ECOLOGICAL EVALUATION OF THE POTENTIAL BEARTOOTH BUTTE RESEARCH NATURAL AREA WITHIN THE SHOSHONE NATIONAL FOREST, PARK COUNTY, WYOMING

Prepared for the
Shoshone National Forest,
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By

George P. Jones
Walter Fertig

Wyoming Natural Diversity Database
University of Wyoming
3381 University Station
Laramie, Wyoming 82071-3381

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INTRODUCTION

The potential Beartooth Butte Research Natural Area (RNA) is located at the southern edge of the Beartooth Plateau, in the drainage of the Clark's Fork of the Yellowstone River. The potential RNA is in the Clark's Fork Ranger District of the Shoshone National Forest and is used primarily for recreation, watershed protection, and wildlife habitat.

In 1997, The Nature Conservancy entered a contract with the USDA Forest Service, Shoshone National Forest, to prepare ecological evaluations of areas on the Forest for use by the Forest Service in examining the suitability of the areas as research natural areas. The evaluation of the Beartooth Butte area was done by the Wyoming Natural Diversity Database. This report presents the results of that evaluation.

LAND MANAGEMENT PLANNING

In 1997, the Beartooth Butte area was selected by USDA Forest Service staff as a potential RNA for possible analysis during revision of the Land and Resource Management Plan. This ecological evaluation is intended to aid the Forest Service staff in that analysis.

OBJECTIVES

One of the primary objectives of research natural areas is to "...preserve a wide spectrum of pristine representative areas that typify important forest, shrubland, grassland, alpine, aquatic, geologic and similar natural situations..." (Forest Service Manual 4063.02).

The objectives of a Beartooth Butte RNA would be to 1) maintain a reference area for (a) monitoring effects of resource management techniques and practices applied to similar ecosystems, (b) comparing results from manipulative research, and (c) determining range of natural variability; 2) protect elements of biological diversity; 3) provide a site for non-manipulative scientific research; and 4) provide on-site and extension educational opportunities.

PRINCIPAL DISTINGUISHING FEATURES

The principal distinguishing features of the potential Beartooth Butte RNA are alpine tundra, barren slopes, a mosaic of upper timberline conifer woodlands and herbaceous meadows, and a suite of rare plants (including one species endemic to the land within the potential RNA). All of these features occur on an island of Paleozoic sedimentary rocks lying atop the Pre-Cambrian rocks of the Beartooth Plateau.

LOCATION

The potential Beartooth Butte RNA is located within the Shoshone National Forest in northwestern Wyoming. The approximate center of the potential RNA is at latitude 44°57'50"N and longitude 109°36'50"W.

The potential RNA includes all or parts of the following sections (all on the 6th Principal Meridian): Township 57 North, Range 105 West, Section 6; T57N, R106W, Sections 1, 2, 12; T58N, R105W, Sections 30 & 31; T58N, R106W, Sections 25, 26, 35, 36.

BOUNDARY

See Figure 1

For the most part, the boundary of the potential RNA indicated on Figures 1 and 2 parallels Forest Trails that run along the lower slopes of Beartooth Butte and Clay Butte. Starting at the southeastern corner of the potential RNA, at a point ca. 200 feet (61 m) above and 800 feet (244 m) west of Forest Trail 619, the boundary runs north-northwest, roughly parallel to and 100-200 feet (30-61 m) west of Trail 619, for a distance of ca. 2 miles (3.2 km) to the northern end of the area, ca. 500 feet (152 m) south of the intersection of Forest Trail 619 with Forest Trail 6141; thence generally southwest, roughly parallel to and 100-200 feet (30-61 m) east of Trail 6141, for a distance of ca. 2 miles (3.2 km) to the southwestern corner of the area; thence generally southeast ca. 1.4 miles (2.2 km), in part parallel to Secondary Forest Road #142 (the Clay Butte Lookout road) to the southern end of the area, ca. 0.25 mile (0.4 km) north of U.S. Highway 212; thence generally northeast ca. 1.3 miles (2.1 km) to the starting point.

This boundary was drawn simply to exclude the established forest trails and roads and to include the major features of the potential RNA. The exact location of the trail must be determined from survey on the ground.

AREA

The total area of the potential Beartooth Butte RNA is ca. 2194 acres (888 ha).

ELEVATION

The elevation of the potential Beartooth Butte RNA ranges from ca. 9200 feet (2804 m) at the southern end to 10,514 feet (3205 m) atop Beartooth Butte.

ACCESS

The potential Beartooth Butte RNA may be reached via public roads and trails. To reach the western side of the area, from Cook City, Montana, travel east ca. 30 miles (48 km) on U.S. Highway 212 to the intersection with Forest Secondary Road 142 (the Clay Butte Lookout road), thence on Forest Secondary Road 142 ca. 2.3 miles (3.7 km) to the trailhead of Forest Trail 6141. The western side of the area may be reached on foot from that trail.

To reach the southern end of the potential RNA, continue on Forest Secondary Road 142 an additional 0.5 mile (0.6 km) to the Clay Butte Lookout, then walk northeast ca. 750 feet (228 m) to the potential RNA.

To reach the eastern side of the potential RNA, continue on U.S. Highway 212 past the intersection with Forest Secondary Road 142 an additional ca. 2 miles (3.2 km) to the road leading to the Shoshone National Forest Beartooth Lake Campground, thence ca. 0.75 mile (1.2 km) through the campground to the trailhead of Forest Trail 619, thence ca. 0.7 mile (1.1 km) on that trail around the northern end of Beartooth Lake to the southeastern corner of the potential RNA. The eastern side of the area can be reached from that trail.

ECOREGION

The potential Beartooth Butte RNA lies within the Southern Rocky Mountain Steppe-Open Woodland-Coniferous Forest-Alpine Meadow Province, Yellowstone Highlands Section, Beartooth Mountains Subsection (M331Ah) of the ecoregion classification of Bailey et al. (1994) (Freeouf 1996).

MAPS

USDA Forest Service 1/2 inch = 1 mile scale map of the Shoshone National Forest.

USDI Geological Survey 7.5 minute topographic Quadrangle Maps: Beartooth Butte, Wyo. and Muddy Creek, Wyo.

VEGETATION

DESCRIPTION

Synonyms for the plant community type names are given in Appendix 5. Data from sample plots and descriptions of vegetation at various locations are given in Appendix 3.

Upland vegetation

The upland vegetation of the area is primarily a mix of alpine community types at higher elevations and timberline meadows at the lower elevations. The alpine vegetation includes the mountain avens-curly sedge community type, the Kobresia-like sedge type, and the cushion phlox type on windblown slopes and flats; the tufted hairgrass-mountain timothy type and the Idaho fescue - vari-leaf cinquefoil type on protected slopes with deeper soils; and the net-leaf willow type, the Arctic willow/ American bistort type, and the Grayleaf willow type on wet sites. Barren scree slopes and cliffs cover a substantial part of the alpine zone.

Below the alpine zone, the vegetation is a matrix grassy meadows (the Idaho fescue - vari-leaf cinquefoil, Idaho fescue-slender wheatgrass, and Pumpelly brome types) and tall forb meadow, with patches of Engelmann spruce-subalpine fir/heartleaf arnica woodland at the southern

Riparian vegetation

At lower elevations in the southern part of the area, the riparian zones support stands of Booth willow shrub vegetation (the Booth willow/mesic forb type and the Booth willow-Wolf willow type) and the mountain bluebells type.

AREA BY TYPE

Kuchler vegetation types (Kuchler 1966) were mapped on 1:24,000-scale topographic maps using aerial photographs and field reconnaissance, and the area of each type was estimated from the maps by use of a digital planimeter. Areas of complexes of plant community types (Table 2) were estimated in the same manner. Areas of the individual community types were not estimated because estimates of the proportion of each community in each complex were unavailable, given the difficulty of distinguishing closely-related plant communities from aerial photos and the limited extent of the field survey.

Table 1. Areas of Kuchler Types (Kuchler 1966) in the potential Beartooth Butte RNA. See Figure 1.

Cover Type	Acres	Hectares
14 Western spruce-fir forest (14) (Picea-Abies)	255	103
45 Alpine meadows and barren (45) (Agrostis,Carex,Festuca,Poa)	1939	785

Table 2. Areas of SAF cover types (Eyre 1980) in the potential Beartooth Butte RNA. See Figure 1.

Engelmann spruce - Subalpinefir (206)	255	103

Table 3. Areas of complexes of plant community types in the potential Beartooth Butte RNA. Major community types in each complex are indicated by "(M)" following the type names, and minor community types by "(m)". Appendix 5 contains synonyms.

Community Complex	Acres	Hectares
Engelmann spruce-Subalpine fir woodland	255	103
Idaho fescue - vari-leaf cinquefoil (M), Idaho fescue meadow (M), Pumpelly brome (M), Tufted hairgrass-alpine timothy (M), Forb meadow (M), with Idaho fescue-slender wheatgrass (m), Booth willow/mesic forb (m), Booth willow-Wolf willow (m), and Mountain bluebells (m)	985	399
Alpine avens-curly sedge (M), Grayleaf willow (M), Net-leaf willow/marsh marigold (M), Arctic willow/American bistort (M), Kobresia-like sedge (M), Cushion phlox (M), Idaho fescue - vari-leaf cinquefoil (M), with mountain bluebells (m)	954	386

PHYSICAL AND CLIMATIC CONDITIONS

PHYSICAL SETTING

The potential Beartooth Butte RNA is located on an isolated area of sedimentary rock (mainly Paleozoic limestone and shale) lying atop Pre-Cambrian rocks at the southern edge of the rolling Beartooth Plateau. Topography in the area consists of two ridges aligned north-south, with east-facing and west-facing slopes below them. The valley of a perennial stream separates the southern ends of the ridges.

