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Vegetation and flora of the Line Creek P



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VEGETATION AND FLORA OF THE LINE CREEK PLATEAU AREA,
CARBON COUNTY, MONTANA

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Justification

The Beartooth Mountains of south-central Montana and adjacent Wyoming are one of the most extensive and significant alpine areas of North America. The range contains the highest peaks and the largest representation of tundra in Montana and Region One of the U.S. Forest Service. Numerous alpine plant communities, from wetlands to dry turf are well developed here. Many species of arctic plants with disjunct populations in the Beartooth Mountains are considered rare in Montana (Johnson 1962, Lesica and Shelly 1991). As a result, this area is one of the most significant floristic areas in the state (Lesica et al. 1984). A large proportion of this alpine area is contained in the Absaroka-Beartooth Wilderness Area on Custer, Gallatin and Shoshone national forests.

The Line Creek Plateau occurs on the eastern edge of the range, separated from the wilderness area to the west by the Beartooth Highway. The top of the plateau is gently rolling alpine tundra and turf with extensive moist snowbed vegetation but little actual wetland or permanent surface water features. Slopes of the plateau on the north and east sides fall off steeply and are clothed in coniferous forest or nearly barren talus. Drainages are narrow with steep sides and little or no riparian areas. A high narrow ridge of Madison limestone occurs along the east foothills below the plateau where the uplift has raised the sedimentary beds on edge. Sagebrush steppe and limber pine woodland dominate these foothills.

The Line Creek Plateau supports large representations of many of the common alpine plant communities found throughout the Beartooth Mountains but is more accessible than most other parts of the range that occur in the wilderness. The Beartooth Range is higher and farther east than any other high alpine range in Montana or Region One. As such it is floristically more similar to the high ranges of Wyoming, Utah and Colorado than other ranges in the state. Two alpine plant communities, Festuca idahoensis/Geum rossii and Salix glauca/Deschampsia cespitosa c.t.s are well-developed on the Line Creek Plateau but are not otherwise reported for Montana. In addition, two alpine communities found in southwest Montana have unique forms in the Beartooth Mountains. Moist tundra in the Carex scirpoidea/Geum rossii c.t. is often dominated by Deschampsia cespitosa; additional sampling may warrant recognition of a Deschampsia cespitosa/Geum rossii c.t. Some areas of fellfield now placed in the Carex elynoides c.t. are dominated by Kobresia bellardii, and this type may also warrant recognition as a separate community type. Both of these communities are not otherwise reported for Montana and are more similar to vegetation found in Wyoming and Colorado.

The slopes of the Line Creek Plateau support a number of subalpine and montane forest communities. The eastern foothills at the base of the Line Creek Plateau support good-condition grasslands, sagebrush steppe and limber pine woodlands developed on calcareous soils derived from Madison limestone (Veseth and Montagne 1980).

Sixteen species of vascular plants listed as species of special concern by the Montana Natural Heritage Program are known to occur on the Line Creek Plateau. Fourteen of these are found near or above timberline; two more are found in sagebrush steppe in the eastern foothills of the plateau. One species is a candidate for listing as a threatened or endangered species; five others are listed as sensitive by Region One of the U.S. Forest Service. Many areas of the Beartooth Mountains have been explored botanically; nonetheless, four species of plants have been found in Montana only on the Line Creek Plateau or the adjacent Hellroaring Plateau. The earlier snow-release occurring on the Line Creek Plateau may provide conditions more amenable to species that evolved in low-elevation arctic environments suggesting ways in which this easternmost and warmest plateau may be biologically unique.

Most of Montana's Beartooth Mountains are included in the Absaroka-Beartooth Wilderness Area and are thus protected from most human-caused disturbances. The area of limestone scarps and desert foothills on the east face of the mountains along Grove and Gold creeks forms the proposed Meeteetse Spires Preserve (Lesica 1988), a cooperative project of The Nature Conservancy, The Bureau of Land Management and private landowners. The Line Creek Plateau, one of the five largest alpine plateaus of the Beartooth Mountains, lies between Meeteetse Spires Preserve and the Absaroka-Beartooth Wilderness. The Meeteetse Spires area adjoins the Pryor Mountain Desert region, a large area of primarily public land supporting a spectacular array of desert communities and rare plants (DeVelice and Lesica 1993, Kratz 1988, Lesica and Achuff 1992, Lesica et al. 1992). On the eastern margin of the Pryor Mountain Desert lies the Bighorn Canyon National Recreation Area and the Bighorn Mountains of Wyoming. Thus, the Line Creek Plateau is the missing link in the chain that connects the Bighorn-Pryor Mountains and the Pryor Mountain Desert with the Absaroka-Beartooth Wilderness and the Greater Yellowstone Ecosystem.

This system of reserves and wildlands captures an unprecedented degree of the habitat diversity present in the Northern Rocky Mountains (Lesica 1991). The most significant nature reserves are those that encompass the broadest range of environments (Hunter et al. 1988). There are three reasons why habitat diversity is important: (1) high species diversity is associated with many different communities and their ecotones, (2) habitat diversity provides conditions necessary for continued

evolution of locally-adapted ecotypes and species, and (3) large environmental gradients will allow species to persist during periods of climatic stress or change. Protection of the Line Creek Plateau will help preserve biological diversity by securing connectivity among major wildlands ecosystems in the Rocky Mountains.

Principal Distinguishing Features

Alpine Communities

The Line Creek Plateau occurs on the eastern edge of the range, separated from the wilderness area to the west by the Beartooth Highway. This plateau supports large pristine representations of many of the common alpine plant communities found throughout the Beartooth Mountains, but it is more accessible than most other parts of the range that occur in the wilderness. The Salix glauca/Deschampsia cespitosa and Festuca idahoensis/Geum rossii community types considered rare in the Beartooth Range and the rest of Montana (Cooper and Lesica 1992) are common on the Line Creek Plateau. Alpine communities occur between 9,300 and 10,500 ft. Classification of alpine community types is based on Cooper and Lesica (1992) and data acquired in 1993 using ECODATA methodology.

(1) Festuca idahoensis/Geum rossii c.t.

Warm slopes with well-developed soil at elevations near timberline support herbaceous vegetation dominated by Festuca idahoensis, Agropyron caninum, Poa rupicola and Koeleria cristata. Common forb species include Geum rossii, Lupinus argenteus, Solidago multiradiata, and Agoseris glauca. This community was not described by Johnson and Billings (1962) but similar vegetation in southwest Montana was described by Cooper and Lesica (1992) and classified as the alpine grassland physiognomic type. Southwest Montana communities have Potentilla diversifolia as a dominant forb; Geum rossii was not present. Potkin and Munn (1987) described a Festuca ovina c.t. from the Wind River Range alpine zone that is similar to this type. Their F. ovina is probably a small form of F. idahoensis.

(2) Carex elynoides c.t.

Gravelly, poorly developed soils of upper slopes, ridge crests and other wind-exposed areas were dominated by Geum rossii, Carex rupestris, Kobresia bellardii and Poa rupicola as well as many cushion-forming species such as Arenaria obtusiloba, Silene acaulis and Trifolium parryi. Luzula spicata, Festuca ovina and Lupinus argenteus were other common species. Similar turf communities dominated by either C. rupestris or C. elynoides have been described for southwest Montana (Cooper and Lesica

1992). Johnson and Billings (1962) referred to this vegetation as the cushion plant community in Geum turf vegetation, and Bamberg (1961) described two similar communities, fellfield and dry Carex from the Beartooth Mountains that are probably referable to this type. Similar vegetation has also been described for Idaho (Moseley 1985, Caicco 1983), Wyoming (Potkin and Munn 1987), Utah (Lewis 1970) and Colorado (Willard 1979, Komarkova and Webber 1978). Turf dominated by Kobresia bellardii was described from the Colorado and may warrant recognition as a separate community type in Montana.

(3) Carex scirpoidea/Geum rossii c.t.

Gentle to moderate, cool slopes with intermediate soil development support vegetation dominated by Carex scirpoidea, C. paysonis, Deschampsia cespitosa and Luzula spicata. Dominant forbs included Geum rossii, Artemisia scopulorum, Lloydia serotina and Solidago multiradiata. Moister sites had higher coverages of D. cespitosa, while in more xeric examples dominance shifted to Carex paysonis. This community type has been described for southwest Montana (Cooper and Lesica 1992) and Utah (Lewis 1970). Potkin and Munn (1987) described a similar community in the Wind River Range of Wyoming as the Geum rossii/Deschampsia cespitosa c.t. Johnson and Billings (1962) and Bamberg (1961) described a Deschampsia meadow vegetation which is probably referable to moister stands of this type. Additional sampling may warrant recognition of a Deschampsia cespitosa/Geum rossii c.t. for Montana

(4) Dryas octopetala/Carex rupestris c.t.

Moist, north-facing, gentle slopes dominated by Dryas octopetala occurred in one area at the head of Quad Creek. Silene acaulis, Geum rossii, Trifolium nanum, Calamagrostis purpurascens and Carex rupestris were common associated species. This association is found throughout Montana (Bamberg 1961, Bamberg and Major 1968, Cooper and Lesica 1992) south to Colorado (Komarkova and Webber 1979, Willard 1978).

(5) Juncus drummondii/Antennaria lanata c.t.

