small perennial fern that is currently known from a total of nine populations in Colorado, Oregon, Montana, and Washington. In addition to these currently known populations, historic populations were previously known from Idaho (Boundary County), Montana (Lake County), California (Fresno County), Colorado (Boulder County), and Canada (Quebec and New Brunswick). However, they have not been seen for at least 20 years and may be extirpated (Wagner and Wagner 1994). Since the 12-month petition finding was published we received some additional information regarding the status and distribution of *B. lineare*. Two new population sites of *B. lineare* were tentatively identified in 2001, one site each in Idaho and Nevada, with an additional historic site discovered from a herbarium specimen collected in Utah in 1905.

The Utah herbarium specimen was collected at Silver Lake in Big Cottonwood Canyon in 1901 at approximately 2650 m (8,700 feet) elevation. Attempts to relocate this population on the meadows surrounding Silver Lake in both 2001 and 2002 were unsuccessful. But because of its diminutive size and its ability to remain below ground during periods of low precipitation (Farrar 2002), it is possible for this plant to still exist on this site. Because of possible impacts to potential habitat, surveys were also conducted on private lands around Lake Solitude in 2002. No plants were found.

Habitat

Describing the habitat requirements for this species is difficult because of its current and historically disjunct distribution. It occurs at sea level in Quebec to nearly 3,000 meters (9,840 ft) Colorado. *Botrychium lineare* may be a habitat generalist and is often found along disturbed roadsides. Farrar (2002) stated that it commonly occurs where a combination of sedges, grasses, and small forbs such as wild strawberry, common cinquefoil, and aster grow in combination. It may also be that this species is more common than currently known because it is difficult to observe in the wild for reasons noted above.

Threats

Threats identified in the Federal Register (USDI USFWS 2002) include road maintenance, herbicide spraying, recreation, timber harvest, trampling, and development. It was also noted that livestock or wildlife grazing might affect *Botrychium lineare*, but that these effects are currently unknown. None of these threats occur at the historic collection site at Silver Lake. Livestock grazing has not occurred on this species' historical range for over a century. The construction of a raised boardwalk in the mid 1990's to protect the fragile wetland habitats from trampling (recreation use), has also eliminated threats from road maintenance, and development. No herbicides are currently used in vicinity of Silver Lake. Timber harvest occurred in the early

1900's to support mining activities in the area, but now is restricted to maintenance of ski runs at both Brighton and Solitude Ski Area adjacent to Silver Lake. Farrar (2002) noted that *Botrychium lineare* has been found on constructed ski slopes elsewhere so this treatment may have a positive effect on this species.

Current Management

Botrychium lineare is not currently on the U.S. Forest Service, Intermountain Region sensitive species list and is not currently given any formal consideration. The U.S. Fish and Wildlife Service has concluded that "...the overall magnitude of threats to *B. lineare* throughout its range is moderate and the overall immediacy of these threats is non-imminent" (USDI USFWS 2002). They assigned this species a listing priority number of 11 and any additional information they receive on the distribution, threats, and conservation actions associated with *Botrychium* will influence their determination on whether listing under the Endangered Species Act is still warranted.

Selection of Species for Analysis

Forest Service ecologist and botanists compiled existing information of rare or potentially rare plant species from the Intermountain Region Sensitive Species List, and lists maintained by the Utah Native Plant Society and Utah Conservation Data Center (UCDC). Information on the biology, demography, current threats, and distribution of these plant species was obtained from current scientific literature, technical reports, monitoring and inventory reports, professional expertise, and the UCDC.

All plant species with global (G) ranking of G1-G3 or Utah state ranking of S1-S2 (Utah Rare Plant Meeting Results 2000) known to occur on the Wasatch-Cache National Forest were examined for analysis. Global and State rankings are based on a system developed by The Nature Conservancy and used by the Natural Heritage and Conservation Data Center network. These rankings serve as a reflection of the overall status of a species throughout its global and State range. The global system is a one-through-five ranking system, ranging from species considered globally rare (G1-G3) to those rare in Utah (G4-G5).

- A G1 ranking refers to those species that are critically imperiled globally because of extreme intrinsic rarity or because of some factor of its biology making it vulnerable to extinction and typically have fewer than 5 viable occurrences (Utah Plant Report, 2000).
- G2 species are defined as those that are imperiled globally because of rarity or because other factors may increase its vulnerability to extinction throughout its range (6 to 20 element occurrences).
- G3 are those species that are vulnerable, either due to rarity or vulnerability of other factors (21 to 100 element occurrences).
- G4-G5 species are apparently secure (usually more than 100 element occurrences) but typically have cause for long-term viability concern.

All G1-G3 species were included for evaluation in the effects analysis, unless documentation was provided that any given species did not require sensitive status (e.g., new population data or increased occurrence data provided after the original G-rank assignment). The state of Utah, through the UCDC and the Utah Native Plant Society, also assigns state rankings. Like the global ranking system, the state system is a five-level ranking system, ranging from species considered extremely rare in the State. A species that is rare in one state, however, may range from being rare to common globally. The definitions for the state rankings correspond to the global and state rankings. All species ranked S1-S2 were included in the evaluation for effects analysis.

The preliminary list of rare species to be evaluated included many species. From this list, it was determined which species should be included in the effects analysis, which additional species of concern should be added, and which of those species should be removed because they were considered secure enough to drop from a list of “watch” plants. The resulting rare plant list (Appendix F, Tables F-1 and F-2) comprises the best available information on rare plant species either known to occur on the Wasatch-Cache or, on adjacent lands and have potential habitat on the Forest. Those species that have known special management needs to maintain their long-term viability are of primary concern. Species needing special protection on public lands include those: 1) designated as Endangered or Threatened under the ESA (or proposed as Threatened or Endangered), 2) proposed or candidate species under consideration for designation under ESA, and 3) on the Intermountain Region’s Regional Forester Service Sensitive Species List, both current and proposed (see Table F-1).