GEOLOGY

The bedrock in the proposed RNA is primarily Cambrian-age limestone and shale, with a smaller area of Ordovician-age dolomite and Upper Devonian-Lower Mississippian dolomite, limestone, and shale on Beartooth Butte (Pierce and Nelson 1971). Much of the bedrock is covered with Quaternary landslide deposits. These sediments form an isolated deposit atop the Pre-

Cambrian granite of the Beartooth Plateau and provide the only alpine calcareous habitat on the Plateau.

DESCRIPTION OF VALUES

VEGETATION TYPES

See Table 1 for a list of the Kuchler (1964) vegetation types present in the area and the estimated acreage of each, and Table 2 for a list of the plant associations present.

FLORA

Threatened, Endangered, and Sensitive Plant Species

No federally listed Threatened or Endangered plant species are found in the potential Beartooth Butte RNA. Two USFS Region 2 Sensitive plant species (Estill 1993), *Agoseris lackschewitzii* and *Parrya nudicaulis*, are known from the area, and a third, *Carex livida*, may occur in a large bog south of the Clay Butte Overlook Road (Sabine Mellmann-Brown, personal communication). Eleven other plants listed as "species of special concern" or "watch list" species by WYNDD (Fertig and Beauvais 1999) are also known from the potential RNA. The status of each of these species is briefly summarized below. Complete Element Occurrence Records and location maps for each population are included in Appendix 6.

Agoseris lackschewitzii (Pink agoseris)
Heritage Rank: G4Q/S3 (WYNDD Watch List).
Federal Status: USFS Region 2 Sensitive; USFS Region 4 Sensitive.
Geographic Range: Regional endemic of east-central Idaho, southwest Montana, and northern Wyoming (Fertig *et al.* 1994). In Wyoming, it is known from the Beartooth, Wind River, Gros Ventre, and Bighorn ranges and Yellowstone Plateau in Big Horn, Fremont, Johnson, Park, Sheridan, Sublette, Teton, and Washakie counties.
Habitat: Wet montane and subalpine meadows.
Comments: Two occurrences of pink agoseris are found near Beartooth Butte and Beartooth Lake, including the oldest known record for Wyoming (collected by C.L. Porter in 1951, but originally determined as *A. aurantiaca*) (WYNDD records). Stephanie Mills discovered a small colony along Beartooth Creek and Beartooth Lake in 1995 (Mills and Fertig 1996 b) which is part of a much larger population that extends for several miles to Long Lake and Fantan Lake (Fertig 1997). This species is now known from nearly 40 sites statewide (at least 10 of which are protected in national park or wilderness areas). WYNDD recently dropped pink agoseris to the “watch list” category due to its new-found abundance and wide distribution in the state. A change

in its Sensitive status may be justified in the near future (Fertig 1997).

Antennaria aromatica (Aromatic pussytoes)
Heritage Rank: G3G4/S2 (WYNDD Watch List).
Federal Status: None.
Geographic Range: Regional endemic of the Rocky Mountains in Alberta, western Montana, and northwestern Wyoming. In Wyoming, it is known from the Absaroka, Beartooth, Bighorn, Gros Ventre, Wind River, and Wyoming/Salt River Mountain Ranges.
Habitat: Calcareous talus slopes, rocky flats, cushion plant communities, and meadows in the alpine zone.
Comments: Two locally abundant colonies were observed on the summits of Clay and Beartooth Buttes in 1996 (Fertig 1997). Although largely secure within the potential RNA, individual clusters may be potentially impacted by high recreation use. Aromatic pussytoes is currently known from 27 locations in Wyoming, 19 of which have been discovered since 1988. Due to low overall threats, large population size, and adequate protection in designated wilderness areas, this species has not been recommended for Sensitive status (Marriott 1988) and has been downlisted to "Watch list" rank by WYNDD (Fertig 1997).

Carex limosa (Mud sedge)
Heritage Rank: G5/S2.
Federal Status: None.
Geographic Range: Circumboreal; south in North America to the Great Lakes, Iowa, Wyoming, Utah, and California. In Wyoming, it occurs in the Bighorn, Absaroka, Wind River, Sierra Madre, and Beartooth ranges and Yellowstone Plateau in Big Horn, Carbon, Park, Sublette, and Teton counties.
Habitat: *Sphagnum* bogs, wet meadows, and calcareous fens. Populations in the Beartooth Butte area are found on floating mats of *Carex simulata* rimming areas of open water in a large swamp.
Comments: A small colony was discovered by Fertig, Houston, and Whipple in the large wetland south of Clay Butte in August 1993. Approximately 10 other populations occur in the state, including five in wilderness, national park, and other protected areas.

Castilleja crista-gallii (Cock's-comb paintbrush)
Heritage Rank: G3/S2.
Federal Status: None.
Geographic Range: Regional endemic of northwestern Wyoming, south-central Montana, and eastern Idaho (Hitchcock et al. 1959).
Habitat: Dry montane slopes and meadows, often on clay or volcanic soils.

Comments: An historical collection of cock's-comb paintbrush is known from the southwestern slope of Clay Butte. This species is currently known from 19 extant and 2 historical records in Wyoming. Hitchcock et al. (1959) postulate that this taxon originated as a hybrid between *C. linariifolia* and *C. miniata*, but recent biosystematic studies by Mathews and Lavin (1998) indicate that *C. crista-galli* is as genetically distinct as any other *Castilleja* species.

Draba globosa (Rockcress draba)
Synonyms: *Draba apiculata; D. densifolia var. apiculata.*
Heritage Rank: G3/S2 (WYNDD Watch List).
Federal Status: USFS Region 4 Sensitive.
Geographic Range: Regional endemic of the mountains of southwestern Montana, east-central Idaho, western Wyoming, central Colorado, and northwestern Utah (Fertig et al. 1994).
Habitat: Moist, gravelly, alpine meadows and talus slopes, usually on calcareous substrates (Fertig et al. 1994).
Comments: Two small colonies of rockcress draba (with fewer than 100 plants) were observed by Fertig and Mellmann-Brown on Clay and Beartooth Buttes in 1996 (Fertig 1997). This species is currently known from 17 locations in Wyoming, 13 of which are protected in designated wilderness areas or in Grand Teton National Park (Fertig 1998). Stone (1995) recently recommended that this species be dropped from the USDA Forest Service Region 4 Sensitive list due to low threats and large population sizes in the mountains of Utah.

Draba paysonii var. paysonii (Payson's draba)
Heritage Rank: G5T3?/S2.
Federal Status: None.
Geographic Range: Regional endemic of Montana and northwestern Wyoming. In Wyoming, known from the Beartooth, Absaroka, Wyoming, and Wind River ranges in Fremont, Lincoln, Park, and Sublette counties.
Habitat: Alpine limestone scree fields, talus slopes, and rock outcrops. Populations in the Beartooth Butte area are found in sparsely vegetated cushion plant communities on steep, yellowish clay soils covered by dolomite gravel.
Comments: Payson’s draba was first discovered on Beartooth and Clay buttes by Rollins and Porter in 1951 (Rollins 1953). Three small colonies containing several hundred plants were relocated by Fertig and Mellmann-Brown in 1996 (Fertig 1997). This species is known from at least 6 extant occurrences in Wyoming, most of which occur in alpine wilderness areas (Fertig 1998).

Draba pectinipila (Comb-hair whitlow-grass)
Synonym: *Draba oligosperma var. pectinipila*.
Heritage Rank: G1Q/S1.
Federal Status: None.
Geographic Range: Endemic to Clay and Beartooth Buttes in northern Park County, Wyoming (Fertig et al. 1994).
Habitat: Rocky alpine cliffs and calcareous rock outcrops (Fertig et al. 1994).
Comments: Three main subpopulations of *Draba pectinipila* were observed on Clay and Beartooth Buttes by Fertig and Mellmann-Brown in 1996 (Fertig 1997). The total population was estimated at 500-750 plants, with individual colonies averaging 20-30 plants. This species was often observed in mixed colonies with *D. oligosperma*, and occasional hybrids were observed. Rollins (1993) has questioned the taxonomic validity of *D. pectinipila*, suggesting that it may be a minor, asexually reproducing variant of *D. oligosperma*. No breeding or pollen fertility studies have been done on Comb-hair whitlow-grass to confirm Rollins' hypothesis. The potential RNA contains the entire world population of this taxon.

Draba porsildii var. brevicula (Little snow draba)
Synonym: *Draba nivalis var. brevicaule*.
Heritage Rank: G3T1/S1.
Federal Status: None.
Geographic Range: Regional endemic of south-central Montana and northwestern Wyoming in the Beartooth Range (Mills and Fertig 1996 a).
Habitat: Alpine cliff crevices and rock outcrops derived from calcareous substrates (Mills and Fertig 1996 a).
Comments: Little snow draba was first discovered on Clay and Beartooth buttes in 1937, but was not described as a new taxon until 1953 (Rollins 1953). Four small, but locally abundant colonies were located at this site by Fertig and Mellmann-Brown in 1996 (Fertig 1997). The Beartooth Butte pRNA contains the entire state distribution of this taxon (Fertig 1998).