Late snowmelt areas on lee slopes and in shallow accumulation areas develop vegetation dominated by Antennaria lanata, Carex paysonis and Juncus drummondii. Other common species include Deschampsia cespitosa, Carex scirpoidea, Luzula spicata, Sibbaldia procumbens and Antennaria umbrinella. Stands in the study area were usually dominated by either A. lanata or J. drummondii rather than a mixture of the two. The community type also occurs in the Madison Range of southwest Montana (Cooper and Lesica 1992). Potkin and Munn (1987) described a similar community for the Wind River Range of Wyoming.

(6) Salix glauca/Deschampsia cespitosa c.t.

Broad, gently concave, cool upper slopes often support vegetation dominated by dense thickets of Salix glauca with lesser amounts of S. planifolia. Common ground layer species included the graminoids, Deschampsia cespitosa, Carex paysonis, C. scirpoidea and Luzula spicata and the forbs, Lupinus argenteus, Geum rossii, Artemisia scopulorum and Solidago multiradiata. Soils are saturated early in the growing season but become dry later in the year. These communities combined with the next type were described for this same area by Johnson and Billings (1962). Potkin and Munn (1987) described a Salix glauca/Deschampsia cespitosa c.t. for the Wind River Range of Wyoming. Other communities dominated by S. glauca have been described for the Canadian Rockies (Achuff and Corns 1982), southwest Montana (Cooper and Lesica 1992) and Colorado (Komarkova and Webber 1978), but the associated species in these types are appreciably different.

(7) Salix planifolia/Carex paysonis c.t.

Stream terraces and seep areas often display vegetation dominated by Salix planifolia. The ground layer was dominated by Carex paysonis, Deschampsia cespitosa, Caltha leptosepala, Sedum rhodanthum and Senecio cymbalarioides. Soils are usually saturated throughout the growing season. Johnson and Billings (1962) described similar communities from the same area. This community is found in many areas of the Beartooth Range (Lesica pers. obs.). Subalpine and montane communities dominated by S. planifolia have been described for Montana by Hansen et al. (1991), but the ground layer is different. Potkin and Munn (1987) described three communities dominated by S. planifolia in the Wind River Range of Wyoming. Lewis (1970) mentioned colonies of S. planifolia in the alpine zone of the Uinta Range of Utah.

(8) Deschampsia cespitosa/Caltha leptosepala c.t.

Subirrigated stream terraces near timberline may support wet meadows dominated by Deschampsia cespitosa and Carex macloviana. Common forbs include Caltha leptosepala, Potentilla diversifolia and Polygonum bistortoides. Soils are moist throughout most of the growing season. Both Mueggler and Stewart (1980) and Hansen et al. (1991) described meadow vegetation dominated by D. cespitosa for the subalpine and montane zones, but their types were drier and warmer than the alpine community described for southwest Montana by Cooper and Lesica (1992) and for the Wind River Range of Wyoming by Potkin and Munn (1987). Alpine meadows dominated by D. cespitosa but with fewer wet-site forbs occur in Colorado and Utah (Willard 1979, May and Webber 1982, Lewis 1970).

Coniferous Forests

The slopes of the plateau support a number of subalpine and montane forest communities typical of southwest and south-central Montana (Pfister et al. 1977). These forest types are all prone to fire (Fischer and Clayton 1983) and most stands are in seral stage as evidenced by the presence or dominance of Pinus contorta and Pseudotsuga menziesii at all but the highest elevations. Coniferous forest occurs between 6,000 and 9,500 ft. Forest habitat types for Montana have been described by Pfister et al. (1977). The following types were observed in the study area, and common types are vouchered by plot data acquired using ECODATA methodology. Due to the predominance of steep slopes in the forest zone, extensive representations of riparian communities are rare or absent.

(9) Pinus albicaulis h.t.

Ridge crests, warm slopes and other exposed sites near timberline (8,500-9,500 ft) support forests dominated by Pinus albicaulis. Picea engelmannii and Abies lasiocarpa were scarce and of small stature. The ground layer was dominated by Festuca idahoensis, Carex phaeocephala, Lupinus argenteus and Trifolium parryi. Numerous species of forbs were common but had low cover.

Many stands of P. albicaulis supported large trees that were 150+ years old, and most stands appeared healthy. I observed no extensive areas of beetle kill or blister rust.

(10) Abies lasiocarpa-Pinus albicaulis/Vaccinium scoparium h.t.

Cool slopes near timberline on the north side of the Line Creek Plateau support forests dominated by Abies lasiocarpa, Pinus albicaulis, P. contorta and Picea engelmannii. Lodgepole pine was more common at the lower reaches of the type, while spruce became more common above. Vaccinium scoparium was the dominant shrub, although Spiraea betulifolia and Shepherdia canadensis may be common in lower stands. The ground layer was generally sparse with Arnica cordifolia, A. latifolia and Potentilla diversifolia the most common species. This type merges into the Abies lasiocarpa/Vaccinium scoparium h.t. below, and the two may be difficult to distinguish over large portions of the study area.

(11) Abies lasiocarpa/Vaccinium scoparium h.t.

Between 7,600 and 9,200 ft on the north side of the Line Creek Plateau, forests are dominated by Pinus contorta and Abies lasiocarpa. Pinus albicaulis was common only in more exposed positions, and Pseudotsuga menziesii occurred in warmer stands. These successional stands generally had a dense shrub layer of Vaccinium scoparium with Juniperus communis and Shepherdia canadensis often present. Colonies of Alnus sinuata may persist

in seep areas. Arnica cordifolia and Antennaria racemosa were common ground layer plants.

(12) Abies lasiocarpa/Arnica cordifolia h.t.

North and east-facing slopes between 7,000 ft and 8,000 ft support forests dominated by Pinus contorta, Pseudotsuga menziesii, Abies lasiocarpa and Picea engelmannii. Steep slopes and poorly developed soils commonly underlie these sites. Juniperus communis, Shepherdia canadensis and Physocarpus malvaceus were common shrubs. Arnica cordifolia and Antennaria racemosa were common members of the sparse ground layer. Abies lasiocarpa/Vaccinium scoparium usually occurs upslope and along drainage courses, while Pseudotsuga menziesii sites occur below.

(13) Pseudotsuga menziesii/Physocarpus malvaceus h.t.

Foothills between 6,500 and 7,000 ft on the north and east sides of the Line Creek Plateau support forest stands dominated by Pseudotsuga menziesii and Pinus contorta. The understory was dominated by Physocarpus malvaceus and Juniperus communis. Other common shrubs included Spiraea betulifolia, Rosa acicularis and Shepherdia canadensis. Common forbs were Aster conspicuus, Arnica cordifolia, Antennaria racemosa, Clematis columbiana, and Viola canadensis. This habitat type is common on limestone-derived soils on the east side of the Line Creek Plateau but is rare on the crystalline-derived soils found on the north side.

(14) Pseudotsuga menziesii/Juniperus communis h.t.

This habitat type is found on cool and warm slopes at 6,500-8,400 ft on the north and east sides of the Line Creek Plateau. Stands were dominated by Pseudotsuga menziesii and Pinus contorta. Pinus flexilis was common in seral stands at lower elevations on the east side of the study area. The shrub layer was dominated by Juniperus communis with minor amounts of Spiraea betulifolia. Arnica cordifolia and Antennaria racemosa were common ground layer species. Low-elevation seral stands often have many components of the Pinus flexilis/Festuca idahoensis type, but Pseudotsuga menziesii is the indicated climax. This is the most common lower montane habitat type in the study area.

(15) Pinus flexilis/Festuca idahoensis h.t.

Foothills along the east slope of the Line Creek Plateau at 6,200-7,200 ft have soils derived from limestone and support savannah dominated by Pinus flexilis. Juniperus scopulorum and Pseudotsuga menziesii were present in some stands. Artemisia tridentata and Juniperus horizontalis were the common shrubs. Festuca idahoensis, Agropyron spicatum and Koeleria cristata were abundant. Balsamorhiza incana, Cerastium arvense and Antennaria

microphylla were some of the many common forbs present in this type.

Pinus flexilis stands with a dense understory of shrubs such as occur in the study area are prone to severe crown fires with high P. flexilis mortality (Fischer and Clayton 1983). It is likely that much of what is now limber pine woodland was sagebrush steppe before active fire suppression (see discussion below under Artrri/Fesida).

A large proportion of the limber pine occurring on the limestone ridge at the north end of the study area had infections of dwarf mistletoe. In some areas administered by BLM, ca. 50% of the limber pine were dead or dying.

Shrublands and Grasslands

Shrub steppe dominated by species of Artemisia occur in the lower foothills at the base of the Line Creek Plateau on the east side and, to a limited extent, on the north side along Rock Creek. Elevations range from 5,700 ft to 7,500 ft. These communities have undoubtedly been affected by livestock grazing and fire suppression, both of which would result in an increase of shrubs. Portions of this area have experienced fire in the past five years. Studies are currently underway to elucidate the role of fire in structuring vegetation of the region (K. Reid, pers. comm.). Classification of shrublands follows Mueggler and Stewart (1980). These authors place Artemisia nova in synonymy under A. arbuscula. Most authorities recognize these taxa as separate species, and I have followed their treatment (e.g., Dorn 1984).