Additional consideration has been given to “watch list” plants regarding their management. Utah Natural Heritage Program defines watch list plant species as those that are regionally endemic but without range wide viability concern. Some watch list plants do not meet all criteria for being designated as sensitive species, but may need to be tracked because of their local rarity or because sufficient population viability concerns exist. Other may meet the criteria for being classified as Forest Service Sensitive, but because of the lack of current threats warrant a lower level of concern. Watch list plant species are not evaluated for effects in the plan revision process.

Sensitive Species and Species at Risk

Plant species are designated "Sensitive" by the Regional Forester because their populations or habitats are trending downward, or because little information is available on their population or habitat trends. A six-step process is now used to determine whether a plant is designated as sensitive (USDA Forest Service 1999f). The primary purpose of the Sensitive Species Program is to maintain viability and to conserve or restore habitat conditions for designated species, in order to prevent them from becoming federally listed.

The initial Intermountain Region Sensitive Plant Species List was published in 1988-1989, and later updated in 1995. New information about sensitive plant habitats, occurrence, successional relationships, potential threats, and disturbance response has become available in the last 10 years. Another revision of the Sensitive Species List is expected in mid-2001. The list is likely to expand the number of plant species that potentially occupy habitat on the Wasatch-Cache

National Forest. The number of endemics included in this list is also expected to increase. Endemic plants are defined as those that are restricted to a specific locality or region. Regional Endemics are defined as species with a distribution is contained between 100 and 10,000 square miles, while local endemics have a distribution that is less than 100 square miles.

The Wasatch-Cache currently has 14 plant species that are designated as Sensitive on the Region 4 Sensitive Species List. An additional 14 species are recommended Sensitive to be added to the updated Region 4 Sensitive list. In addition to the current or proposed sensitive species an additional 17 plant species at risk or watch list species have been identified as occurring on, or having potential habitat within the Wasatch-Cache National Forest. These 48 species represent the set of species at risk for the effects analysis presented here. Table B-2 summarizes the endemism of these species. The life form and taxonomic groupings of these species (along with the six TEP species) are summarized in Table B-3. Appendix F, Table F-1 provides a complete list of these species, their global and state status, endemism, and global and geographic unit distribution. Appendix F, Table F-2 provides information on habit, life form, habitat group, and plant status (US Forest Status and recommended status by UCDC).

Table B-2. Endemism and Distribution of Threatened and Sensitive (current and proposed) Plant Species

Endemism and Distribution	Number of Species
Endemic to the Wasatch-Cache National Forest (all populations on FS lands)	6
Endemic to the state of Utah	17
Endemic to the Central Wasatch Mountains	10
Endemic caliciphiles in the Bear River Range	7
Endemic to seasonally to permanently moist wet areas in Utah	6
Endemic to Salt Lake County, Utah	1
Endemic to the Wasatch Mountain Range	3
Paleoendemics – relict species	2
Sparsely distributed (found throughout several states but in isolated populations)	6
Regional Endemics (distribution is contained between 100 and 10,000 square miles)	14
Local Endemics (distribution is less than 100 square miles)	18

Table B-3. Life-form and Taxonomic Groupings of Threatened, Proposed and Sensitive (current and proposed) Plant species

Life-form and Taxonomic Grouping	Number of Species
Vascular Plants	48
Ferns and Fern Allies	1
Perennial Herbs	42
Annual and Biennial Herbs	3
Shrubs	1
Trees	1
Non-vascular Plants	0

Environmental Consequences

Resource Protection Measures

Laws, Regulations, and Policies - Threatened, Endangered, proposed, or candidate species have special management requirements for all Forest Service management activities. Conservation Assessments, Strategies, and Agreements, along with Recovery plans (described above), currently established for these plant species within the Wasatch-Cache will be met and upheld to ensure the viability and conservation of these species.

Sensitive species will be managed to ensure their population viability and preservation. The Forest Service management policy (FSH 2609.25 and FSM 2670) ensures that for all TEPS plant species, the following measures will be taken: (1) biological evaluations will be written for all activities that may impact sensitive species and their habitat, (2) “effects” of activities will be determined as similar to those for threatened, endangered, or proposed species, and (3) sensitive species must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for federal listing. This Forest Service management policy will be employed at a species level in all alternatives to ensure its mandates are achieved and that sensitive species are conserved.

Wasatch-Cache Forest Plan Direction and Implementation – There are inherent risks and uncertainty in attempting to determine the overall effects of management activities on TES plant species and rare plant communities at a Forest Plan level. Many of the species analyzed in the effects analysis presented here may be beneficially or detrimentally affected by the activities emphasized by each Management Prescription Category (MPC) for each alternative. Rare communities, not unlike rare species, may also increase or decrease in abundance or quality based upon activities associated with alternative emphasis or prescription categories. To provide for viability and conservation of all plant species and communities, mitigation measures would be implemented at the appropriate scale for all alternatives. These measures include specific standards and guidelines that are to be used in analysis, implementation, and monitoring at both the forest wide and site-specific project level. Additionally, these measures strive to maintain or restore the distribution of native plant communities and special habitat features within the Wasatch-Cache National Forest.