Erigeron humilis (Low fleabane)
Heritage Rank: G4/S2.
Federal Status: None.
Geographic Range: Siberia to Greenland, south in western North America to British Columbia, Montana, and northern Wyoming. In Wyoming, it is known from the Wind River, Beartooth, Bighorn, Gros Ventre, and Absaroka ranges in Big Horn, Park, and Sublette counties.
Habitat: Fellfields, meadows, and moist rocky outcrops. Populations in the pRNA are found in moss-rich pockets of

limestone cliffs and alpine tundra with *Salix arctica* and *S. rotundifolia*.
Comments: This species was originally discovered in the area by Dorn and Evert in 1984. Stephanie Mills located a small colony with 10 plants in 1995 (Mills and Fertig 1996 b) and Fertig, Walford, and Mellmann-Brown discovered 2 small colonies in 1996 (Fertig 1997). Low fleabane is presently known from 8 extant populations in Wyoming, nearly all of which are small and restricted to specialized microhabitats. Eight occurrences are found in designated wilderness areas.

Erigeron radicatus (Taprooted fleabane)
Heritage Rank: G3/S2.
Federal Status: None.
Geographic Range: Regional endemic of the middle Rocky Mountains from southern Canada to central Idaho, southwestern Montana, and western Wyoming. In Wyoming, it is known from the Wind River, Absaroka, and Beartooth Mountain Ranges in Fremont, Park, and Sublette counties.
Habitat: Timberline krummholz, fellfield, ridge-lines, and meadows on calcareous soils (Mills and Fertig 1996 a).
Comments: Fertig and Mellmann-Brown discovered two colonies on Clay and Beartooth buttes in 1996 (Fertig 1997). Eight occurrences are found in the state, six of which are protected in wilderness areas (Fertig 1998).

Luzula glabrata var. hitchcockii (Smooth wood-rush)
Heritage Rank: G5T4/S1.
Federal Status: None.
Geographic Range: Southern British Columbia to Alberta south to Oregon and northwest Wyoming. In Wyoming, it occurs in the Beartooth and Teton/Snake River ranges in Park and Teton counties.
Habitat: Subalpine to alpine montane forests.
Comments: Smooth wood-rush was last observed on the southwest slope below the Clay Butte Lookout Station in 1973 (WYNDD records). This species is known from only three other occurrences in Wyoming, two of which are protected in Grand Teton National Park (Fertig 1998).

Parrya nudicaulis (Naked-stemmed parrya)
Heritage Rank: G5/S2.
Federal Status: USFS R2 Sensitive; USFS R4 Sensitive.
Geographic Range: Siberia to Alaska and northern Canada, with disjunct populations in northeastern Utah and western Wyoming (Beartooth, Gros Ventre, and Wind River Mountain Ranges) (Fertig 1995).

Habitat: Sparsely vegetated limestone or quartzite talus slopes in the alpine zone (Fertig 1995).
Comments: Naked-stemmed parrya was first discovered on Beartooth Butte by Rollins and Munoz in 1939. Fertig and Mellmann-Brown conservatively estimated the population at 25,000-30,000 plants on the steep west-facing slope and summit of the Beartooth Butte massif in 1996 (Fertig 1997). This species is currently known from 9 extant occurrences and at least 100,000 individuals in Wyoming. Due to low threats and high population numbers, Fertig (1995) recommended that this species be dropped as Forest Sensitive.

Salix farriae (Farr's willow)
Heritage Rank: G4/S1S2.
Federal Status: None.
Geographic Range: British Columbia to Alberta south to Oregon, eastern Idaho, western Montana, and northwestern Wyoming. In Wyoming, it is known from the Beartooth, Absaroka, Gros Ventre, and Wind River Mountain Ranges and Jackson Hole in Fremont, Park, and Teton counties (Fertig and Markow 1998).
Habitat: Willow thickets dominated by *Salix drummondiana, S. boothii,* and *S. wolfii* on volcanic silts along medium-sized streams and on hummocks in *Picea engelmannii/Pinus contorta* swamp forests (Fertig and Markow 1998).
Comments: Farr's willow is locally abundant (comprising nearly 30% of the total shrub cover) on the western side of Beartooth Lake (Fertig 1997). Seven additional occurrences have been discovered in northwestern Wyoming since 1995, indicating that this species is more widespread than originally suspected. Most populations are secure, although some wetland sites may be potentially impacted by grazing or high recreation use (Fertig 1997).

Plant Species List

The following species checklist is based on field surveys conducted by Jill Walford, Sabine Mellmann-Brown, and W. Fertig in 1996 and on historical records from the Rocky Mountain Herbarium. For more information on the vascular flora of Beartooth Butte and the Beartooth Range, consult Rollins (1953) and Lesica (1993). Nomenclature follows Dorn (1992) for scientific names and Hitchcock and Cronquist (1973) and Welsh et al. (1993) for common names. Family acronyms are based on Weber (1982). Non-native species are indicated by "!" before the species name.

Scientific Name	Common Name	Fam.
	Trees	
Picea engelmannii	Engelmann spruce	PIN
	Shrubs	
Ribes montigenum	Mountain gooseberry	GRS
Salix arctica var. petraea	Arctic willow	SAL
Salix boothii	Booth willow	SAL
Salix eastwoodiae	Eastwood willow	SAL
Salix farriae	Farr's willow	SAL
Salix glauca		SAL
Salix planifolia var. monica	Planeleaf willow	SAL
Salix reticulata var. nana	Snow willow	SAL
Salix rotundifolia var. dodgeana	Dodge willow	SAL
Salix tweedyi	Tweedy's willow	SAL
Salix wolfii var. idahoensis	Wolf willow	SAL
Salix wolfii var. wolfii	Wolf willow	SAL
	Forbs	
Achillea millefolium	Common yarrow	AST
Agoseris glauca var. dasycephala	Short-beaked agoseris	AST
Agoseris lackschewitzii	Pink agoseris	AST
Androsace septentrionalis var. subulifera	Northern rock jasmine	PRM
Anemone multifida	Cutleaf anemone	RAN
Anemone parviflora	Northern anemone	RAN
Anemone tetonensis	Teton anemone	RAN
Antennaria aromatica	Aromatic pussytoes	AST
Antennaria lanata		AST
Antennaria media		AST
Antennaria rosea	Rosy pussytoes	AST

Arabis drummondii	Drummond's rockcress	BRA
Arenaria congesta var. congesta	Ballhead sandwort	CRY
Arenaria obtusiloba [*Minuartia obtusiloba*]	Arctic sandwort	CRY
Arenaria rossii [*Minuartia austromontana*]	Ross sandwort	CRY
Arenaria rubella [*Minuartia rubella*]	Boreal sandwort	CRY
Arnica cordifolia	Heartleaf arnica	AST
Arnica longifolia	Seep-spring arnica	AST
Arnica mollis	Hairy arnica	AST
Arnica parryi	Nodding arnica	AST
Aster alpigenus var. haydenii	Hayden's alpine aster	AST
Aster foliaceus var. apricus	Leafy aster	AST
Aster integrifolius	Thick-stemmed aster	AST
Astragalus alpinus	Alpine milkvetch	FAB
Astragalus kentrophyta var. tegetarius	Mountain thistle milkvetch	FAB
Astragalus miser var. hylophilus	Weedy milkvetch	FAB
Besseya wyomingensis	Wyoming kittentails	SCR
Caltha leptosepala	Elkslip	RAN
Castilleja cristagalli	Cock's-comb paintbrush	SCR
Castilleja miniata	Scarlet paintbrush	SCR
Castilleja pulchella	Showy paintbrush	SCR
Castilleja rhexifolia	Rhexia-leaved paintbrush	SCR
Castilleja sulphurea	Sulfur paintbrush	SCR
Cerastium arvense	Field chickweed	CRY
Cirsium scariosum	Elk thistle	AST
Claytonia lanceolata	Western springbeauty	POR
Collomia linearis	Narrowleaf collomia	PLM
Delphinium glaucum	Pale larkspur	RAN
Descurainia incana var. macrosperma	Mountain tansymustard	BRA
Descurainia incana var. major	Mountain tansymustard	BRA