(16) Artemisia tridentata/Festuca idahoensis h.t.

Lower slopes along the foothills on the north and east sides of the Line Creek Plateau are occupied by shrublands dominated by Artemisia tridentata and cool season bunch grasses such as Festuca idahoensis, Agropyron spicatum, A. dasystachyum and Stipa comata. Common forbs included Artemisia frigida, Cerastium arvense, Lupinus sericeus and Balsamorhiza incana.

This community occurs intermixed with Pinus flexilis woodland. Fire destroys both the P. flexilis and the understory of A. tridentata. The resultant Festuca-Agropyron grasslands are then reinvaded by A. tridentata and eventually P. flexilis. Thus, the Pinus flexilis/Festuca idahoensis, Artemisia tridentata/Festuca idahoensis, Artemisia nova/Festuca idahoensis, and Festuca idahoensis/Agropyron spicatum "habitat types" in the east foothills of the Line Creek Plateau form a dynamic mosaic dependent on fire frequency. It may be that the entire area would be considered potential P. flexilis woodland under atypically long fire-free intervals.

(17) Artemisia nova/Festuca idahoensis h.t.

Soils derived from limestone in the foothills on the east side of the Line Creek Plateau support shrublands dominated by Artemisia nova and A. tridentata. Common grasses included Festuca idahoensis, Agropyron spicatum and Stipa comata. Common forbs were Phlox hoodii, Astragalus adsurgens and Artemisia frigida. This community generally occurs on sites with more exposure and/or shallower soils than the Artemisia tridentata/Festuca idahoensis h.t. However, the two types intermingle with Pinus flexilis woodland throughout much of the area. Note: It lies southeast of tentative RNA boundaries.

(18) Hesperocloa kingii c.t.

Steep high-subalpine slopes with poorly developed soils support communities dominated by Hesperocloa kingii, Poa secunda, Agropyron spicatum and forbs such as Eriogonum umbellatum, Aster sibiricus, Cirsium tweedyi and Trifolium haydenii. These associations have not been described for Montana. They seem to occur on recently stabilized talus and could be considered a very early seral stage of the Abies lasiocarpa/Vaccinium scoparium habitat type. Festuca idahoensis probably occurs in at least some stands; however, only one stand of this minor type was sampled.

Plant Species of Concern

Sixteen species of vascular plants listed as species of special concern by the Montana Natural Heritage Program are known to occur on the Line Creek Plateau. Five species, Agoseris lackschewitzii, Kobresia macrocarpa, Salix barrattiana, Selaqinella watsonii and Thlaspi parviflorum, are listed as sensitive by Region One of the U.S. Forest Service. These five species as well as Castilleja longispica, Draba porsildii, Senecio amplexans and Stellaria crassifolia are considered sensitive in Montana (Lesica and Shelly 1991). In addition to these eight species, Eriophorum callitrix was discovered for the first time in Montana on the Line Creek Plateau in 1991, and Haplopappus carthamoides var. subsquarrosus, previously known only from Park Co., Wyoming, was discovered in the east foothills of the Beartooth Range in Montana in 1993. Seven other species, Erigeron flabellifolius, Gentiana prostrata, Gentianella tenella, Juncus triglumis var. triglumis, Koenigia islandica, Phippsia alvida and Senecio fuscatus, have a limited distribution in Montana (Lesica and Shelly 1991). These species are common or locally common in the Beartooth Mountains but are rare or absent in the rest of the state. They are arctic species disjunct in the Beartooth Mountains. Erigeron flabellifolius and Haplopappus carthamoides var. subsquarrosus are endemic to the mountains of south-central Montana and adjacent Wyoming. The latter species is a candidate for listing as a threatened or endangered species

by the U.S. Fish and Wildlife Service (USDI-FWS 1993). Many areas of the Beartooth Mountains have been explored botanically; nonetheless, K. macrocarpa, S. barrattiana, Senecio amplexans and Eriophorum callitrix have been found only on the Line Creek Plateau or the adjacent Hellroaring Plateau. The earlier snow-release occurring on the Line Creek Plateau may provide conditions more amenable to species that evolved in low-elevation arctic environments such as Kobresia macrocarpa and Eriophorum callitrix. These observations suggest ways in which this easternmost and warmest plateau may be biologically unique.

AGOSERIS LACKSCHEWITZII Hend. & Mos. (Pink agoseris) [G3/S2S3]

Geographic Range: Western Montana, adjacent Wyoming and east-central Idaho.

Habitat: Moist to wet meadows in the upper montane to subalpine zones.

Occurrence: This newly-described species can be found in many of the Montana mountain ranges east of the Continental Divide. In the Beartooth Mountains it is currently known only from a single moderate-size population on the Line Creek Plateau.

CASTILLEJA LONGISPICA Nels. (White paintbrush) [G4/S1]

Geographic Range: California and Nevada across eastern Oregon and central Idaho to western Montana and Wyoming.

Habitat: Grasslands, meadows and sagebrush steppe in the valleys and montane zones.

Occurrence: In Montana this species is known from the Sapphire, Pryor and Beartooth ranges. In the Beartooth area, the species is currently known from a single moderate-size population on the east side of the Line Creek Plateau.

DRABA PORSILDII Mulligan (Porsild's draba) [G3/S1]

Geographic Range: Alaska south to British Columbia and Alberta and disjunct in southern Montana and Wyoming.

Habitat: Stony or gravelly soil among sparse vegetation, often on steep, cool slopes near or above timberline

Occurrence: In the Continental U.S. this species is known only from the Beartooth and Wind River ranges. Montana populations are small. Two of three known locations in Montana are on the Line Creek Plateau.

ERIGERON FLABELLIFOLIUS Rydb. (Fan-leaved daisy) [G3G4/S3]

Geographic Range: Southwest Montana and northwest Wyoming

Habitat: Barren gravelly soil or talus slopes near or above timberline.

Occurrence: In Montana this species occurs in the Beartooth, Absaroka and Crazy mountain ranges. One population is known from the north slope of the Line Creek Plateau. Much available habitat occurs in relatively inaccessible areas of the Beartooth Range, and the plant may be more common than is currently known.

ERIOPHORUM CALLITRIX Cham. (Beautiful cottongrass) [G5/S1]

Geographic Range: Circumpolar, south in western North America to British Columbia and Alberta, disjunct in Beartooth and Wind River ranges of Montana and Wyoming.

Habitat: Wet boggy soil of seeps and stream terraces above timberline.

Occurrence: This species was known from the Beartooth Mountains of Wyoming, but was not collected in Montana until 1991. As of 1993, there are four known sites for the plant in Montana, three in the Line Creek Plateau study area and one on the Hellroaring Plateau. Populations are very small and local, and the wetland habitat is fragile and easily disturbed.

GENTIANA PROSTRATA Haenke (Moss gentian) [G5/S1]

Geographic Range: Circumboreal, south in western North America to California and Colorado; South America.

Habitat: Moist tundra and gravelly soil in the alpine zone.

Occurrence: This inconspicuous plant is locally common in Glacier National Park, the Anaconda Mountains and the Beartooth Mountains. It has been observed in at least six places in seep areas and wet tundra on the Line Creek Plateau and probably occurs in many others.

GENTIANELLA TENELLA Rottb. Borner (Slender gentian) [G4/S2]

Geographic Range: Circumboreal, south in western North America to California, Arizona and New Mexico.

Habitat: Moist tundra and wet organic soils above timberline.

Occurrence: This species occurs in the Beartooth, Absaroka, and Gravelly ranges. It is locally common in the Beartooth Mountains, but its habitat is fragile and easily disturbed. It is a small, short-lived species that is easily overlooked.

HAPLOPAPPUS CARTHAMOIDES (Hook.) Gray var. **SUBSQUARROSUS** (Greene) Dorn (Columbia goldenweed) [G5T2/S1]

Geographic Range: The range of the species as a whole is eastern Oregon and Washington east to central Montana and western Wyoming and south to Nevada and California. The variety is known only from Park Co., Wyoming and adjacent Carbon Co., Montana.

Habitat: Sagebrush steppe in the lower montane zone.

Occurrence: This variety is not recognized by A. Cronquist, but has a disjunct range and is quite morphologically distinct from other Montana collections of this species. In Montana it is currently known from only one large population in the foothills on the east side of the Line Creek Plateau.

JUNCUS TRIGLUMIS L. var. **TRIGLUMIS** (Three-flowered rush) [G5T5/SU]

Geographic Range: Circumpolar, south in western North America to Wyoming and Colorado.

Habitat: Wet, open, gravelly soil around seeps and streams and organic soil of boggy areas above timberline.

Occurrence: In Montana, this species is found only in the Beartooth Mountains, where it is locally common. There are two

small populations on the Line Creek Plateau. Its habitat is fragile and easily disturbed.

KOBRESIA MACROCARPA Clokey (Large-fruited kobresia) [G5/S1]
Geographic Range: Circumpolar, south in western North America and disjunct in the Beartooth Mountains of Montana and Wyoming and in Colorado.

Habitat: Wet, boggy soil of seeps and stream terraces, often on hummocks.

Occurrence: In the Northern Rocky Mountains this species is known only from on or near the Line Creek Plateau in the Beartooth Mountains. Two small populations are currently known. The habitat of this species is fragile and easily disturbed.