Detailed goals, standards, guidelines, and management area direction for botanical resources that focus on maintaining population viability, ecological processes, and native plant communities are included in the proposed forest plan.

General Effects

The current threats known for TES plants and species at risk were identified previously in this section. These threats are assessed below for their direct and indirect effects to plant populations and habitats. Impacts were grouped into six management actions that have the most potential to affect plants: 1) recreational activities, 2) mechanical activities, 3) livestock grazing activities, 4) Ski areas and associated activities, 5) fire (fire use and wildland fire), and 6) non-native species invasion. The intensity and spatial extent of the management actions would vary by alternative;

however, the general impacts to plants associated with each of the management actions are described below.

Effects on Botanical Resources from Roads and Access Management

Roads increase access to and fragment habitat and provide an avenue for weed invasion. They are often placed on ridge tops, in riparian areas, or through scree slopes, which are important habitats for a large number of species on the Wasatch-Cache National Forest. 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.

Effects on Botanical Resources from Timber Harvest

Mechanical activities include vegetation management treatments, whether for restoration or to meet growth and yield objectives. Activities such as timber harvest 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 (see above). Sudden changes in seral stage, or an abundance of early seral stages, also reduce the available habitats for those plants that require mid to late seral stages. However, those species that prefer openings, early-seral stages, or some ground disturbance, could benefit from moderate levels of mechanical activities. Changing patch dynamics across the landscape could also have effects to TES plant species.

Forest-dependent species, such as brownie lady's slipper (*Cypripedium fasciculatum*) and Maguire's draba (*Draba maguirei* var. *maguirei*), which typically occur in the understory of conifer forests, occur outside potential timber harvest areas regardless of Alternative. Other species such as Maguire's primrose (*Primula maguirei*), Frank Smith violet (*Viola frank-smithii*), and Cronquist daisy (*Erigeron cronquistii*) are typically associated with shaded rocky habitats beneath a conifer understory. Where these species occur, again is outside potential timber harvest areas regardless of Alternative.

Effects on Botanical Resources from Vegetation/Fuels Treatment

Mechanical activities include vegetation management treatments, whether for restoration or to meet growth and yield objectives. Activities that mechanically remove fuels and/or canopy cover can alter the microhabitat of various rare plant species. As noted with timber harvest above, sudden changes in seral stage, or an abundance of early seral stages, also reduce the available habitats for those plants that require mid to late seral stages. However, those species that prefer openings, early-seral stages, or some ground disturbance, could benefit from moderate levels of mechanical activities.

None of the alternatives proposes any vegetation treatments in rare plant habitat, unless it would maintain or improve conditions required by these species. Mechanical treatments of oak are the greatest in Alternative 7 and are proposed primarily along the urban interface (20,000 acres). The greatest potential for impacts to rare plants would be through access with mechanical equipment across habitat, because none of our plant species at risk are likely to occur in these

dense oak stands. Some fuels treatments could occur in the Douglas-fir stands that provide cover for species such as Maguire's draba. Any treatment would remove fuels and avoid impacts to these rare species.

Effects on Botanical Resources from Recreation

Recreational activities on the Wasatch-Cache National Forest pose many of the major threats faced by TES plants and plant species at risk. The most important direct impact related to recreation is trampling, both by hikers and ORV use (Liddle 1975, 1991). These types of activities particularly threaten many TES plants and plant species at risk. Unauthorized ORV use has resulted in a significant impact to *Draba maguirei* var. *burkei* in the Willard Peak area. 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. Undeveloped camping and recreation have similar impacts, which are more difficult to monitor. Parking areas, particularly undesignated areas, pose similar impacts to plants. The long-term impact of bisecting the population to functions such as reproduction and dispersal are still unknown. Other recreational impacts include ORV use, which can also disturb soil, affecting both habitat and potential habitat. Roads and trails for recreational use can contribute to the spread of noxious weeds, and increase the accessibility of areas to native ungulates and livestock, which can increase the impacts of trampling, herbivory, and congregation. Rock climbing in some portions of the Wasatch-Cache National Forest has threatened the viability of those species that occur on those habitats and these are most common in the Cache-Box Elder and the Central Wasatch Management Areas. The practice of clearing crevices in the rock of vegetation to improve climbing conditions may result in the direct loss of some of our most rare species on the Forest.

Cryptogamic soil crusts can be affected by unauthorized ORV use. The greatest potential for this is in areas where these crusts are most likely to occur, the Stansbury Mountains. No alternatives propose additional road building in this area because no timber harvest or oil and gas exploration occur here. On the other hand, no roads or trails are recommended for closure for wilderness recommendations under any alternative in this area either.

The Wasatch-Cache National Forest is home to some of the largest ski areas in the state of Utah. Snowbird, Solitude, Snowbasin, Brighton, and Alta are all within the forest boundary. Several species are directly impacted by the activities associated with ski areas including *Ivesia utahensis*, *Draba maguirei* var. *burkei*, and *Jamesia americana* var. *macrocalyx*. Threats from ski areas include direct trampling, mechanical construction, increased roads and facility development, increased summer recreation, and habitat fragmentation. Additionally, impacts from snowmaking and avalanche control could directly and indirectly effect populations of TES plants and plant species at risk. The production of snow requires a large support of electrical lines, waterlines, compressor and pump buildings, and other support structures, which could directly impact TES plants and plant species at risk and their habitats. Additional impacts to rare plant species could result from increased snow due to packing and grooming and avalanche control and could result in extended time needed for snow melt in the spring. Those species in the forested habitat and rock outcrop habitat groups could be impacted by expansion efforts of existing ski areas as well.