Dodecatheon pulchellum	Pretty shooting-star	PRM
Draba crassifolia	Thickleaved draba	BRA
Draba globosa [*D. apiculata*]	Rockcress draba	BRA
Draba oligosperma	Few-seeded draba	BRA
Draba paysonii var. paysonii	Payson's draba	BRA
Draba pectinipila	Comb-hair whitlow-grass	BRA
Draba porsildii var. brevicula	Little snow draba	BRA
Dryas octopetala var. hookeriana	White mountain avens	ROS
Epilobium angustifolium	Fireweed	ONA
Epilobium halleanum	Hall's willowherb	ONA
Epilobium hornemannii	Hornemann's willowherb	ONA
Erigeron compositus var. discoideus	Cut-leaved daisy	AST
Erigeron humilis	Low fleabane	AST
Erigeron radicatus	Taprooted fleabane	AST
Erigeron rydbergii	Rydberg's fleabane	AST
Erigeron simplex	Alpine daisy	AST
Erigeron speciosus	Showy fleabane	AST
Erigeron ursinus	Bear River fleabane	AST
Eriogonum umbellatum var. majus	Sulfur buckwheat	PLG
Eriophyllum lanatum var. integrifolium	Woolly yellow daisy	AST
Eritrichium nanum var. elongatum	Pale alpine forget-me-not	BOR
Erysimum asperum var. arkansanum [*E. capitatum*]	Western wallflower	BRA
Fragaria vesca	Wood strawberry	ROS
Fragaria virginiana	Virginia strawberry	ROS
Galium bifolium	Twinleaf bedstraw	RUB
Gentiana affinis var. affinis	Prairie gentian	GEN
Gentianella amarella var. amarella	Northern gentian	GEN
Gentianella tenella	Slender gentian	GEN

Geranium viscosissimum	Sticky geranium	GER
Geum macrophyllum var. perincisum	Large-leaved avens	ROS
Geum triflorum	Prairie smoke	ROS
Habenaria hyperborea [*Platanthera hyperborea*]	Northern green bog-orchid	ORC
Hedysarum sulphurescens	Yellow sweetvetch	FAB
Helianthella quinquenervis	Nodding helianthella	AST
Helianthella uniflora	Rocky Mountain helianthella	AST
Linum lewisii	Blue flax	LIN
Lloydia serotina	Alpine lily	LIL
Lomatium cous	Cous biscuitroot	API
Lupinus argenteus	Silvery lupine	FAB
Mertensia alpina	Alpine bluebells	BOR
Mertensia ciliata	Ciliate bluebells	BOR
Mertensia viridis	Green bluebells	BOR
Mitella pentandra	Five-stamened mitrewort	SAX
Myosotis alpestris	Wood forget-me-not	BOR
Osmorhiza chilensis	Mountain sweet-cicely	API
Oxytropis borealis var. viscida	Sticky locoweed	FAB
Oxytropis campestris var. cusickii	Yellow locoweed	FAB
Oxytropis sericea var. sericea	White locoweed	FAB
Parnassia fimbriata	Fringed grass-of-Parnassus	SAX
Parrya nudicaulis	Naked-stemmed parrya	BRA
Pedicularis bracteosa var. paysoniana	Payson's bracted lousewort	SCR
Penstemon procerus	Small-flower beardtongue	SCR
Penstemon rydbergii var. rydbergii	Rydberg's beardtongue	SCR
Phlox pulvinata	Cushion phlox	PLM
Plantago tweedyi	Tweedy's plantain	PTG
Polemonium viscosum	Sky-pilot	PLM
Polygonum bistortoides	American bistort	PLG
Polygonum douglasii var. douglasii	Douglas' knotweed	PLG

Polygonum sawatchense	Sawatch knotweed	PLG
Polygonum viviparum	Alpine bistort	PLG
Potentilla diversifolia var. diversifolia	Vari-leaf cinquefoil	ROS
Potentilla diversifolia var. perdissecta	Vari-leaf cinquefoil	ROS
Potentilla gracilis var. brunnescens	Slender cinquefoil	ROS
Potentilla ovina var. ovina	Sheep cinquefoil	ROS
Pyrola asarifolia	Pink wintergreen	ERI
Ranunculus eschscholtzii var. eschscholtzii	Subalpine buttercup	RAN
Ranunculus eschscholtzii var. eximius	Subalpine buttercup	RAN
Saxifraga odontoloma	Brook saxifrage	SAX
Saxifraga oppositifolia	Purple saxifrage	SAX
Saxifraga rhomboidea	Diamondleaf saxifrage	SAX
Sedum lanceolatum	Lance-leaved stonecrop	CRS
Senecio canus	Woolly groundsel	AST
Senecio crassulus	Thick-leaved groundsel	AST
Senecio lugens	Black-tipped groundsel	AST
Senecio streptanthifolius var. streptanthifolius	Cleft-leaved groundsel	AST
Senecio triangularis	Arrowleaf groundsel	AST
Smelowskia calycina var. americana	Alpine smelowskia	BRA
Solidago multiradiata var. scopulorum	Northern goldenrod	AST
Stellaria monantha	One-flower starwort	CRY
Swertia radiata [*Frasera speciosa*]	Green gentian	GEN
Taraxacum ceratophorum	Horned dandelion	AST
! Taraxacum officinale	Common dandelion	AST
Thalictrum fendleri	Fendler's meadowrue	RAN
Trifolium parryi	Parry's clover	FAB
Trollius laxus	American globeflower	RAN
Valeriana edulis	Tobacco-root	VAL
Valeriana occidentalis	Western valerian	VAL
Veronica wormskjoldii	American alpine speedwell	SCR

Viola praemorsa	Upland yellow violet	VIO
Zigadenus elegans	Elegant death-camas	LIL

Graminoids

Bromus carinatus	California brome	POA
Bromus inermis var. purpurascens	Pumpelly brome	POA
Carex albonigra		CYP
Carex aquatilis	Water sedge	CYP
Carex elynoides	Kobresia-like sedge	CYP
Carex haydeniana	Hayden's sedge	CYP
Carex hoodii	Hood's sedge	CYP
Carex microptera	Small-wing sedge	CYP
Carex norvegica var. stevenii	Scandanavian sedge	CYP
Carex obtusata	Blunt sedge	CYP
Carex paysonis	Payson's sedge	CYP
Carex phaeocephala	Dunhead sedge	CYP
Carex raynoldsii	Raynolds' sedge	CYP
Carex rupestris	Curly sedge	CYP
Carex scirpoidea	Canadian single-spike sedge	CYP
Carex vallicola	Valley sedge	CYP
Deschampsia cespitosa	Tufted hairgrass	POA
Elymus trachycaulus var. trachycaulus	Bearded wheatgrass	POA
Festuca baffinensis	Baffin fescue	POA
Festuca brachyphylla	Alpine sheep fescue	POA
Festuca idahoensis	Idaho fescue	POA
Juncus mertensianus	Mertens' sedge	JUN
Koeleria macrantha	Prairie junegrass	POA
Luzula glabrata var. hitchcockii	Smooth wood-rush	JUN
Luzula parviflora	Smallflowered woodrush	JUN
Luzula spicata	Spiked woodrush	JUN
Melica spectabilis	Showy oniongrass	POA
Phleum alpinum	Alpine timothy	POA
Poa alpina	Alpine bluegrass	POA

Poa cusickii var. epilis	Skyline bluegrass	POA
Poa fendleriana	Muttongrass	POA
Poa interior	Inland bluegrass	POA
Poa juncifolia var. ampla	Big bluegrass	POA
Poa juncifolia var. juncifolia	Alkali bluegrass	POA
Poa nervosa var. wheeleri	Wheeler's bluegrass	POA
Poa pattersonii	Patterson bluegrass	POA
Poa pratensis	Kentucky bluegrass	POA
Poa reflexa	Nodding bluegrass	POA
Poa rupicola	Timberline bluegrass	POA
Poa secunda var. elongata	Canby bleugrass	POA
Stipa lettermanii	Letterman's needlegrass	POA
Stipa nelsonii var. dorei		POA
Trisetum spicatum	Spike trisetum	POA

Ferns and Fern Allies

Equisetum arvense	Field horsetail	EQU
Selaginella densa	Compact spike-moss	SEL

FAUNA

Threatened, Endangered, and Sensitive Vertebrates

The Wyoming Natural Diversity Database contains no records of threatened, endangered, or sensitive vertebrate species in the potential Beartooth Butte RNA.

Animal Species List

The field work in the potential Beartooth Butte RNA did not include identification of the animal species present.

LANDS

The potential Beartooth Butte RNA is National Forest System land and is surrounded by National Forest System land of the Clark's Fork Ranger District of the Shoshone National Forest. Approximately 51% of the potential RNA (1111 acres, or 450 ha) lies within the Absaroka-Beartooth Wilderness Area.

SUITABILITY FOR RESEARCH NATURAL AREA SELECTION

An area is suitable for designation as a research natural area according to how well it meets four criteria: quality, condition, viability, and defensibility (USDA Forest Service Region 2, 1993). Each criterion is briefly defined below, and the information collected during field work that is pertinent to each criterion is described.

QUALITY

The degree to which the potential RNA represents the range in variability within the ecosystem types that it contains.

In the potential Beartooth Butte RNA, wind, snow, and topography combine to produce the fine-grained mix of environments typical of alpine ecosystems. These environments in turn support a mix of community types that differ in species composition and total plant cover, and the structure of the vegetation differs between low herbaceous vegetation of most tyes and low shrub vegetation of the grayleaf willow type. The alpine zone in the potential RNA lies mainly atop calcareous rocks, which distinguishes this area from the Pre-Cambrian crystalline alpine substrates of the adjoining Beartooth Plateau and the volcanic alpine substrates of the nearby Absaroka Mountains. (Those latter rock types generally support plant communities that contain a substantial amount of *Geum rossii* and differ from the communities of calcareous substrates [Lesica 1993, Cooper et al. 1997]). Thus the potential RNA appears to represent the vegetation pattern typical of calcareous alpine substrates, but not of alpine areas on other rock types.