KOENIGIA ISLANDICA L. (Koenigia) [G4/S2]
Geographic Range: Circumboreal, south in western North America to disjunct locations in Montana, Wyoming and Colorado.

Habitat: Saturated gravelly soil of seeps and other wet areas.

Occurrence: In the Northern Rocky Mountains this species is known only from the Beartooth and Wind River ranges. It is locally common throughout the Beartooth Mountains; however, there is only one location for it on the Line Creek Plateau. The habitat of this species is fragile and easily disturbed.

PHIPPSIA ALGIDA (Phipps) R. Br. (Ice grass) [G5/S2]
Geographic Range: Circumpolar; disjunct in the Beartooth Mountains of Montana and Wyoming and in Colorado.

Habitat: Wet gravel of seep areas above timberline

Occurrence: Although this arctic species is widely disjunct, it is locally common throughout the Beartooth Mountains. There is one known location on the Line Creek Plateau. The habitat of this species is fragile and easily disturbed.

SALIX BARRATTIANA Hook. (Barratt's willow) [G5/S1]
Geographic Range: Alaska and Yukon and Northwest Territories south to British Columbia and Alberta and Glacier National Park, Montana and disjunct in the Beartooth Mountains of Montana and Wyoming.

Habitat: Cold, moist soil near or above timberline.

Occurrence: This species is known from only two locations in Montana. The one site on the Line Creek Plateau is the only known location in the Beartooth Mountains of Montana. It consists of one male clone ca. 100 m² on the Wyoming border. The habitat of this species is fragile and easily disturbed.

SELAGINELLA WATSONII Underw. (Watson's selaginella) [G4G5/S2]

Geographic Range: Northeastern Oregon and south-central Montana south to Utah, Nevada and California.

Habitat: Rock crevices and rocky tundra above timberline (Montana).

Occurrence: This species is common in tundra habitats in the East Pioneer Range of Beaverhead County. It also occurs in the Tobacco Root Range. The only sites in the Beartooth Mtns. are from the west end of the Line Creek Plateau; however, it likely occurs in other areas as well.

SENECIO AMPLECTENS Gray var. HOLMII (Greene) Harr. (Clasping groundsel) [G4T?/S1]

Geographic Range: Beartooth Mountains of Montana, south to Nevada and New Mexico.

Habitat: Talus slopes of the alpine and subalpine zones.

Occurrence: The only known location for this species in Montana is on slopes of the Line Creek Plateau. The population is on a steep slope, so the extent and number of plants are not known. Additional populations may occur on nearby inaccessible slopes.

STELLARIA CRASSIFOLIA Ehrh. (Thick-leaved chickweed) [G4/S1]

Geographic Range: Circumboreal, south in western North America to Montana, Idaho and Colorado.

Habitat: Moist or wet meadows and tundra in the montane to alpine zone.

Occurrence: This plant has been collected once in the Centennial Valley of Beaverhead County and once on the Line Creek Plateau in the Beartooth Mtns. It is very similar to the widespread S. longipes. The collection made by botanists working for Bitterroot Native Growers in 1991 were in fruiting condition and could not be identified positively. All Stellarias I found on the Line Creek Plateau during 1993 surveys appeared to be S. longipes. Consequently, the distribution of this species on the Line Creek Plateau is not known.

THLASPI PARVIFLORUM A. Nels. (Small-flowered pennycress) [G3/S2]
Geographic Range: Central Idaho, northwest Wyoming and southwest Montana.

Habitat: Moist to dry meadows and limestone cliffs in the montane to alpine zones.

Occurrence: Known populations of this species are generally small; the plant occurs sporadically in small colonies throughout large areas of apparently appropriate habitat. At least six colonies are known from the Line Creek Plateau.

Physical and Climatic Conditions

Geology

The Beartooth Mountains are a large uplifted fault block of precambrian crystalline rock, trending from southeast to northwest. Most of the rocks are gneisses; however, small amounts of other types of metamorphosed granitics also occur (Alt and Hyndman 1986). The Line Creek Plateau is the easternmost

alpine area of the range. It is separated from the Hellroaring Plateau on the west and north by the deep valley of Rock Creek. The Line Creek Plateau falls off sharply on the east side into the valley of the Clark's Fork of the Yellowstone River. The east face is formed of the same metamorphic basement rock and a steep ridge of vertically tilted Paleozoic Madison limestone (Alt and Hyndman 1986). The limestone weathers to form calcareous soils very different from the coarse-textured soil derived from the predominant crystalline parent material. The highest portion of the Line Creek Plateau occurs in Wyoming, south of the study area and is bounded by the canyon of Littlerock Creek.

The surface of the Line Creek Plateau is gently arched but relatively level. Massive faulting and glacial action has created very steep sides that fall precipitously 2,000-3,000 ft to the Rock Creek Valley on the north and more gentle foothills on the east. Elevations range from 10,427 ft at the west end of the study area adjacent to the wilderness to ca. 5,700 ft at the southeast corner of the study area.

Permafrost, permanently frozen soil, has been reported from the Beartooth Mountains of Montana and Wyoming (Johnson and Billings 1962, Alt and Hyndman 1986). This typically arctic feature results in permanently saturated soils that have a tendency to slump. It seems unlikely that there is any permafrost on the Line Creek Plateau at this time, but it may have played a roll in forming the level plateau landscape that exists today (Alt and Hyndman 1986). Solifluction terraces, slowly moving wet slumping soil, can be found on the Line Creek Plateau, usually on steeper north slopes. Frost boils, stone nets and stone stripes are also common in the Beartooth Mountains. These features are caused by the action of frost heaving and do occur on the Line Creek Plateau; however, they are more common in the wetter and higher areas of the range. Johnson and Billings (1962) provide a thorough description of these soil features from near the Line Creek Plateau.

Soils

Soil surveys have not been conducted in the study area. Throughout most of the area soils are derived from hard coarse-grained metamorphic rocks. Typical soils of various landforms in the Beartooth Mountains have been described by Veseth and Montagne (1980):

Loamy skeletal, mixed Dystric Cryochrepts develop in coarse residuum on moderately sloping to steep, glacially scoured ridges at elevations above 8,000 ft. Soils are well-drained with 20-30% boulders and 25-35% gravel and cobbles. Soils have base saturations of less than 60% and generally support the Abies lasiocarpa/Vaccinium scoparium habitat type.

Sandy skeletal, mixed Typic Cryochrept formed in coarse glacial till on steep valley and mountain slopes. This is a deep well-drained soil containing 20-35% boulders and 25-35% gravel and cobbles. Base saturation is greater than 60%. These soils also generally support the Abies lasiocarpa/Vaccinium scoparium habitat type.

Sandy skeletal, mixed Typic Cryorthent developed in coarse glacial till and colluvium on steep slopes at elevations of 9,000-10,500 ft. The soil is deep and well-drained and supports the Abies lasiocarpa/Vaccinium scoparium or Pinus albicaulis habitat types.

Loamy skeletal, mixed Typic Cryumbrept formed in coarse residuum or glacial till on frost-churned, glacially-scoured plateaus and ridge tops at 8,500 -11,000 ft. It is a well-drained soil with coarse fragment content ranging from 10-15% gravels in the A horizon to greater than 60% in the C horizon. The soil supports mainly high elevation grassland and alpine tundra vegetation.

Along the east slope of the Line Creek Plateau is a long, narrow ridge of Madison Limestone. Veseth and Montagne (1980) describe typical soils formed from Madison Limestone from the Big Snowy Mountains north of the study area:

Moderately deep soils form from colluvium and residuum on moderate to very steep slopes at 5,000-8,000 ft. Soils are well-drained. B and C horizons contain 25-35% clay and greater than 40% silt in the fine fraction. Typical vegetation is dominated by Pseudotsuga menziesii, Juniperus scopulorum and J. communis.

Alpine soils for the Beartooth Mountains were described by Nimlos and McConnel (1962, 1965). The Ptarmigan Series underlies most of the turf and grassland communities. Soils are well-drained and medium to strongly acidic loams or sandy loams without marked clay increase in the B horizon. The Vasquez (Beartooth) Series occurs along stream terraces and on solifluction lobes. Soils are poorly drained and acidic with a peaty organic horizon. Lower horizons display iron oxides and gley indicating prevailing anoxic conditions. Textures are loam and clay loam. Associated vegetation is willow and Deschampsia cespitosa/Caltha leptosepala community types.

Lesica and Antibus (1986) report pH, percent organic matter, textural classes and available nutrients for soil supporting cushion plant communities in the Beartooth Mountains. Johnson and Billings (1962) provide general morphological descriptions of alpine turf, meadow and bog soils as well as a lengthy discussion of cryopedogenic patterns and processes. Bamberg (1961) also provides descriptions of representative soil profiles from the Beartooth Mountains.

Hydrology

Much of the annual precipitation falling on the Line Creek Plateau occurs as snow. Snow tends to be blown free of windward slopes and deposited on the lee side of ridges. The resultant differential snowpack is important in structuring the mosaic of plant communities in the alpine zone. Seep areas tend to form in shoulder positions below snow deposition areas at the very heads of drainages before they fall from the plateau into the canyons dissecting it. These seep areas harbor some of the rare plants found on the plateau. There are two alpine lakes in the study area at the west end of the Line Creek Plateau. Line Lake occurs in a cirque at the head of the North Fork of Line Creek, and an unnamed lake (mainly in Wyoming) occurs in a cirque at the head of Wyoming Creek.