Effects on Botanical Resources from Livestock Grazing

Most of the rare plant species that occur on the Forest do not occur in habitat or portions of the forest that are currently grazed by domestic livestock. Various direct and indirect impacts, however, are associated with livestock grazing. Direct impacts include livestock trampling, herbivory, congregation and associated soil disturbances. Indirect impacts are more varied and can include the increased potential for the spread of noxious weeds and associated herbicide spraying, the introduction of exotic species, and changes in species composition and density of grasslands, shrublands, and woodland environments. These changes often affect the habitat available for TES plants and plant species at risk. Livestock often utilize and congregate in riparian areas and meadows, which can also alter species composition and change the habitat available to TES plants and plant species at risk. Additionally, changes in vegetation and bank stability can affect hydrological cycles, further stressing plants that depend on stable hydrological conditions. At the same time, plants in the Intermountain West have evolved with herbivory by insects, rodents, and wildlife species, thus some plants may benefit from grazing at appropriate intensity levels.

Cryptogamic soil crusts, where they are most likely to occur (Stansbury Mountains), have likely been and continue to be impacted by livestock grazing except outside of existing livestock allotments. One of the vacant allotments in that area is proposed for closure under Alternative 1. This allotment has approximately 6,200 acres of sagebrush and pinyon-juniper vegetation cover types. These types have the greatest potential for cryptogamic soil crust habitat, which is about 9 percent of the lands managed by the Forest Service in the Stansbury Mountains. Alternative 1 would therefore have the greatest potential to protect these habitats in the future. Because this allotment has been vacant for several years, however, and because there is a very low potential to restock this allotment given the cost of doing so, all alternatives will have a similar impact to cryptogamic soil crusts over the short term of this planning period.

Effects on Botanical Resources from Non-native plant invasion and Noxious Weeds

Noxious weeds directly affect plants and plant populations 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 TES plants and plant species at risk viability. Roads, trails, livestock, and canopy reduction can provide ideal pathways for the introduction of exotic and non-native species. Indirectly, herbicide spraying can destroy populations of native pollinators by contaminating nesting materials and pollen resources (Pierson and Tepedino 2000), further decreasing the viability and reproductive success of TES plants and plant species at risk. Some species of non-native plants will alter hydrological regimes, changing and reducing the habitat available to TES plants.

Effects on Botanical Resources from Wildlife Management

Wildlife management generally does not have an effect on botanical resources. The greatest potential for impacts is from transplanted mountain goats that occupy habitat for several plant

species at risk. No alternative alters the potential for transplantation of Mountain goats and, therefore, effects are the same under each alternative.

Effects on Botanical Resources from Oil and Gas Activities

Oil and gas activity, while having the potential to impact plant species at risk, occurs in a portion of the forest with few rare plant species. Uinta greenthread (*Thelesperma pubescens*) is the closest species to the oil and gas exploration area, but is protected in each alternative from potential impacts.

Effects on Botanical Resources from Fire Management

Fire can be used as a tool to accomplish management goals and objectives as well as pose major threats through uncharacteristic wildfires. Mechanical preparation of fuels may be needed before fire use. As the potential for spring burning increases to meet fire use goals, the potential impacts to many plants increases. Most plants are not adapted to fire at this time of year. Spring burning interferes with flowering, fruiting, and other physiological impacts, and could affect life history patterns with pollinators. However, these risks need to be weighed against the risks of uncharacteristic wildfire and long-term habitat loss of plant species. Fire use to restore the historic fire regime could benefit these open-gap forested species in the long term. Wildfires can pose risks to some of the TES plants, particularly when the fires are uncharacteristic. In general, most plant species would benefit by the restoration of more historical fire regimes. There are also direct and indirect impacts to plants associated with wildfire suppression activities, such as road building and other mechanical activities, salvage logging, reforestation following fire, and the increased potential for the spread of noxious weeds.

Effects on Botanical Resources from Roadless Area Management

Roadless area management, especially when it has a non-motorized ROS, would be beneficial to rare plant species because the likelihood for impacts from management activities or recreational activities would be minimal. Alternative 1 manages nearly all roadless areas (over 605,000 acres) as non-motorized and Alternative 2 manages just over 540,000 acres as non-motorized. These alternatives would have the least effect on botanical resources. Alternative 6 manages nearly 300,000 acres as non-motorized, Alternative 7 manages almost 275,000 acres and Alternative 3 manages more than 230,000 acres as non-motorized. Alternative 4 manages more than 130,000 acres as non-motorized, while Alternative 5 manages less than 170,000 acres of the roadless areas as non-motorized.

Effects on Botanical Resources from Special Designation

Special designations, either research natural area (RNA) or special interest area (SIA) would be beneficial to rare plant species because the likelihood for impacts from management activities or recreational activities would be minimal. RNA status would be the most restrictive, while SIA status would manage for the botanical values for which they are established. Alternative 2 provides the most protection by designating over 5,500 acres of RNAs and nearly 32,500 acres of SIAs. The SIAs in this alternative were, for the most part, directed at maintaining botanical

values of both rare plant species and rare communities, such as Tall Forb communities. Alternatives 1, 6, and 7 are similar to one another in the protection they provide, but this is between 14,000 and 16,000 fewer acres. Alternatives 3, 4, and 5 each provide approximately 6,200 acres of protection through RNA and/or SIA designation.