This area of high-elevation calcareous sediments also supports populations of eight rare vascular plants that are largely restricted to limestone and dolomite, and hence appears to represent an unusual element of the regional alpine flora. One of these species, *Draba pectinipila*, is endemic to the potential RNA.

The lower-elevation, southern part of the potential RNA supports a matrix of herbaceous meadow containing patches of conifer woodland. Composition of the herbaceous vegetation varies between plant community types, due to the mix of environments and (perhaps) to the actions of pocket gophers. Structure of the vegetation ranges from dense herbaceous vegetation to dense willow shrub stands in wetlands.

The patches of conifer woodland differ one from another in composition of the overstory, with some consisting entirely of subalpine fir, some entirely of Engelmann spruce, and some of a mix of the two. The woodland lacks whitebark pine, and thus

appears to be typical of timberline vegetation on calcareous substrates in the region (Steele et al. 1983). The area of conifer woodland is so small, though, that it may not represent well the composition or pattern of timberline woodland.

CONDITION

The degree to which the potential RNA has been altered from pre-settlement conditions.

No evidence was observed during field survey to suggest that the potential RNA has been altered significantly from its pre-settlement condition. Two exotic vascular plant (common dandelion [*Taraxacum officinale*] and Kentucky bluegrass [*Poa pratensis*]) were noted, and although Kentucky bluegrass may contribute substantial cover in some stands, these two species are minor parts of the vegetation throughout the whole area.

A faint two-track road runs from the Clay Butte Lookout north along the ridge in the western part of the potential RNA, but this road is now closed and it appears to have had little effect on the area.

Fire suppression apparently has had little effect on the vegetation in the potential RNA. The patches of Engelmann spruce-subalpine fir woodland apparently occur on the *Picea engalmannii/Arnica cordifolia* habitat type, which resembles the *Picea/Senecio streptanthifolius* habitat type named from Montana (Steele et al. 1983). The latter habitat type belongs to Fischer's and Clayton's (1983) fire group 10, in which fire is secondary to factors of the physical environment in shaping the vegetation.

VIABILITY

The prospect for long-term maintenance of the ecosystem types in the area and the survival of their constituent species.

In the alpine ecosystem, the pattern of vegetation types and the composition and structure of stands of different types are largely controlled by physical factors; succession driven by biotic agents is extremely slow (Billings 1988). The pattern of vegetation types at timberline in the lower part of the potential RNA appears to also be controlled largely by the interaction between topography and wind. The structure of the conifer woodlands should change only slowly, because tree establishment and growth in these high-elevation stands proceed slowly.

Consequently, the viability of the timberline and alpine ecosystems in the potential RNA apparently will depend largely on changes in climate (and consequent changes in patterns of snow deposition and in other weather factors) than it will on management practices.

DEFENSIBILITY

The extent to which the area can be protected from extrinsic, anthropogenic factors that might worsen the condition of the area or threaten the viability of the ecosystems present.

The only motor vehicles allowed in the potential Beartooth Butte RNA are snowmobiles operated on snow, and they are restricted to the southern and eastern portions of the area outside of the Absaroka-Beartooth Wilderness Area. Because the topography in those parts of the potential RNA is relatively steep, snowmobile use probably is minor.

Hikers and horseback riders can easily reach the potential RNA from the trails that nearly surround the area. Only on the eastern side is the topography steep enough to discourage travel. Nevertheless, the area is likely to draw few people because it contains no obvious attractions such as fishing streams or lakes. Those people interested in entering the potential RNA are unlikely to have a significant effect on the ecosystems of the area.

DEGREE TO WHICH THE POTENTIAL RNA MEETS CRITERIA

Although covering only a small area, the potential Beartooth Butte RNA appears to represent two aspects of calcareous alpine ecosystems--the mosaic of plant community types and an element of the regional vascular flora. The condition of the potential RNA appears to have been little altered (by exotic plant species and a two-track road) from its pre-settlement condition. Viability of the ecosystems appears to depend primarily on the physical environment, which will change only slowly. Although the topography of the area makes access to the potential RNA easy, it offers few attractions to most people.

IMPACTS AND POSSIBLE CONFLICTS

This section is limited to the conflicts obvious from field survey and from conversations with USDA Forest Service staff.

MINERAL RESOURCES

No evidence was observed during field survey to suggest that mineral resources would conflict with RNA designation.

GRAZING

No evidence was observed during field survey to suggest that RNA designation would conflict with grazing.

TIMBER

The area appears to contain no stands of merchantable timber, so RNA designation should not conflict with timber management.

WATERSHED VALUES

No evidence was observed during field survey to suggest that RNA designation would conflict with watershed values.

RECREATION VALUES

The potential RNA contains no established campgrounds or picnic grounds, and no maintained trails. It also appears to offer little attraction (such as fishing streams) to most recreational users of the National Forest. The southwestern boundary of the area evaluated in this project lies within 0.1 mile (0.16 km) of the Clay Butte Fire Lookout Visitor Center and National Forest Road 142 leading to it.

WILDLIFE AND PLANT VALUES

No evidence was observed during field survey to suggest that RNA designation would conflict with management of the area for wildlife and plant values. The potential RNA contains eight species of vascular plants that are largely restricted to calcareous habitats and are rare in the region, and one species (*Draba pectinipila*) endemic to the potential RNA. RNA designation would appear to benefit the plants that grow inside the potential RNA but outside of the Absaroka-Beartooth Wilderness Area.

TRANSPORTATION VALUES

The boundaries proposed for the potential Beartooth Butte RNA exclude roads and maintained trails, so RNA designation should not conflict with transportation values.

MANAGEMENT CONCERNS

No evidence was gathered during the field survey to suggest that management of the Beartooth Butte area as an RNA will produce any management concerns.

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Appendixes

APPENDIX 1. MAPS OF THE POTENTIAL BEARTOOTH BUTTE RESEARCH NATURAL AREA

Figure 1. Contour map showing Kuchler (1966) vegetation types and equivalent SAF cover types (Eyre 1980) in the potential Beartooth Butte RNA.

Kuchler/SAF Types	Map Symbol
Kuchler Western spruce-fir forest (14) (Picea-Abies) AND SAF Engelmann spruce-Subalpine fir (206)	14/206
Kuchler Alpine meadows and barren (45) (Agrostis,Carex,Festuca,Poa)	45

Figure 2. Contour map showing complexes of plant community types in the potential Beartooth Butte RNA. Major community types in each complex are indicated by "(M)" following the type names, and minor community types by "(m)". Appendix 5 contains synonyms. Synonyms for community names are listed in Appendix 5.

Community Complexes	Map Symbol
Engelmann spruce-Subalpine fir woodland	1
Idaho fescue - vari-leaf cinquefoil (M), Idaho fescue meadow (M), Pumpelly brome (M), Tufted hairgrass-alpine timothy (M), Forb meadow (M), with Idaho fescue-slender wheatgrass (m), Booth willow/mesic forb (m), Booth willow-Wolf willow (m), and Mountain bluebells (m)	2
Alpine avens-curly sedge (M), Grayleaf willow (M), Net-leaf willow/marsh marigold (M), Arctic willow/American bistort (M), Kobresia-like sedge (M), Cushion phlox (M), Idaho fescue - vari-leaf cinquefoil (M), with mountain bluebells (m)	3

Sample plots

Locations of vegetation descriptions

APPENDIX 2. PHOTOGRAPHS FROM THE POTENTIAL BEARTOOTH BUTTE RNA

All photographs were taken by G.P. Jones in the Clark's Fork Ranger District, Shoshone National Forest, Park County, Wyoming on August 22, 1997..

Photo 97GJ5.21. North half of Beartooth Butte from across Beartooth Lake to the east, showing the carbonate rocks (at top) and shales atop the granitic rocks of the Beartooth Plateau. Vegetation is a matrix of Pumpelly brome grassland and Idaho fescue grassland, with patches of grayleaf willow shrubland and Engelmann spruce-subalpine fir woodland. August 22, 1997.

Photo 97GJ5.23. Eastern side of Beartooth Butte, in area of plot 2 representing Pumpelly brome grassland, which forms matrix vegetation on limestone and dolomite colluvium on side of Butte. August 22, 1997.

Photo 97GJ5.24. Eastern side of Beartooth Butte, showing willow patches (grayleaf willow and tealeaf willow) in talus. August 22, 1997.

Photo 97GJ5.27. Top of Beartooth Butte, looking south. Vegetation is sparse mountain avens/curly sedge. August 22, 1997.

APPENDIX 3. CANOPY COVER OF PLANTS IN PLOTS IN THE POTENTIAL BEARTOOTH BUTTE RESEARCH NATURAL AREA

Estimates of canopy cover from sample plots are shown in tables. The cover values for species are midpoints of the following cover classes:

Cover Value	Range of Canopy Cover
1	<1%
3	1% - 5%
10	5% - 15%
20	15% - 25%
30	25% - 35%
40	35% - 45%
50	45% - 55%
60	55% - 65%
70	65% - 75%
80	75% - 85%
90	85% - 95%
97	95% - 100%

The vegetation descriptions are for parts of stands and were not made for formal sample plots. At each location, the species in each stratum of the vegetation are listed approximately in order from those with the most canopy cover to those with the least.