There are no permanently flowing streams above 9,600 ft. Most water from the alpine zone flows through boulder fields underlying the soil and beneath talus slopes to reappear in the major streams formed in the canyons that dissect the margins of the plateau. Wyoming Creek on the west margin of the Line Creek Plateau and Rock Creek are glacially carved valleys. Other streams fall off steeply to the montane zone and the margins of the study area. There are small calcareous seep areas along the base of the limestone scarp face near North Line Creek.

Climate

There are no permanent weather stations on the Line Creek Plateau or above timberline in the Beartooth Mountains. During the growing seasons of 1958 and 1959, mean temperature near the west edge of the Line Creek Plateau was ca. 47° F with the lowest temperature of 24° F and the highest temperature of 68° F (Johnson and Billings 1962). Average weekly precipitation was 0.3 in. Prevailing winds are from the west. While the main portion of the range receives ca. 70 in annual precipitation (USDA-SCS 1981). However, the Line Creek Plateau receives an average of 40 in because it is in the rain shadow of the main massif. Consequently the Line Creek Plateau is drier and warmer with earlier snow-release than other plateaus in the range.

Red Lodge, the weather recording station closest to the Line Creek Plateau is at 5,575 ft and ca. 13 miles northeast of the study area. From 1950 to 1980, mean July and January temperature was 64.9° and 21.8°, and mean annual precipitation was 25.0 in. Wettest months were April, May and June (NOAA 1982).

Table 1. Climatic summary for Red Lodge weather station.

Month	Mean Temp. (°F)	Mean Precip. (in)
January	21.8	1.48
February	26.8	1.15
March	29.8	2.53
April	39.2	3.83
May	49.2	3.51
June	57.2	2.93
July	64.9	1.31
August	63.3	1.53
September	53.9	2.23
October	45.2	1.65
November	32.0	1.69
December	26.3	1.18

Management Considerations

The study area is generally in pristine condition. There are roads only on the periphery, and these are closed or little used with two exceptions. The Beartooth Highway on the north and west periphery is a major thoroughfare between eastern Montana and Yellowstone National Park and is touted as one of the most beautiful highways in America. The Robinson Draw Road along the southeast periphery is used by hunters, recreationists and ranchers with some regularity. The presence of these roads and their associated traffic and maintenance activities have little impact on the main portion of the study area. There was a road from the Beartooth Highway to the Line Creek Plateau along the Wyoming border. This road is still apparent in some places, but mainly in Wyoming. The road on the plateau is no longer visible in most places.

There are a number of trails in the study area that provide access. These appear to be little used except perhaps during hunting season. There is a hunting camp at the head of corral creek just at the ecotone between forest and tundra. This area has been impacted by trampling and livestock grazing. I observed evidence of a number of mountain bikes on the main trail from the Beartooth Highway to the plateau. Damage to the trail was apparent in places where the trail crossed streams or seep areas. Limited use of the area by mountain bikes probably poses little threat to the biological values, but heavy use could cause degradation of the vegetation and erosion. Line Lake in the southwest corner of the area attracts a small number of people to the fishery. There is some use of the plateau by snowmobiles during winter and early spring months.

There has been some small-scale mining and associated timber harvest activity at the head of Grove and Gold creeks on the eastern periphery of the study area. There is also a small amount of private land with a couple of old cabins. The Maurice Creek-Sheridan Creek area on the north flank of the plateau was logged for mine timbers many years ago. The Line Creek Plateau

is thought to be underlain by oil and natural gas deposits, but no drilling has occurred. There is an old road and gravel pit near Hwy 212 in the northwest corner of the area, and there is an old jade mine somewhere in the area. The timber harvest and roads have caused minimal degradation of the vegetation, and most evidence has healed over to a large extent. There is an old ditch diverted from North Line Creek and at least one building at a spring near the head of North Line Creek.

It is likely that there has been livestock grazing in the southeast portion of the study area along Mill and Robinson draws in the past. However, it does not appear that this area has been grazed in the recent past. There appears to be some degradation of grassland communities along lower treeline especially in the area of North Line Creek. Livestock are currently grazed along Rock Creek in the northeast corner of the area.

There are relatively few exotics present in the study area, and few of these species are considered a problem. Phleum pratense is locally common in some areas in the North Line Creek drainage. Cirsium arvense is common along the irrigation ditch diverting North Line Creek. Small colonies of Centaurea maculosa and Carduus nutans occur in the burned area along upper Robinson Draw, and Phleum pratense and Bromus inermis are common in the creek bottom. At this time, infestations of pernicious exotics are still small enough to be contained or eliminated. Mapping along roads and other areas of disturbance, especially in the low-elevation burn areas, should be completed followed by control measures.

Nearly all of the forest communities in the study area experienced frequent fires before commencement of fire suppression. Low intensity, stand-thinning fires were common in the Psemen/Phymal, Psemen/Juncom and Abilas/Arncor habitat types (Fischer and Clayton 1983). Absence of fire has led to overstocked stands and increased hazard of stand-replacing fire in some areas. The absence of fire in the Abilas/Vacsco habitat type during the recent past has probably not yet had a major impact as mean stand-replacing fire interval is ca. 50-100 years (Fischer and Clayton 1983), and growth is slow enough that Pinus contorta still dominates many stands. Much of the area on the eastern periphery of the study area is Pinus flexilis woodland with increasing numbers of Pseudotsuga menziesii in the higher stands. These shrubland-forest ecotone areas likely had high fire frequencies (Arno and Gruell 1983), and trees and shrubs were probably much less common. Studies on the role of fire in the east portion of the study area are currently under way (K. Reid, pers. comm.).

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Appendix A. Vascular plant species observed in the Line Creek Plateau study area in 1991 and 1993. Species occur in one or more of three elevation/vegetation zones: alpine (Al), coniferous forests (CF) and woodland-shrubland-grassland (WSG). An asterisk (*) indicates an introduced species.

		Al	CF	WSG
Trees				
<i>Abies lasiocarpa</i>	Subalpine fir		X	
<i>Betula occidentalis</i>	Water birch		X	
<i>Juniperus scopulorum</i>	Rocky Mtn. juniper		X	X
<i>Picea engelmannii</i>	Englemann spruce	X	X	
<i>Pinus albicaulis</i>	Whitebark pine	X	X	
<i>Pinus contorta</i>	Lodgepole pine		X	
<i>Pinus flexilis</i>	Limber pine		X	X
<i>Populus tremuloides</i>	Quaking aspen		X	
<i>Populus trichocarpa</i>	Black cottonwood			X
<i>Pseudotsuga menziesii</i>	Douglas fir		X	X
Shrubs				
<i>Acer glabrum</i>	Rocky Mtn. maple		X	
<i>Alnus incana</i>	Thinleaf alder		X	
<i>Alnus sinuata</i>	Sitka alder		X	
<i>Amelanchier alnifolia</i>	Western serviceberry		X	
<i>Arctostaphylos uva-ursi</i>	Kinnikinnick	X	X	
<i>Artemisia frigida</i>	Fringed sagewort	X		X
<i>Artemisia nova</i>	Black sagebrush			X
<i>Artemisia tridentata</i>	Big sagebrush		X	X
<i>Berberis repens</i>	Creeping oregongrape		X	
<i>Betula glandulosa</i>	Bog birch		X	
<i>Ceanothus velutinus</i>	Mountain balm		X	
<i>Chrysothamnus nauseosus</i>	Rubber rabbitbrush			X
<i>Chrysothamnus viscidiflorus</i>	Green rabbitbrush			X
<i>Clematis columbiana</i>	Columbia clematis		X	
<i>Dryas octopetala</i>	White dryas	X		
<i>Juniperus communis</i>	Common juniper	X	X	
<i>Juniperus horizontalis</i>	Creeping juniper		X	X
<i>Kalmia microphylla</i>	Small-leaved laurel	X		
<i>Ledum glandulosum</i>	Bog Labrador tea		X	
<i>Menziesia ferruginea</i>	Fool's huckleberry		X	
<i>Penstemon fruticosus</i>	Shrubby penstemon		X	
<i>Phyllodoce empetriformis</i>	Red mountain-heather	X		
<i>Phyllodoce glanduliflora</i>	Yellow mountain-heather	X		
<i>Physocarpus malvaceus</i>	Mallow ninebark		X	
<i>Potentilla fruticosa</i>	Shrubby cinquefoil	X		X
<i>Prunus virginiana</i>	Chokecherry			X
<i>Ribes cereum</i>	Wax currant		X	X
<i>Ribes lacustre</i>	Swamp currant	X	X	
<i>Ribes montigenum</i>	Mountain gooseberry		X	
<i>Ribes setosum</i>	Bristly gooseberry			X
<i>Rosa acicularis</i>	Prickly rose		X	
<i>Rosa woodsii</i>	Wood's rose		X	X
<i>Rubus idaeus</i>	Red raspberry		X	
<i>Rubus parviflorus</i>	Thimbleberry		X	
<i>Salix arctica</i>	Arctic willow	X		
<i>Salix barratiana</i>	Barratt's willow	X		
<i>Salix bebbiana</i>	Bebb willow			X
<i>Salix commutata</i>	Undergreen willow	X		
<i>Salix exigua</i>	Sandbar willow		X	
<i>Salix glauca</i>	Greenleaf willow	X		
<i>Salix lutea</i>	Yellow willow		X	
<i>Salix nivalis</i>	Snow willow	X		