Evaluation of Risk and Uncertainty

There are limitations in determining the impacts of the complex set of proposed actions under each alternative for the current sensitive, recommended sensitive, and watch list species (Threatened and suggested Proposed were analyzed separately) when assessing effects for the entire Wasatch-Cache National Forest. Causes of rarity can vary greatly for individual species. Species may be intrinsically rare or rare as a result of anthropogenic interference (Kruckeberg and Rabinowitz 1985). Other plant species may be rare due to their population ecology, evolutionary history, or basic reproductive biology. Historical or current anthropogenic activities may also contribute to the current distribution of these rare species. It is assumed in this analysis that certain management actions may promote or detract the potential long-term viability of TEPS plant species, or may increase or decrease the availability or quality of habitats that support these TEPS plant species.

Degree of Active Management by MPC

The potential impacts of each management prescription category (MPC) were ranked as low, moderate, or high based on the definitions and objectives for each prescription category (see Appendix D-1). The potential impacts to the TES plants and plant species at risk were ranked for the five management actions (fire, livestock grazing activities, recreational activities, mechanical activities, noxious weed invasion, ski areas) that have the most potential impacts to plants. These rankings are displayed in Table B-16.

Limitations of Using Habitat Groups

The habitat group methodology employed in this effects analysis may overlook key features of plant habitat and ecology. Ecological interrelationships such as pollinators and their viability requirements, or mycorrhizal associations, are often important features that are necessary for the continued survival and viability of TES plant species and plant species at risk. Such factors may not be accounted for by using broad habitat categories to classify TEPS plant species. In natural ecological systems, the factors that contribute to the physiognomy and distribution of species often occur as a continuum, not as discrete categories named habitat groups. Soil moisture, soil type, microsite moisture conditions, canopy closure, temperature, and light conditions often occur along a gradient. Individuals or populations of TES plant species occur along this gradient in a wide range of conditions. The use of habitat groupings is an attempt to begin capturing this variation of ranges and to bring like species together. The scale we are using to bring together these associations cannot possibly capture all of the environmental characteristics and intrinsic features necessary for the successful establishment and continued viability of TES plant species.

Table B-4. Rating of Potential Impacts on TES Species and Habitats by MPC

MPC	Fire Use	Grazing	Recreation	Mechanical	Noxious Weeds	Ski Areas
1.1	Moderate to high	Low to moderate	Low	None	Moderate	None
1.2	Moderate to high	Low to moderate	Low	None	Moderate	None
1.3	Moderate to high	Low to moderate	Low to moderate	None	Moderate	None
1.4	Moderate to high	Low to moderate	Low to moderate	None	Moderate	None
1.5	Moderate to high	Low to moderate	Low to moderate	Low to none	Moderate	None
2.4	Low to moderate	None	Low to moderate	Low to none	Low to moderate	None
2.5	None to low	Low to moderate	Moderate to high	Low to moderate	Moderate to high	None
2.6	Low to moderate	Low to moderate	Low to moderate	Low	Low to moderate	None
2.7	Low to moderate	Low to none	Low	Low to none	Low to moderate	None
3.1	Low to moderate	Low to moderate	Low	Low to none	Moderate	None
3.2	Moderate	Low to moderate	Low	Low to moderate	Moderate to high	None
4.1	Moderate to High	Moderate	Low	Low to none	Low to none	None
4.2	Low to moderate	Low to moderate	Low to moderate	Low to none	Low to moderate	None
4.3	Low to moderate	Low to moderate	Low to moderate	Low to moderate	Moderate to high	Low to none
4.4	Low to moderate	Low to moderate	Moderate to high	Low to moderate	Moderate to high	Low to none
4.5	Low	None	Moderate to very high	Moderate	Moderate to high	Moderate to high
5.1	Moderate	Low to moderate	Moderate	Moderate to high	Moderate	None
51/6.1	Moderate	Low to moderate	Moderate	Moderate to high	Moderate to high	None
5.2	Low	Low to moderate	Moderate	Moderate to high	Moderate to high	None
5.2/6.2	Low	Moderate to high	Moderate	Moderate to high	Moderate to high	None
6.1	Moderate	Low to moderate	Moderate to high	Moderate to high	Moderate to high	None
6.2	Moderate	Moderate to high	Moderate	Moderate to high	Moderate to high	None
8.0	Low to moderate	Moderate	Low to moderate	Low to moderate	Moderate to high	None
8.1	Low to moderate	Moderate	Low to moderate	Low to moderate	Moderate to high	None

Limitations of Extrapolating Effects Analysis for TEPS Species to the Wasatch-Cache Flora

The habitat group concept is based upon the habitat requirements of the current or proposed sensitive species and plant species at risk identified within the Wasatch-Cache. The habitat distribution of these rare plant species is not representative of the entire flora of north-central Utah, and should not be treated as such. Many of the plant species at risk have rather unique habitat requirements, such as edaphic characteristics, microsite limitations, or ecological associations. Many species may be intrinsically rare, newly evolved, or may be relicts. An additional limitation of this analysis is based upon the limited spatial data for potential habitat of TEPS plant species. Only those species with known element occurrences (UDWR UDNR 2002) within the Wasatch-Cache were included in the analysis. Spatial data of potential habitat for most TES species is not currently available. An analysis of the entire Wasatch-Cache flora has not been designed or attempted at this time.

Assumptions of Implementation of Standards, Guidelines, and Forest Service Directives

The viability of the plant species at risk and their respective habitats will be promoted with implementation of standards and guidelines, inventory and monitoring, and adherence to Forest Service directives for threatened, endangered, proposed, and sensitive plant species. Consistent implementation of standards and guidelines and adherence to Forest Service Management Policy across the Wasatch-Cache National Forest for all alternatives is mandatory for TES plant species conservation.