Locations of sample plots and of vegetation descriptions are shown on Figure 2. Plots with four-letter codes (e.g., BEBU11) are from Walford et al. (1997).

Table 3-1. Canopy cover of plants in the riparian Booth willow sample plots in the potential Beartooth Butte RNA.

	BEBU13	CLBU41
	Salboo/	Salboo/
SPECIES	Mesic	Salwol
	Forb	
TREES		
Picea engelmannii	1	
SHRUBS		
Salix boothii	50	20
Salix eastwoodiae		30
Salix farriae	30	
Salix planifolia	10	10
Salix tweedyi	3	
Salix wolfii		30
GRAMINOIDS		
Carex aquatilis	1	3
Carex microptera		10
Carex norvegica var. stevenii	1	10
Deschampsia cespitosa	1	3
Elymus trachycaulus		1
Juncus mertensianus	1	3
Phleum alpinum		1
FORBS		
Achillea millefolium		1
Agoseris glauca		3
Arnica longifolia		1
Aster foliaceus	1	3
Caltha leptosepala	3	1
Castilleja rhexifolia	1	
Epilobium halleanum		1
Epilobium hornemannii	1	1
Equisetum arvense	1	3
Fragaria vesca	1	1
Fragaria virginiana	1	
Gentiana affinis		1
Geum macrophyllum	1	3
Habenaria hyperborea	1	
Mertensia ciliata	1	
Mitella pentandra	1	
Parnassia fimbriata		3
Parnassia sp.	1	
Polygonum viviparum	1	1
Potentilla diversifolia		1

Pyrola asarifolia	1	
Saxifraga odontoloma	3	3
Senecio triangularis	3	3
Solidago multiradiata	1	
Stellaria monantha		1
Thalictrum fendleri	1	
Trifolium parryi		1
Trollius laxus		40
Valeriana edulis		3
Valeriana occidentalis	1	1
Veronica wormskjoldii		1
GROUND COVER		
Bare ground	60	3
Gravel		
Rock		
Litter	1	10
Wood		
Moss	20	60
Basal vegetation		

Association acronyms:

Salboo/Mesic Forb = Salix boothii/Mesic Forb (Booth's willow/mesic forb)

Salboo-Salwol = Salix boothii-Salix wolfii (Booth's willow-wolf willow)

Plot notes:

Plot BEBU13: Gently-sloping, east-facing concave bench alongside perennial stream.

Plot CLBU41: First surface ca. 0.3 m above channel of perennial stream. Surface undulates and contains small ponds.

Table 3-2. Canopy cover of plants in the upland willow sample plots in the potential Beartooth Butte RNA.

	Plot 3	Plot 4	96CLBU23
	Salgla	Salret	Salarc/
SPECIES			Polbis
DWARF SHRUBS			
Salix arctica			30
Salix glauca	60		
Salix reticulata		50	
Salix rotundifolia			40
GRAMINOIDS			
Carex albonigra		3	
Carex paysonis			3
Carex rupestris			1
Carex scirpoidea	1	30	1
Deschampsia atropurpurea?		1	
Deschampsia cespitosa			1
Elymus trachycaulus var. trachycaulus	1		
Festuca brachyphylla	1		3
Poa alpina	1		1
Poa sp.	1		
Trisetum spicatum	3		
FORBS			
Achillea millefolium	1		1
Androsace septentrionalis	1		
Anemone parviflora			3
Antennaria media	1		1
Arenaria congesta	1		
Arenaria obtusiloba			1
Aster sp.	1		1
Caltha leptosepala		1	
Clematis sp.	1		
Draba crassifolia			1
Erigeron humilus			1
Erigeron simplex			3
Erigeron sp.		1	
Gentianella amarella			1
Gentianella tenella			1
Hedysarum sulphurescens	20		30
Lloydia serotina	3	1	
Mertensia alpina			1
Myosotis alpestris			3
Parnassia fimbriata		1	

Pedicularis groenlandica		1	
Penstemon sp.	3		
Phlox pulvinata			1
Polygonnum bistortoides	1	1	3
Polygonum viviparum			30
Potentilla diversifolia	1	1	1
Ranunculus sp.	3		
Saxifraga odontoloma		1	
Saxifraga sp.	1	1	
Sedum lanceolatum	1		1
Senecio dimorphophyllus	1		
Senecio lugens			1
Sisyrinchium sp.	1		
Solidago multiradiata	10		1
Swertia perennis	3		
Taraxacum sp.		1	
Trollis laxus		1	
Valeriana edulis	1		
Zigadenus elegans	1		1
GROUND COVER			
Bare ground	16	15	10
Gravel	60	4	10
Rock	11	6	10
Litter	10	34	20
Wood			
Moss		35	30
Basal vegetation	3	6	

Association acronyms:

Salgla = Salix glauca (Grayleaf willow)
Salret = Salix reticulata (Net-leaf willow)
Salarc/Polbis = Salix arctica/Polygonum bistortoides (Arctic willow/American bistort)

Plot notes:

Plot 3: On middle of moderately-steep, east-facing slope on limestone. 10 m x 10 m. Represents the vegetation on ca. 50% of the slope. Photo 97GJ5.24 & 5.25.

Plot 4: In relatively wet patch at foot of steep, west-facing slope on limestone. 10 m x 10 m. Surrounding drier vegetation is mountain avens type. Photo 97GJ5.29.

Plot 96CLBU23: Northwest-facing limestone talus slope at the foot of cliff, up-slope from Carex scirpoidea-C. elynoides vegetation and Salix glauca vegetation. 17 m x 6 m.

Table 3-3. Canopy cover of plants in the Idaho fescue sample plots and tufted hairgrass sample plot in the potential Beartooth Butte RNA.

	Plot 5	Plot 33	CLBU12	Plot 7	BEBU11	Plot 1
	Fesida-	Fesida-	Fesida-	Fesida	Fesida	Desces-
Species	Potdiv	Potdiv	Potdiv			Phlalp
DWARF SHRUBS						
Salix wolfii						1
GRAMINOIDS						
Bromus inermis var. purpurascens	3		3	1		1
Carex elynoides	20	20	3			
Carex raynoldsii						1
Carex obtusata		10	3			
Carex phaeocephala			1			
Carex sp. (brown ball)						1
Carex sp. (tall green)		1				
Deschampsia cespitosa						20
Elymus trachycaulus var. trachycaulus	1			10		1
Festuca idahoensis	10	50	50	20	30	10
Koeleria macrantha			1			
Luzula spicata		1	1			
Phleum alpinum						20
Poa alpina		1				1
Poa pratensis			3			
Poa rupicola		1	3			
Poa secunda var. elongata						1
Poa sp. (tall green)		1		1		
Stipa nelsonii var. dorei				3		
Trisetum spicatum				1		1
FORBS						
Achillium millefolium	1	10	3	1	3	3
Agoseris sp.		10	10	1	3	1
Antennaria rosea			1		3	
Antennaria, low	10	1		1		
Arenaria congesta	1			3	3	10
Aster alpigenus			1		3	
Aster foliaceus	3			3	3	20
Besseya wyomingensis			1	1	1	
Castilleja, tall				1		
Castilleja short						1
Cerastium arvense		1	3			1
Cirsium scariosum					1	1
Claytonia lanceolata			1			
Clematis sp.	1					
Delphinium glaucum				1	3	

Dodecatheon pulchellimum			1	1		
Draba crassifolia			1			
Epilobium angustifolium					1	
Epilobium sp.						1
Eriogonum umbellatum				1	1	
Eriophyllum lanatum				10	1	
Fragaria virginiana					3	
Gentianopsis detonsa						1
Geum triflorum	30	40	20			1
Geranium viscosissimum				30	3	
Hedysarum sulphurescens	30					
Helianthella uniflora				1		
Linum lewisii	1	1			1	
Lupinus argenteus		10	20		10	
Mertensia viridis			1			
Myosotis alpestris			1		1	
Oxytropis campestris			1			
Oxytropis sericea					1	
Oxytropis sp.		1				
Pedicularis bracteosa					1	
Penstemon procerus	1	20	1	1	3	1
Phlox pulvinata			10			
Polygonum bistortoides		1	10	1		1
Potentilla diversifolia		1	1	1		10
Potentilla gracilis					10	
Ranunculus eschscholtzii						1
Senecio streptanthifolius					1	
Senecio, clasp-leaf				1		
Sisyrinchium sp.						1
Solidago multiradiata	3	1	3		1	10
Solidago sp. (low)						1
Swertia perennis	3				10	3
Taraxacum sp.			1	1		1
Trifolium sp.						1
Valeriana edulis	1					10
Valeriana occidentalis					3	
Zigadenus elegans	1					
GROUND COVER						
Bare ground	20	5	3	65	10	65
Gravel	30	1		15	3	1
Rock	15			1	3	1
Litter	30	87	70	15	10	27
Wood						
Moss						
Basal vegetation	5	7		4		6

Association acronyms:

Fesida-Potdiv = Festuca idahoensis-Potentilla diversifolia (Idaho fescue - vari-leaf cinquefoil)
Desces-Phlalp = Deschampsia cespitosa-Phleum alpinum (Tufted hairgrass-alpine timothy)

Plot notes:

Plot 5: Flat atop limestone hill. 10 m x 10 m. Photo 97GJ5.31.