<i>Salix planifolia</i>	Planeleaf willow	X		
		Al	CF	WSG
<i>Salix pseudomonticola</i>	Mountain willow		X	
<i>Salix scouleriana</i>	Scouler willow		X	
<i>Salix wolfii</i>	Wolf's willow		X	
<i>Shepherdia canadensis</i>	Canada buffaloberry		X	
<i>Spiraea betulifolia</i>	Shiny-leaf spiraea		X	
<i>Symphoricarpos albus</i>	Common snowberry		X	
<i>Symphoricarpos oreophilus</i>	Mountain snowberry		X	X
<i>Vaccinium scoparium</i>	Grouse whortleberry	X	X	
Graminoids				
<i>Agropyron cristatum*</i>	Crested wheatgrass			X
<i>Agropyron dasystachyum</i>	Thick-spiked wheatgrass			X
<i>Agropyron scribneri</i>	Spreading wheatgrass	X		
<i>Agropyron smithii</i>	Western wheatgrass			
<i>Agropyron spicatum</i>	Bluebunch wheatgrass	X	X	X
<i>Agrostis humilis</i>	Alpine bentgrass	X		
<i>Agrostis scabra</i>	Rough bentgrass	X	X	X
<i>Agrostis stolonifera*</i>	Redtop			X
<i>Bromus ciliatus</i>	Fringed brome		X	
<i>Bromus inermis*</i>	Smooth brome			X
<i>Bromus pumpellianus</i>	Pumpelly brome	X		
<i>Bromus tectorum*</i>	Cheatgrass brome			X
<i>Calamagrostis canadensis</i>	Bluejoint reedgrass	X	X	
<i>Calamagrostis purpurascens</i>	Purple reedgrass	X	X	
<i>Calamagrostis rubescens</i>	Pinegrass			
<i>Carex albonigra</i>	Black & white scaled sedge	X		
<i>Carex atrata</i>	Blackened sedge	X	X	
<i>Carex aurea</i>	Golden sedge		X	
<i>Carex canescens</i>	Pale sedge	X		
<i>Carex capillaris</i>	Hairlike sedge	X		
<i>Carex capitata</i>	Capitate sedge	X		
<i>Carex deweyana</i>	Dewey's sedge		X	
<i>Carex douglasii</i>	Douglas' sedge			X
<i>Carex elynoides</i>	Blackroot sedge	X		
<i>Carex filifolia</i>	Thread-leaved sedge			X
<i>Carex haydeniana</i>	Cloud sedge	X		
<i>Carex hoodii</i>	Hood's sedge		X	
<i>Carex illota</i>	Sheep sedge	X		
<i>Carex macloviana</i>	Thickheaded sedge	X		
<i>Carex microptera</i>	Small-winged sedge			X
<i>Carex misandra</i>	Few-flowered sedge	X		
<i>Carex nebrascensis</i>	Nebraska sedge			X
<i>Carex nigricans</i>	Black alpine sedge	X		
<i>Carex norvegica</i>	Scandinavian sedge	X		
<i>Carex nova</i>	New sedge	X		
<i>Carex obtusata</i>	Obtuse sedge	X		
<i>Carex pachystachya</i>	Chamisso sedge	X		
<i>Carex paysonis</i>	Payson sedge	X		
<i>Carex petasata</i>	Liddon's sedge	X		X
<i>Carex phaeocephala</i>	Dunhead sedge	X		
<i>Carex pyrenaica</i>	Pyrenaean sedge	X		
<i>Carex rossii</i>	Ross sedge		X	X
<i>Carex rostrata</i>	Beaked sedge		X	
<i>Carex rupestris</i>	Curly sedge	X		
<i>Carex scirpoidea</i>	Northern single-spike sedge	X	X	
<i>Carex scopulorum</i>	Holm's Rocky Mtn. sedge	X		
<i>Danthonia intermedia</i>	Timber danthonia	X	X	
<i>Danthonia unispicata</i>	Onespike danthonia			X
<i>Deschampsia cespitosa</i>	Tufted hairgrass	X	X	

<i>Eleocharis pauciflora</i>	Few-flowered spikesedge	X		
<i>Elymus cinereus</i>	Basin wildrye			X
<i>Elymus glaucus</i>	Blue wildrye	Al	CF	WSG
<i>Eriophorum callitrix</i>	Cottonsedge		X	
<i>Festuca baffinensis</i>	Baffin fescue	X		
<i>Festuca idahoensis</i>	Idaho fescue	X		
<i>Festuca occidentalis</i>	Western fescue	X	X	X
<i>Festuca ovina</i>	Sheep fescue	X	X	
<i>Festuca pratensis*</i>	Meadow fescue			X
<i>Helictotrichon hookeri</i>	Spike oat	X		
<i>Hesperocloa kingii</i>	Spike-fescue		X	X
<i>Juncus balticus</i>	Baltic rush			X
<i>Juncus biglumis</i>	Two-flowered rush	X		
<i>Juncus castaneus</i>	Chestnut rush	X		
<i>Juncus drummondii</i>	Drummond's rush	X		
<i>Juncus ensifolius</i>	Swordleaf rush		X	
<i>Juncus longistylis</i>	Longstyle rush		X	
<i>Juncus mertensianus</i>	Merten's rush	X		
<i>Juncus parryi</i>	Parry's rush	X		
<i>Juncus triglumis</i>	Three-flowered rush	X		
<i>Kobresia bellardii</i>	Bellard's alpinesedge	X		
<i>Kobresia macrocarpa</i>	Large-fruited kobresia	X		
<i>Koeleria cristata</i>	Prairie junegrass	X		X
<i>Luzula hitchcockii</i>	Smooth woodrush	X		
<i>Luzula parviflora</i>	Small-flowered woodrush	X		
<i>Luzula spicata</i>	Spike woodrush	X	X	
<i>Oryzopsis hymenoides</i>	Indian ricegrass			X
<i>Phippsia algida</i>	Ice grass	X		
<i>Phleum alpinum</i>	Alpine timothy	X	X	
<i>Phleum pratense*</i>	Common timothy		X	X
<i>Poa alpina</i>	Alpine bluegrass	X	X	
<i>Poa annua*</i>	Annual bluegrass		X	
<i>Poa compressa*</i>	Canada bluegrass			X
<i>Poa cusickii</i>	Cusick's bluegrass	X		X
<i>Poa interior</i>	Inland bluegrass		X	
<i>Poa leptocoma</i>	Bog bluegrass	X		
<i>Poa nervosa</i>	Wheeler's bluegrass		X	
<i>Poa pratensis*</i>	Kentucky bluegrass			X
<i>Poa reflexa</i>	Nodding bluegrass	X		
<i>Poa rupicola</i>	Thimble bluegrass	X		
<i>Poa sandbergii</i>	Sandberg's bluegrass	X		
<i>Sitanion hystrix</i>	Bottlebrush squirreltail		X	
<i>Stipa comata</i>	Needle-and-thread			X
<i>Stipa occidentalis</i>	Western needlegrass			X
<i>Trisetum spicatum</i>	Spike trisetum	X	X	
Forbs				
<i>Achillea millefolium</i>	Common yarrow	X	X	X
<i>Actaea rubra</i>	Baneberry		X	
<i>Agoseris aurantiaca</i>	Orange agoseris		X	
<i>Agoseris glauca</i>	Pale agoseris	X	X	X
<i>Agoseris lackechewitzii</i>	Pink agoseris		X	
<i>Allium cernuum</i>	Nodding onion	X		X
<i>Alyssum alyssoides*</i>	Pale alyssum			X
<i>Anaphalis margaritacea</i>	Common pearly-everlasting		X	
<i>Androsace septentrionalis</i>	Northern fairy-candelabra	X	X	X
<i>Anemone cylindrica</i>	Candle anemone			X
<i>Anemone multifida</i>	Cliff anemone			X
<i>Anemone patens</i>	Pasqueflower	X		X
<i>Angelica arguta</i>	Sharp-tooth angelica		X	