Measures and Factors to Assess Effects

Measures Used to Evaluate Effects on Threatened, Endangered, and Proposed Species

Current and potential threats to each individual threatened, endangered, or proposed (including candidate species) species were determined from current scientific literature and professional botanical knowledge and expertise (summarized in Appendix F Tables F-3, F-4, and F-5; and above, under Current Conditions). Using GIS technology, a map with an overlay of MPCs and the most current distribution information for element occurrences of TEP plant species (UDWR UDNR 2002) was created for each alternative. The ratings of potential impacts (Table B-16) for TEP species and habitats by MPC were then used to determine the overall effects of the MPCs for each individual Threatened or proposed species by alternative.

Direct and Indirect Effects by Species

Threatened, Endangered, and Proposed Species

***Primula maguirei* (Maguire's Primrose)**

The threats for potential impacts due to recreation and associated activities are moderate to high under all alternatives. However, alternative 5 may pose the highest risk to the populations and potential habitat for *Primula maguirei*. In this alternative, a high proportion of the habitat area and populations are assigned to MPC 2.5, followed by MPC 5.1. The impacts from recreation in MPC 5.1 are moderate to high as are the risks of invasion from noxious weeds. Recreational climbing and its impacts have been identified, currently, as posing the highest threats to this threatened species (see above and Appendix F). Alternative 4 poses the second greatest risk to

the populations of *P. maguirei* due to the high proportion of populations assigned to MPC 2.5. Additionally, several populations occur in MPC 6.2, which pose moderate to high risks from noxious weed invasion, and fire. These populations, while occurring in grazing allotments, do not receive grazing pressures because of the severe cliff habitat of this threatened species. Many of the threats from mechanical activities and fire are minimized due to the extreme nature of the habitat. In many populations, the existing overstory of Douglas-fir provides for microhabitat necessary to maintain this species. Thus, fire could negatively impact these populations. Alternatives 1, 2, 3, and 6 pose similar and intermediate impacts to the *P. maguirei*, with recreational activities posing the greatest risk to population viability.

***Spiranthes diluvialis* (Ute Ladies'-tresses Orchid)**

While Potential habitat occurs for *Spiranthes diluvialis* within the boundary of the Wasatch-Cache National Forest recent surveys have not found this species. Historic occurrences of this species were off the Forest. The potential for moderate levels of impact to potential habitat for this threatened species are common to all alternatives. However, *S. diluvialis* populations occur in riparian habitats and fall into RCAs. Within these RCAs, the management emphasis for any proposed action is to either maintain current conditions or to achieve desired conditions. Therefore, only those actions that would benefit riparian resources over the long term are permitted and impacts may be minimized.

***Viola frank-smithii* (Frank Smith Violet)**

Like *Primula maguirei*, the threats for potential impacts due to recreation and associated activities are moderate to high under all alternatives. However, alternative 5 may pose the highest risk to the populations and potential habitat for *Viola frank-smithii*. In this alternative, a high proportion of the habitat area and populations are assigned to MPC 5.1, followed by 2.5. Because of the proximity to Logan Canyon and the habitat on which this species occurs, the impacts from recreation, primarily climbing, in MPC 5.1 are moderate to high. Recreational climbing and its impacts have been identified, currently, as posing the highest threats to this threatened species (see above and Appendix F). Alternative 4 poses the second greatest risk to the populations of *V. frank-smithii* due to the high proportion of populations assigned to MPC 2.5. Additionally, several populations occur in MPC 6.2, which pose moderate to high risks from noxious weed invasion, and fire. These populations, while occurring in a grazing allotment, do not receive grazing pressures because of the severe cliff habitat of this threatened species. Many of the threats from mechanical activities and fire are minimized due to the extreme nature of the habitat. In many populations, the existing overstory of Douglas-fir provides for microhabitat necessary to maintain this species. Thus, fire could negatively impact these populations. Alternatives 1, 2, 3, and 6 pose similar and intermediate impacts to the *D. frank-smithii*, with recreational activities posing the greatest risk to population viability.

***Draba maguirei* var. *burkei* (Burke's Draba)**

Under all alternatives, the risks from recreation and associated activities are moderate to high. Alternative 5 may pose the highest risks to the populations and habitats of *Draba maguirei* var. *burkei* due to impacts from recreation and noxious weeds. Many of the populations are located along trails and may be impacted by increased use. Alternatives 1, 2, 3, 6 and 7 may pose the least impacts to *D. maguirei* var. *burkei* because of the large proportion of populations assigned to MPCs 1.1, 2.7, and 3.1. Alternative 4 may pose intermediate impacts to these populations due

increased demands for recreation. In all alternatives, the largest population occurs in MPC 4.5, which has already experienced loss of plants due to development.

***Dodecatheon dentatum* var. *utahense* (Utah Shooting Star, Wasatch Shooting Star)**

All alternatives would have moderate to high threats from recreation. In addition, there may be some moderate threats from weed invasion. Recreation impacts have already been documented as the primary threat to this species.

***Botrychium lineare* (Slender Moonwort)**

As previously noted, the threats to the historic habitat on the Wasatch-Cache National Forest for this species have been minimized. Livestock grazing has not occurred at Silver Lake in the past several decades. Cattle were grazed around Silver Lake when the original Brighton Hotel was constructed in 1841 and expanded in 1898 (Murphy 1996). The collection of this species that is in the Garrett Herbarium was collected in 1905, about the time when this resort was likely to be very active. It is possible that the amount of use in the area, both by livestock and by people, negatively effected the population. Up until the early 1990's there were abundant user created trails in the meadows around Silver Lake and vehicle tracks were evident in the area. The construction of a raised boardwalk in the mid 1990's to protect the fragile wetland habitats from uncontrolled trampling also eliminated threats from road maintenance and development. Timber harvest occurred in the early 1900's to support mining activities in the area, but now is restricted to maintenance of ski runs at both Brighton and Solitude Ski Area adjacent to Silver Lake.