Plot 33: Matrix type on ridge north of Clay Butte fire lookout, and major type along west side of potential RNA. Plot 20 m x 20 m, on middle of gentle, south-facing slope on shale bedrock. Near plot CLBU12.

Plot CLBU12: Southwest-facing, gentle slope. 37.25 foot radius. Plot represents matrix type on ridge north of Clay Butte fire lookout, and major type along west side of potential RNA. Near plot 33.

Plot 7: Represents major vegetation type on valley wall, on landslide deposit developed in shale. 10 m x 10 m.

Plot BEBU11: Vegetation type atop ridges. Plot 4.5 m x 15 m, on southeast-facing slope, in patch ca. 300 square meters. Pocket gopher diggings common. Adjacent vegetation is tall forb type.

Plot 1: Matrix vegetation type on benches on the east side of Beartooth Butte. Shale substrate. Pocket gopher diggings common. 10 m x 15 m. Photo 97GJ5.22

Table 3-4. Canopy cover of plants in plots in the Pumpelly brome and vegetation type and the tall forb vegetation type in the potential Beartooth Butte RNA.

	Plot 2	Plot 6	CLBU31
	Broine	Broine	Forb
Species			
DWARF SHRUBS			
Salix glauca	3		
GRAMINOIDS			
Bromus carinatus			1
Bromus inermis var. purpurascens	20	40	
Carex hoodii			1
Carex raynoldsii		1	1
Carex vallicola			1
Carex, brown ball	1	1	
Deschampsia cespitosa		1	
Elymus trachycaulus var. trachycaulus	1	1	1
Festuca idahoensis			1
Melica spectabilis		1	10
Phleum alpinum		1	
Poa alpina	1		
Poa interior			1
Poa juncifolia			1
Poa nervosa			1
Poa reflexa		1	
Poa secunda var. elongata			1
Poa, tall purple	1	1	
Stipa nelsonnii var. dorei	1	3	
Trisetum spicatum	1	1	1
FORBS			
Achillea millefolium	1	1	1
Agoseris sp.	1	1	3
Anenome sp.	1		
Antennaria sp.	1		
Arenaria congesta	3		
Arnica cordifolia	1		
Arnica longifolia		3	
Aster alpigenus			1
Aster foliaceus	3	3	
Aster integrifolius			1
Castilleja, tall	1	1	
Cerastium arvense			1
Cirsium scariosum	1		1
Collomia linearis			1
Delphinium glaucum		1	10
Descurainia incana			1

Dodecatheon pulchellum			1
Erigeron sp.			3
Eriophyllum lanatum	3		1
Erysimum asperum			1
Galium biflorum			1
Geranium viscosissimum	1	3	40
Geum triflorum			1
Hedysarum sulphurescens	1		
Helianthella uniflora	1		3
Lupinus argenteus			20
Mertensia viridis			1
Myosotis alpestris			1
Penstemon procerus	3		1
Polygonum bistortoides	1	1	1
Polygonum douglasii		1	
Polygonum sawatchense			1
Potentilla diversifolia	1	3	
Potentilla gracilis		1	10
Ranunculus eschscholtzii	1		
Rumex sp.		1	
Sedum lanceolatum	1		
Senecio crassulus			1
Senecio dimorphophyllus	3		
Senecio sp.	1		
Senecio, clasp-leaf		10	
Sisyrinchium sp.	1		
Solidago multiradiata			1
Solidago, clasp-leaf	1		
Swertia perennis	10		1
Taraxacum sp.			1
Thalictrum fendleria	1		
Valeriana edulis	1	1	
Valeriana occidentalis	1		10

GROUND COVER			
Bare ground	45	87	3
Gravel	38	1	
Rock	10		
Litter	4	7	3
Wood			
Moss Basal vegetation	3	5	

Association acronyms:

Broine = Bromus inermis var. purpurascens (Pumpelly brome)

Plot notes:

Plot 2: Represents matrix vegetation on steep slope on limestone colluvium over shale. 10 m x 15 m. Photo 97GJ5.23.

Plot 6: Part of matrix vegetation at foot of slope, on landslide deposit from limestone. Plot 10 m x 10 m represents area of strong Bromus dominance; other patches have less grass. Pocket gopher diggings common.

Plot CLBU31: Represents tall forb community on undulating landslide deposit on moderately-steep, southeast-facing slope. Part of mosaic with Engelmann spruce forest patches. Radius 11 m.

Table 3-5. Canopy cover of plants in plots in the cushion plant vegetation types in the potential Beartooth Butte RNA.

	CLBU11	CLBU21	CLBU24
	Phlpul	Phlpul	Carely
Species			
GRAMINOIDS			
Bromus inermis var. purpurascens	1		
Carex elynoides	1	1	20
Carex rupestris?		1	
Festuca brachyphylla		1	1
Festuca sp.	1		
Koeleria macrantha	1		
Poa alpina			1
Poa cusickii var. epilis	1	1	
Poa pattersonii	10		
Poa rupicola		1	
Poa secunda var. elongata	3		
Trisetum spicatum		1	1
FORBS			
Achillea millefolium	1		
Agoseris sp.	3		1
Androsace septentrionalis	1		1
Anemone sp.		1	1
Antennaria media			1
Arenaria congesta			10
Arenaria obtusiloba		10	1
Arenaria rossii		1	
Arenaria rubella		1	1
Aster alpigenus			10
Astragalus kentrophyta	3	1	
Besseya wyomingensis	10		1
Castilleja pulchella			1
Cerastium arvense	3		
Dodecatheon pulchellimum	1		1
Draba globosa		1	1
Draba oligosperma		3	
Erigeron compositus	3	3	
Erigeron simplex			1
Eritrichium nanum		10	
Erysimum asperum	1		
Hedysarum sulphurescens			3
Linum lewisii	1		
Lomatium cous		3	
Mertensia alpina		1	
Mertensia viridis	10		

Myosotis alpestris	3	1	1
Oxytropis borealis		10	
Oxytropis campestris	20		1
Phlox pulvinata	30	20	3
Polygonum bistortoides			3
Potentilla diversifolia		1	1
Potentilla ovina	20	10	1
Ranunculus eschscholtzii			1
Saxifraga rhomboidea			1
Saxifraga sp.	3		
Sedum lanceolatum	1	1	1
Senecio canus	10	1	
Smelowskia calycina	1	1	
Solidago multiradiata	1	3	3
Swertia perennis			1
Taraxacum sp.	1	1	
Valeriana edulia			3
Zigadenus elegans		1	1
FERNS & FERN ALLIES			
Selaginella dense		10	
GROUND COVER			
Bare ground	30	3	40
Gravel	20	30	30
Rock	10	20	3
Litter	30	1	3
Wood			
Moss	1	1	3
Basal vegetation			

Association acronyms:

Phlpul = Phlox pulvinata (cushion phlox)
Carely = Carex elynoides (Kobresia-like sedge)

Plot notes:

Plot CLBU11: Upper part of moderately-steep, southwest-facing slope. Limestone gravel common. 37.25 foot radius.

Plot CLBU21: Patchy vegetation on limestone scree atop limestone outcrop at edge of plateau. 40 m x 10 m.

Plot CLBU24: Patch of ca. 0.5 acre (0.2 ha) on ridge, in slight depression. 37.25 foot radius.

VEGETATION DESCRIPTIONS

Numbers following species names indicate canopy cover classes shown on page 31.

LOCATION 0. East side of Beartooth Butte.
ELEVATION: 10,000-10,400 feet (3139-3170 meters). ASPECT: East
TOPOGRAPHIC POSITION: Slope

0a.
VEGETATION TYPE: Engelmann spruce-subalpine fir woodland
DESCRIPTION: Patches of trees, most ca. 100 square meters and including < 20 trees of pole and sapling size, in a mosaic of limestone scree, cushion plant vegetation, tall forb vegetation, and dwarf willow stands.
Trees: Abies lasiocarpa, Picea engelmannii, Pinus albicaulis (latter uncommon)
Shrubs:
Dwarf Shrubs: Ribes montigenum, Salix sp.
Graminoids & Forbs: Thalictrum fendleri
NOTES:

0b.
VEGETATION TYPE: Arctic willow/American bistort
DESCRIPTION: Patchy vegetation growing in limestone talus.
Trees:
Shrubs:
Dwarf Shrubs: Salix arctica
Graminoids & Forbs: Poa alpina, Carex scirpoidea, Dryas octopetala, Saxifraga sp.
NOTES: Patches of this type cover ca. 50% of talus slope.

LOCATION 1. Top of Beartooth Butte.
VEGETATION TYPE: Mountain avens-curly sedge
ELEVATION: 10360 feet (3158 meters). ASPECT: West
TOPOGRAPHIC POSITION: Upper part of gentle, west-facing slope.
DESCRIPTION: Very sparse and patchy vegetation; major species form patches, and the patches of different species are concentrated in different areas.
Trees:
Shrubs:
Dwarf Shrubs:
Graminoids & Forbs: Major species are Carex scirpoidea, Dryas octopetala, Saxifraga oppositifilia; less common species are Festuca brachyphylla, Trisetum spicatum, Oxytropis sp., Eritrichium sp., Antennaria sp., Carex elynoides.
NOTES: Photos 97GJ5.27 & 5.28.