Antennaria alpina	Alpine pussytoes	X		
Antennaria aromatica	Aromatic everlasting	X		
Antennaria lanata	Woolly pussytoes	X		
		Al	CF	WSG
Antennaria microphylla	Rosy pussytoes	X	X	X
Antennaria parvifolia	Littleleaf pussytoes			X
Antennaria racemosa	Raceme pussytoes		X	
Antennaria umbrinella	Umber pussytoes	X	X	X
Aquilegia flavescens	Yellow columbine		X	
Arabis drummondii	Drummond's rockcress	X		X
Arabis holboellii	Holboell's rockcress		X	
Arabis lyallii	Lyall's rockcress	X		
Arabis nuttallii	Nuttall's rockcress	X		
Arenaria capillaris	Fescue sandwort	X		X
Arenaria congesta	Ballhead sandwort	X		X
Arenaria hookeri	Hooker's sandwort			X
Arenaria lateriflora	Bluntleaf sandwort		X	
Arenaria nuttallii	Nuttall's sandwort	X		
Arenaria obtusiloba	Arctic sandwort	X	X	
Arenaria rossii	Ross's sandwort	X		
Arenaria rubella	Reddish sandwort	X		
Arnica cordifolia	Heartleaf arnica		X	
Arnica fulgens	Orange arnica	X		
Arnica latifolia	Broadleaf arnica	X	X	
Arnica longifolia	Longleaf arnica	X	X	
Arnica mollis	Hairy arnica	X	X	
Arnica rydbergii	Rydberg's arnica	X		
Artemisia campestris	Pacific sagewort	X		
Artemisia ludoviciana	Prairie sagewort		X	X
Artemisia michauxiana	Michaux sagewort	X		
Artemisia scopulorum	Rocky Mtn. sagewort	X		
Aster alpinus	Alpine aster	X	X	
Aster conspicuus	Showy aster		X	
Aster eatonii	Eaton's aster		X	
Aster foliaceus	Leafy aster	X	X	
Aster occidentalis	Western aster			X
Aster sibiricus	Siberian aster		X	
Astragalus aboriginum	Indian milkvetch			X
Astragalus adsurgens	Standing milkvetch		X	X
Astragalus agrestis	Field milkvetch		X	
Astragalus alpinus	Alpine milkvetch	X		
Astragalus drummondii	Drummond's milkvetch			X
Astragalus gilviflorus	Three-leaved milkvetch			X
Astragalus kentrophyta	Thistle milkvetch	X		
Astragalus miser	Weedy milkvetch		X	X
Astragalus robbinsii	Robbin's milkvetch		X	
Astragalus vexiliflexus	Bent-flowered milkvetch			X
Balsamorhiza incana	Hoary balsamroot			X
Besseyia wyomingensis	Arrow-leaved balsamroot			X
Bupleurum americanum	Wyoming kittentail	X		
Calochortus gunnisonii	American thorough-wax	X	X	X
Calochortus nuttallii	Gunnison's mariposa			X
Caltha leptosepala	Sego lily			X
Campanula rotundifolia	Elkslip marshmarigold	X	X	
Campanula uniflora	Lady's-thimble	X		X
Carduus nutans*	Arctic bellflower	X		
Castilleja angustifolia	Musk thistle			X
Castilleja hispida	Northwestern paintbrush			X
Castilleja linearifolia	Harsh paintbrush		X	
Castilleja longispica	Narrow-leaved paintbrush		X	X
	White paintbrush			X

Castilleja miniata	Scarlet paintbrush		X	
Castilleja nivea	Snow paintbrush			
Castilleja pallascens	Palish Indian-paintbrush	X		
Castilleja pulchella	Showy Indian-paintbrush	X	X	
Centaurea maculosa*	Spotted knapweed		Al	CF WSG
Cerastium arvense	Field chickweed	X		X
Cerastium beeringianum	Alpine chickweed	X		X
Cerastium vulgatum*	Common chickweed			
Chaenactis alpina	Alpine chaenactis	X	X	
Chaenactis douglasii	Douglas chaenactis			
Chamaerhodos erecta	Chamaerhodos			X
Chenopodium fremontii	Fremont's goosefoot			X
Chimaphila umbellata	Common prince's-pine		X	
Chrysopsis villosa	Hairy goldenaster			X
Cirsium arvense*	Canada thistle		X	X
Cirsium hookerianum	Hooker's thistle	X		
Cirsium tweedyi	Tweedy's thistle	X	X	X
Cirsium undulatum	Wavyleaf thistle			X
Cirsium vulgare*	Bull thistle		X	
Claytonia lanceolata	Lanceleaf springbeauty	X		
Claytonia megarhiza	Alpine springbeauty	X		
Collomia linearis	Narrowleaf collomia			X
Commandra umbellata	Bastard toadflax			X
Corallorhiza trifida	Yellow coral-root		X	
Crepis acuminata	Slender hawksbeard		X	
Crepis occidentalis	Western hawksbeard			X
Cryptantha ambigua	Obscure cryptantha			X
Cryptantha celosioides	Northern cryptantha			X
Cryptantha sobolifera	Sprout cryptantha	X		
Cryptantha spiculifera	Pointed cryptantha			X
Cymopterus hendersonii	Henderson's cymopterus	X		
Cymopterus terebinthinus	Turpentine cymopterus			X
Delphinium occidentale	Western larkspur			X
Disporum trachycarpum	Wartberry fairybell		X	
Dodecatheon pulchellum	Few-flowered shooting star	X		
Douglasia montana	Rocky Mtn. douglasia	X		
Draba aurea	Golden draba		X	
Draba crassifolia	Hairy whitlow grass	X	X	
Draba incerta	Yellowstone draba	X		
Draba lanceolata	Lance-leaved draba	X		
Draba lonchocarpa	Lancefruit draba	X		
Draba oligosperma	Few-seeded draba	X		
Draba porsildii	Porsild's draba	X		
Draba reptans	Carolina draba	X		
Dracocephalum parviflorum	American dragonhead			X
Epilobium alpinum	Alpine willow-herb	X	X	
Epilobium angustifolium	Fireweed	X	X	
Epilobium glaberrimum	Smooth willow-herb		X	
Epilobium palustre	Swamp willow-herb		X	X
Erigeron acris	Bitter fleabane	X		
Erigeron caespitosus	Tufted fleabane			X
Erigeron compositus	Cut-leaved daisy	X		X
Erigeron divergens	Spreading fleabane			X
Erigeron flabellifolius	Fan-leaved daisy	X		
Erigeron lonchophyllus	Spearleaf fleabane		X	
Erigeron ochroleucus	Buff fleabane	X		X
Erigeron peregrinus	Subalpine daisy	X	X	
Erigeron radicans	Taprooted fleabane	X		
Erigeron rydbergii	Rydberg's daisy	X		
Erigeron simplex	One-flower fleabane	X	X	

Erigeron ursinus	Bear River fleabane	X		
Eriogonum flavum	Yellow eriogonum	X	X	X
Eriogonum ovalifolium	Oval-leaved buckwheat			X
Eriogonum umbellatum	Sulfur buckwheat	X	X	X
Eritrichium nanum	Pale alpine forget-me-not	X		
			Al	CF
				WSG
Erysimum asperum	Plains wallflower	X		X
Euphorbia robusta	Robust spurge			X
Fragaria virginiana	Virginia strawberry		X	
Frasera speciosa	Giant frasera		X	
Fritillaria atropurpurea	Checker lily		X	
Gaillardia aristata	Blanket flower			X
Galium boreale	Northern bedstraw		X	X
Galium triflorum	Sweet-scented bedstraw		X	
Gaura coccinea	Scarlet gaura			X
Gentiana algida	Siberia gentian	X		
Gentianella amarella	Northern gentian	X	X	
Gentianella tenella	Slender gentian	X		
Geranium richardsonii	White geranium		X	
Geranium viscosissimum	Sticky geranium			X
Geum macrophyllum	Large-leaved avens		X	
Geum rossii	Ross' avens	X	X	
Geum triflorum	Old man's whiskers	X		X
Glycyrrhiza lepidota	American licorice			X
Grindelia squarrosa	Curlycup gumweed			X
Habenaria dilatata	White bog-orchid			X
Habenaria hyperborea	Northern green bog-orchid		X	
Haplopappus carthamoides	Large-flowered goldenweed			X
Hedysarum boreale	Northern hedysarum			X
Hedysarum sulphurescens	Sulphur hedysarum			X
Helianthella uniflora	One-flower helianthella			X
Heraclenum lanatum	Cow parsnip			X
Heuchera cylindrica	Roundleaf alumroot		X	
Heuchera grossularifolia	Gooseberry-leaved alumroot	X		
Hieracium albiflorum	White hawkweed		X	
Hieracium gracile	Slender hawkweed	X		
Hieracium umbellatum	Narrow-leaved hawkweed		X	
Hulsea algida	Alpine hulsea	X		
Hymenopappus filifolius	Columbia cutleaf			X
Hymenoxys acaulis	Stemless hymenoxys			X
Ipomopsis spicata	Spicate gilia	X		
Koenigia islandica	Koenigia	X		
Lactuca oblongifolia	Chicory lettuce			X
Lactuca serriola*	Prickly lettuce			X
Lesquerella alpina	Alpine bladderpod	X		X
Lewisia pygmaea	Least lewisia	X		
Ligusticum filicinum	Fern-leaf lovage		X	
Linum lewisii	Blue flax		X	X
Lithophragma bulbifera	Bulbiferous fringecup	X		
Lithospermum ruderales	Wayside gromwell			X
Lloydia serotina	Alpine lily	X		
Lomatium cous	Cous biscuitroot	X		
Lomatium dissectum	Fern-leaved lomatium			X
Lomatium triternatum	Narrowleaf lomatium			X
Lupinus argenteus	Silvery lupine	X	X	
Lupinus sericeus	Silky lupine			X
Lychnis apetala	Apet campion	X		
Machaeranthera grindeloides	Nuttall's goldenweed			X
Medicago lupulina*	Black medic			X
Medicago sativa*	Alfalfa			X
Melilotus officinalis*	Yellow sweetclover			X