Cumulative Effects

Threatened, Endangered, and Proposed Species

Cumulative effects are defined as those impacts on the environment that result from the incremental effects of an action when it is added to past, present, and foreseeable future actions, regardless of the parties, government agencies or otherwise, responsible. The alternatives of the forest plan provide land and resource management direction for those lands within Wasatch-Cache National Forest that are administered by the Forest Service. Forest Service botanists and ecologist will continue to coordinate with American Indian tribes, other federal agencies, state and local agencies, university researchers, ICDC, and other resource advisory councils to further minimize or avoid adverse cumulative effects for all TES species, rare and unique communities, and potential habitat.

***Primula maguirei* (Maguire's Primrose)**

Currently, a total of 14 element occurrences of *P. maguirei* have been identified within a corridor of Logan Canyon approximately 19 km long and less than 1 km wide. The total global population of *P. maguirei* is estimated at 3000 individuals (USDI USFWS 1990). The narrow distribution and small population size of *P. maguirei* is likely best explained by its unique habitat requirements and need for calcareous substrates. It is more likely a relict species that formerly had wider ranges when climatic conditions in North America were wetter and cooler. Potential and actual habitat within the canyon and along the canyon floor may have been significantly impacted by human activity because of development (USDI USFWS 1990). Populations of *P. maguirei* are restricted to an elevational range of 1400 to 1800 meters (4,600 to 5,900 feet) along

the lower canyon walls of Logan Canyon (Padgett 1986) and plants are often found in cracks or crevices or amidst well-developed mats of moss and is most often found in areas of cool, moist microclimates. Extensive surveys of potentially suitable habitat (additional outcrops of Fish Haven and Laketown Dolomites) have been conducted in adjacent drainages and in other portions of the Bear River Range of northern Utah and southern Idaho. No additional populations of *P. maguirei* have been located (Franklin 1990c).

The US Fish and Wildlife Service prepared a Recovery Plan for *Primula maguirei* (USDI USFWS 1986) that has been in effect since 1990. Additionally, a Conservation Strategy for the Bear River Range Endemics, which includes *P. maguirei*, was prepared and signed in 1995 (Glisson 1995a). A progress report and amendment to the Conservation Strategy and Action Plan is currently in draft form. This amendment will provide new information and proposed changes to the existing strategy and will enhance conservation and recovery efforts for *P. maguirei* and the other Bear River Range Endemics.

***Spiranthes diluvialis* (Ute Ladies'-tresses Orchid)** - *Spiranthes diluvialis* populations are randomly interspersed throughout relatively low-elevation riparian, vernal wet, and lakeside wetlands throughout the interior western United States. Known populations have been located on a variety of land ownerships including, Forest Service lands, BLM lands, and private ownership. Despite extensive surveys, no populations of this species have been discovered on the Wasatch-Cache National Forest. *Spiranthes diluvialis* prefers open, early seral riparian areas for establishment, thus restoration efforts for aquatic resources may be in direct conflict with management efforts for this threatened plant species. Additionally, activities that potentially contribute to the cumulative effects for this threatened species include mining, timber harvest, livestock grazing, flood events, prescribed natural fire, reservoir level and river flow management, and road construction activities.

The USFWS has prepared a Draft Recovery Plan (USDI USFWS 1995a), which outlines the management actions and directives needed to restore populations and reduce current threats. The draft recovery plan outlines guidelines, objectives, and management directives. The intent of the draft and final recovery plan will be met and upheld for all Forest Service actions under all alternatives to ensure the continued viability of existing populations and to maintain potential habitat conditions. Efforts to streamline recovery actions with aquatic TEPS species conservation will be made to prevent conflicts in management activities and to most effectively preserve viability of all resources.

***Dodecatheon dentatum* var. *utahense* (Utah Shooting Star, Wasatch Shooting Star)** *Dodecatheon dentatum* var. *utahense* is endemic to shady, moist cracks and crevices of rock outcrops, often in the spray of waterfalls (Holmgren 1994) and ranges in elevation from 2000 to 2900 m (6,400 to 9,500 feet). Four known populations have been identified in Big Cottonwood Canyon within an area of approximately 3 miles square (Welsh et al. 1993). Many surrounding seeps have been surveyed for the presence of *D. dentatum* var. *utahense*, though no new populations have been located.

Dodecatheon dentatum var. *utahense* is currently being considered for addition to the Region 4 Sensitive Species list for the Wasatch-Cache National Forest and is on the Utah Natural Heritage

Program Tracking list (UDWR 1998a). It currently has no designation or proposed legal protection with the US Fish and Wildlife Service. Currently, no preventative measures (i.e. fences, barriers) have been taken to exclude picnickers, hikers, or climbers from the fragile populations (Padgett 2000b). Future efforts to minimize long-term threats to the population viability will include measures to fence area to prevent further losses and interpretative measures to educate the public about the rarity of this species.

***Viola frank-smithii* (Frank Smith Violet)**

Viola frank-smithii is one of the few rock-dwelling violets known in North America (Holmgren 1992). Endemic to cliffs and near-vertical outcrops of carbonate rock, this species is found in elevation from 1646 to 2073 m (5,400 to 6,800 feet) with most populations occurring on cool, northerly exposures that are shaded for the majority of the day (Stone 1994). *Viola frank-smithii* is found in distinct microhabitats similar to that of *Primula maguirei* and these species are often found in close proximity (UDWR 1998b).