<i>Mentha arvensis</i>	Field mint			X
<i>Mertensia alpina</i>	Alpine bluebell	X		
<i>Mertensia ciliata</i>	Mountain bluebell	X	X	
<i>Mertensia oblongifolia</i>	Oblongleaf bluebell	X		X
<i>Microseris nigrescens</i>	Black-hairy microseris	X		
<i>Mimulus guttatus</i>	Common monkeyflower		X	
		Al	CF	WSG
<i>Mitella pentandra</i>	Five-stamened miterwort		X	
<i>Monarda fistulosa</i>	Horsemint			X
<i>Musineon divaricatum</i>	Leafy musineon			X
<i>Myosotis sylvatica</i>	Alpine forget-me-not	X		
<i>Oenothera caespitosa</i>	Tufted evening-primrose			X
<i>Oenothera strigosa</i>	Common evening-primrose			X
<i>Opuntia polyacantha</i>	Plains pricklypear			X
<i>Orobanche fasciculata</i>	Clustered broomrape			X
<i>Orobanche ludoviciana</i>	Suksdorf's broomrape			X
<i>Orobanche uniflora</i>	Naked broomrape		X	
<i>Osmorhiza chilensis</i>	Mountain sweet-root		X	
<i>Osmorhiza depauperata</i>	Bluntseed sweet-root		X	
<i>Oxyria digyna</i>	Mountain sorrel	X		
<i>Oxytropis besseyi</i>	Bessey's locoweed			X
<i>Oxytropis campestris</i>	Slender locoweed	X		X
<i>Oxytropis deflexa</i>	Pendent-pod locoweed			
<i>Parnassia fimbriata</i>	Fringed grass-of-Parnasus	X	X	
<i>Parnassia kotzebuei</i>	Kotzebue's grass-of-Parnasus	X		
<i>Parnassia palustris</i>	Northern grass-of-Parnasus		X	
<i>Paronychia sessiliflora</i>	Stemless whitlow-wort			X
<i>Pedicularis bracteosa</i>	Bracted lousewort		X	
<i>Pedicularis contorta</i>	Coiled-beak lousewort	X		
<i>Pedicularis cystopteridifolia</i>	Fern-leaved lousewort	X		
<i>Pedicularis groenlandica</i>	Elephanthead	X		
<i>Pedicularis oederi</i>	Oeder's lousewort	X		
<i>Pedicularis pulchella</i>	Pretty dwarf lousewort	X		
<i>Penstemon eriantherus</i>	Fuzzytongue penstemon		X	
<i>Penstemon nitidus</i>	Wax-leaf penstemon			X
<i>Penstemon procerus</i>	Littleflower penstemon	X	X	
<i>Phacelia hastata</i>	Silverleaf phacelia	X		X
<i>Phacelia linearis</i>	Threadleaf phacelia			X
<i>Phlox hoodii</i>	Hood's phlox			X
<i>Phlox pulvinata</i>	Cushion phlox	X	X	
<i>Plantago major*</i>	Common plantain		X	
<i>Polemonium viscosum</i>	Sticky polemonium	X		
<i>Polygonum bistortoides</i>	American bistort	X	X	
<i>Polygonum douglasii</i>	Douglas' knotweed	X		X
<i>Polygonum viviparum</i>	Viviparous bistort	X		
<i>Potentilla arguta</i>	Tall cinquefoil			X
<i>Potentilla diversifolia</i>	Diverse-leaved cinquefoil	X	X	
<i>Potentilla glandulosa</i>	Sticky cinquefoil	X	X	
<i>Potentilla gracilis</i>	Northwest cinquefoil			X
<i>Potentilla hippiana</i>	Woolly cinquefoil			X
<i>Potentilla nivea</i>	Snow cinquefoil	X		
<i>Potentilla pensylvanica</i>	Prairie cinquefoil	X		X
<i>Prunella vulgaris</i>	Self-heal		X	
<i>Pterospora andromeda</i>	Woodland pinedrops		X	
<i>Pyrola asarifolia</i>	Pink wintergreen		X	
<i>Pyrola chlorantha</i>	Green wintergreen		X	
<i>Pyrola secunda</i>	One-sided wintergreen		X	
<i>Pyrola uniflora</i>	Woodnymph		X	
<i>Ranunculus eschscholtzii</i>	Eschscholtz's buttercup	X		
<i>Ranunculus natans</i>	Floating water buttercup	X		
<i>Ranunculus pygmaeus</i>	Dwarf buttercup	X		

Ranunculus uncinatus	Little buttercup		X	
Ratibida columnifera	Prairie coneflower			X
Rorippa curvipes	Obtuse fieldcress	X		
Rumex acetosa	Garden sorrel	X		
Rumex paucifolius	Mountain sorrel	X		
Sagina saginoides	Arctic pearlwort	X		
Saxifraga arguta	Brook saxifrage	X		
		Al	CF	WSG
Saxifraga bronchialis	Spotted saxifrage	X		
Saxifraga caespitosa	Tufted saxifrage	X		
Saxifraga cernua	Nodding saxifrage	X		
Saxifraga debilis	Pygmy saxifrage	X		
Saxifraga flagillaris	Stoloniferous saxifrage	X		
Saxifraga oppositifolia	Twinflowered saxifrage	X		
Saxifraga oregana	Oregon saxifrage	X	X	
Saxifraga rhomboidea	Diamondleaf saxifrage	X		
Sedum integrifolium	King's crown	X		
Sedum lanceolatum	Lance-leaved stonecrop	X	X	X
Sedum rhodanthum	Rosecrown stonecrop	X		
Senecio amplexans	Showy alpine groundsel		X	
Senecio canus	Woolly groundsel	X	X	X
Senecio crassulus	Thickleaf groundsel	X	X	
Senecio cymbalarioides	Cutleaf groundsel	X		
Senecio fremontii	Fremont groundsel	X		
Senecio fuscatus	Twice-hairy butterweed	X		
Senecio sphaerocephalus	Mountain-marsh butterweed	X		
Senecio streptanthifolius	Rocky Mtn. butterweed		X	
Senecio triangularis	Arrowleaf groundsel	X	X	
Sibbaldia procumbens	Creeping sibbaldia	X		
Silene acaulis	Moss campion	X		
Silene cucubalis*	Bladder campion			X
Silene parryi	Parry's silene		X	
Sisymbrium altissimum*	Tumblemustard			X
Sisyrinchium angustifolium	Common blue-eyed grass			X
Smelowskia calycina	Alpine smelowskia	X		
Smilacina racemosa	False spikenard		X	
Smilacina stellata	Starry Solomon-plume		X	
Solidago canadensis	Canada goldenrod			X
Solidago missouriensis	Missouri goldenrod			X
Solidago multiradiata	Northern goldenrod	X	X	
Solidago spathulata	Coast goldenrod		X	
Sphaeralcea coccinea	Red globe-mallow			X
Spraguea umbellata	Mt. Hood pussypaws	X		
Stellaria calycantha	Northern starwort	X		X
Stellaria longipes	Longstalk starwort	X		
Streptopus amplexifolius	Clasping-leaved twisted-stalk		X	
Swertia perennis	Alpinebog swertia	X		
Taraxacum ceratophorum	Rough dandelion	X		
Taraxacum lyratum	Dwarf alpine dandelion	X		
Taraxacum officinale*	Common dandelion	X		
Thalictrum occidentale	Western meadowrue		X	
Thelesperma subnudum	Greenthread			X
Thlaspi arvense*	Field pennycress			X
Thlaspi parviflorum	Small-flowered pennycress	X		
Townsendia hookeri	Hooker's townsendia			X
Townsendia parryi	Parry's townsendia	X		X
Tragopogon dubius*	Yellow salsify			X
Trifolium haydenii	Hayden's clover	X	X	
Trifolium hybridum*	Alsike clover			X
Trifolium nanum	Dwarf clover	X		
Trifolium parryi	Parry's clover	X		

<i>Trolius latus</i>	American globeflower	X	X	
<i>Urtica dioica</i>	Stinging nettle		X	
<i>Valeriana dioica</i>	Northern valerian		X	
<i>Valeriana sitchensis</i>	Sitka valerian		X	
<i>Verbascum thapsus*</i>	Flannel mullein			X
<i>Verbena bracteata</i>	Bracted verbena			X
<i>Veronica americana</i>	American speedwell			X
<i>Veronica wormskjoldii</i>	Wormskjold speedwell	X		
			Al	CF
<i>Vicia americana</i>	American vetch			WSG
<i>Viola adunca</i>	Field violet	X		X
<i>Viola canadensis</i>	Canada violet			X
<i>Viola nephrophylla</i>	Northern bog violet			X
<i>Zigadenus elegans</i>	<i>Glaucus zigadenus</i>	X		
<i>Zigadenus venenosus</i>	Meadow death-camas			X
Ferns and Allies				
<i>Athyrium dissentifolium</i>	Alpine ladyfern	X		
<i>Cystopteris fragilis</i>	Brittle bladderfern	X	X	
<i>Equisetum arvense</i>	Field horsetail			X
<i>Equisetum variegatum</i>	Variegated horsetail			X
<i>Selaginella densa</i>	Spikemoss selaginella	X	X	
<i>Woodsia scopulina</i>	Rocky Mtn. woodsia		X	

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