Conservation Strategy for the Bear River Range Endemics, which includes *Viola frank-smithii* was prepared and signed in 1995 (Glisson 1995a). Direct provisions for *V. frank-smithii* include the development and implementation of specific research aimed at determining habitat dynamics, germination requirements, and microhabitat characteristics. The completion of Conservation Agreements with US Fish and Wildlife Service and establishment of an interagency Technical Team to oversee implementation of the Conservation Strategy and Action Plan will further enhance recovery efforts for all the Bear River Range Endemics.

***Draba maguirei* var. *burkei* (Burke's Draba)**

Recent research has shown that variety *burkei* is a distinct species (Windam and Beilstein 1998) and will be elevated to the species level. A total of 13 populations are known, ranging from the Wellsville Mountains, Strawberry Peak, and James Peak. Burke's draba populations occur on ledges and in crevices of exposed carbonate and quartzite outcrops and on the adjacent rock loam soils in Douglas fir and mixed conifer communities. The elevation range for this taxon is 1650 to 2975 m (5,400 to 9,765 feet).

Draba maguirei var. *burkei* is currently a Sensitive species on the Region 4 Sensitive Species list for the Wasatch-Cache National Forest and is on the Utah Natural Heritage Program Tracking list (UDWR 1998a). It currently has no designation or proposed legal protection with the US Fish and Wildlife Service. Due to the existing threats to this taxon and its conservation needs, it was suggested by the Utah Native Plant Society (2000) that the status of *D. maguirei* var. *burkei* be elevated to Threatened with the US Fish and Wildlife Service. Forest Service ecologist, biologists, and managers are currently preparing a Conservation Assessment and Strategy for *Draba maguirei* var. *burkei*. Once completed, this Conservation Assessment and Strategy will provide management objectives that upon implementation will maintain the viability of populations, provide research opportunities to determine life history, demography, ecology, and factors contributing to rarity, and establish monitoring protocols for Burke's draba.

***Botrychium lineare* (Slender Moonwort)**

Recent surveys and data review show that this species is possibly more widespread than previously known. It is currently known from a total of nine populations in Colorado, Oregon,

Montana, and Washington and, in addition, there are four historic population sites in California, Colorado, Idaho, and Montana and two in Canada. (USDI USFWS 2002a). It is believed that these historic populations may be extirpated. Cumulatively some of the recognized threats include road maintenance, herbicide spraying, recreation, timber harvest, trampling and grazing by wildlife and livestock, exotic species, and development. And because of its distribution and possible cumulative effects, it was noted in the Federal Register that:

Because we concluded that the overall magnitude of threats to *B. lineare* throughout its range is moderate and the overall immediacy of these threats is nonimminent, we assigned this species a listing priority number of 11. Although we are not proposing a listing priority change or removal of candidate status at this time, any new information we receive on the distribution and threat/conservation actions of *B. lineare* may have a bearing on whether listing under the Endangered Species Act is still warranted.

Species at Risk

The current or proposed sensitive plants species inhabit a diverse array of habitat and vary in their distribution across the landscape. These species are faced with a variable range of threats and differ in the degree to which Forest Service management and other management may affect their status. The amount of current scientific information and distribution data available also varies greatly among species, thus often limiting the assessment of the cumulative effects of all management activities and environmental consequences on the long-term viability of such species.

Distribution on the Landscape

A large majority of the TES plant species or plant species at risk is locally or regionally endemic to the Wasatch-Cache National Forest and surrounding areas (Appendix F, Table F-1). Thus, the Wasatch-Cache is primarily responsible for a large majority of the populations of these species. Indeed, several species are found only the Wasatch-Cache National Forest lands (Appendix F, Table F-1). Management activities including livestock grazing, fire use, mechanical treatments such as timber harvest and road construction, recreation and noxious weed invasion may pose potential impacts to these species. The Forest Service endemic and local endemic species (Appendix F, Table F-1) have been identified for each specific Geographic Unit to further ensure that manage project level management and planning incorporate and protect these narrowly distributed species.

Trends

All TEPS species and their habitats could be potentially impacted, positively or negatively, by the activities of management agencies, private landowners, state agencies, and human impacts. However, several species may be more susceptible to these potential impacts (fire, grazing, recreation, mechanical treatments, noxious weed invasion, ski area activities) given their current population trend. For many of the sensitive species or species at risk, little to no current information is known concerning biology, threats, or population trends, thus making the estimation of cumulative effects difficult. Many are thought to have a declining population trends within the extent of their distribution.

These species would be at greater risk of loss or habitat destruction from the impacts of all management and human activities than those with stable or increasing trends. Efforts to increase information concerning trends, biology, and viability, and to preserve existing populations will be made for all TEPS species and plant species at risk.

Mitigation

Management efforts are already in place in an attempt to offset the cumulative effects that may occur under management activities. The National Forest Service (FSM 2670 and FSH 2609.25) Management Policy ensures that for all TEPS plant species, declining or otherwise, the following measures will be taken: (1) biological evaluations will be written for all activities that may impact sensitive species and their habitat, (2) “effects” of activities will be determined as similar to those for threatened, endangered or proposed species, and (3) sensitive species must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for federal listing. This National Forest Service Management Policy will be employed at a species level in all alternatives to ensure its mandates are achieved and that sensitive species are conserved. Additionally, guidelines for proactive management include preparation of Conservation Agreements and Strategies to maintain or restore habitats of sensitive species.