LOCATION 3. Upper, rocky part of west slope of Beartooth Butte.
VEGETATION TYPE: Net-leaf willow
ELEVATION: 10,100-10,200 feet (3078-3109 meters). ASPECT: West
TOPOGRAPHIC POSITION: Upper part of relatively gentle slope, below steep slope.
DESCRIPTION: Patches of low, relatively dense vegetation growing in the less rocky parts of the slope, on limestone substrate. Limestone gravel and rock covers ca. 30% of surface.
Trees:
Shrubs:
Dwarf Shrubs: Salix arctica (ca. 20% cover), S. reticulata (minor)
Graminoids & Forbs: Carex scirpoidea, Pedicularis groenlandica, Polygonum bistortoides, Hedysarum sulphurescens, Poa alpina.
NOTES: Adjacent rocky slopes support mats of Dryas octopetala.

LOCATION 5. Lower, less rocky part of west slope of Beartooth Butte.
ELEVATION: 9600-10,000 feet (2926-3048 meters). ASPECT: West
TOPOGRAPHIC POSITION: West-facing slope.
VEGETATION TYPE: Mix of two types:

5a.
VEGETATION TYPE: Engelmann spruce-subalpine fir woodland
DESCRIPTION: Patches of subalpine fir and patches of Engelmann spruce, most $\leq$ several hundred square meters, with scattered Engelmann spruce between the patches.
Trees: Abies lasiocarpa, Picea engelmannii
Shrubs: Ribes montigenum (sparse)
Dwarf Shrubs:
Graminoids & Forbs: Aquilegia sp., Arnica cordifolia
NOTES: Trees mostly saplings and poles, 5-15 m tall.

5b.
VEGETATION TYPE: Forb meadow
DESCRIPTION: Herbaceous vegetation between the patches of conifers.
Trees:
Shrubs:
Dwarf Shrubs:
Graminoids & Forbs: Hedysarum sulphurescens, Arenaria congesta, Penstemon procerus, Solidago sp. (low stature), Valeriana edulis, Ranunculus eschscholtzii, Phleum alpinum, Trisetum alpinum, Poa juncifolia, Aster foliaceus.

NOTES: Soil heavily churned by pocket gophers.

LOCATION 6. Valley between Beartooth Butte and Clay Butte.
VEGETATION TYPE: Mountain bluebells
ELEVATION: 9520-9640 feet (2901-2938 meters). ASPECT: South
TOPOGRAPHIC POSITION: Bottom of valley
DESCRIPTION: Fringe of tall, dense forb riparian vegetation along perennial stream.
Trees:
Shrubs:
Dwarf Shrubs:
Graminoids & Forbs: Mertensia ciliata, Senecio triangularis, Arnica longifolia, Senecio sp. (clasp-leaf).
NOTES:

LOCATION 9. South foot of Beartooth Butte.
ELEVATION: 9400-9800 feet (2685-2987 meters). ASPECT: West through south
TOPOGRAPHIC POSITION: Slopes and small benches

a.
VEGETATION TYPE: Idaho fescue vari-leaf cinquefoil
DESCRIPTION: Dense herbaceous vegetation.
Trees:
Shrubs:
Dwarf Shrubs:
Graminoids & Forbs: Festuca idahoensis, Geum triflorum, Aster foliaceus, Valeriana edulis; some Achillea millefolium, Elymus trachycaulus var. trachycaulus
NOTES: Pocket gopher diggings are common. This type forms a mosaic with the Pumpelly brome-tall forb type (10b) and the conifer patches (10c).

b.
VEGETATION TYPE: Pumpelly brome-forb
DESCRIPTION: Dense, tall herbaceous vegetation.
Trees:
Shrubs:
Dwarf Shrubs:
Graminoids & Forbs: Bromus inermis var. purpurascens, Aster foliaceus, Valeriana edulis, Festuca idahoensis, Geranium viscosissimum
NOTES: This type forms a mosaic with the Idaho fescue-prairie smoke type (10a) and the conifer patches (10c).

c.
VEGETATION TYPE: Engelmann spruce-subalpine fir woodland
DESCRIPTION: Patches of Engelmann spruce and subalpine fir

woodland in a matrix of herbaceous vegetation.
Trees: Picea engelmannii, Abies lasiocarpa
Shrubs:
Dwarf Shrubs:
Graminoids & Forbs: Arnica cordifolia, Aquilegia sp. (yellow flowers)
NOTES: This type forms a mosaic with the Idaho fescue-prairie smoke type (10a) and the Pumpelly brome-forb type (10b).

APPENDIX 4. EXPLANATIONS OF RANKS USED BY THE WYOMING NATURAL DIVERSITY DATABASE

As part of the North American network of natural heritage programs, the Wyoming Natural Diversity Database (WYNDD) uses the natural heritage element ranking system developed by The Nature Conservancy. In this system, each element (in this case, species) is assigned a two-part rank that reflects its rarity and security both globally (the G part of the rank) and within a state or province (the S part of the rank). Both the global rank and the state rank can range from 1 (extremely rare or threatened) to 5 (common and secure). Ranks are defined as follows:

Global Ranks

G1: Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factors making it especially vulnerable to extinction.

G2: Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals) or because of factors making it very vulnerable to extinction.

G3: Either very rare and localized throughout its range, or found locally (and perhaps abundantly at some sites) throughout a restricted range, or vulnerable to extinction throughout its range.

G4: Apparently secure globally, although it may be quite rare in parts of its range, especially at the periphery.

G5: Demonstrably secure globally and essentially ineradicable under present conditions.

T: A "T" following the global rank (G#T#) refers to a rank assigned to a subspecific taxon. The number following the "G" is the rank of the species, and the number following the "T" is the rank of the subspecific taxon.

Q: Taxonomic questions or problems exist about the taxon; more information is needed. A "G#Q" rank implies that the taxonomic distinctiveness of the taxon may be of questionable validity. A "G#T#Q" rank implies that the taxonomic distinctiveness of the subspecific taxon is of questionable validity.

State Ranks

S1: Critically imperiled in the state or province because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factors making it especially vulnerable to extinction.

S2: Imperiled in the state or province because of rarity (6 to 20 occurrences or few remaining individuals) or because of factors making it very vulnerable to extinction.

S3: Rare or uncommon in the state (on the order of 21 to 100 occurrences).

S4: Apparently secure in the state or province, with many occurrences.

G5: Demonstrably secure in the state or province and essentially ineradicable under present conditions.

SU: Possibly imperiled in the state but status is uncertain; more information needed before a numerical rank can be assigned.

S?: Status uncertain due to lack of information. The "?" is usually combined with any of the numerical ranks, as in "S3?".

Migratory Ranks

B: A "B" following a rank (e.g., S3B) indicates that the rank refers to the breeding status of the species within the state. B ranks are usually assigned to birds.

N: An "N" following a rank (e.g., S3N) indicates that the preceding rank refers to the non-breeding status of the species in the state. N ranks are usually assigned to birds.

A state rank of S2BS5N indicates that the species is rare in the state as a breeder, but abundant as a non-breeder.

APPENDIX 5. PLANT COMMUNITY TYPES IN THE POTENTIAL BEARTOOTH BUTTE RESEARCH NATURAL AREA

The communities are listed by common name. Citations following the common names refer to these sources:
-- Johnston (1987): equivalent plant association from the list for USDA Forest Service Region 2;
-- Anderson et al. (1998): equivalent plant association from the National Vegetation Classification;
-- Tweit and Houston (1980): equivalent grassland or shrubland habitat type (if any);
-- Steele et al. (1983): equivalent forest habitat type (if any);
-- Federal Geographic Data Committee (1997): type in the hierarchy of the National Vegetation Classification Standard to which the association belongs;
-- Kuchler (1966): Kuchler vegetation type to which the association belongs;
-- Eyre (1980): Society of American Foresters forest cover type to which the association belongs (if any).

Engelmann spruce-subalpine fir woodland
-- Johnston (1987): *Abies lasiocarpa-Picea engelmannii/Arnica cordifolia* plant association
-- Anderson et al. (1998): *Abies lasiocarpa-Picea engelmannii* (tree island) forest?
-- Steele et al. (1983): *Abies lasiocarpa* habitat type
-- Tweit and Houston (1983): none
-- Federal Geographic Data Committee (1997): II.A.4.N.b.; conical-crowned, natural/semi-natural, temperate or subpolar, open-canopy woodland
-- Kuchler (1966): Western Spruce-Fir Forest (*Picea-Abies*)
-- Eyre (1980): Engelmann Spruce-Subalpine Fir

Booth willow/mesic forb
-- Johnston (1987): Unknown
-- Anderson et al. (1998): Salix boothii/Mesic Forb shrubland
-- Steele et al. (1983): None
-- Tweit and Houston (1980): None
-- Federal Geographic Data Committee (1997): III.B.2.N.c.; intermittently-flooded, natural/semi-natural, cold-deciduous shrubland
-- Kuchler (1966): Unknown
-- Eyre (1980): None

Booth willow-wolf willow
-- Johnston (1987): Salix wolfii/Fragaria virginiana plant association?
-- Anderson et al. (1998): Salix boothii-Salix eastwoodiae shrubland
-- Tweit and Houston (1980): None
-- Steele et al. (1983): None
-- Federal Geographic Data Committee (1997): III.B.2.N.c.; intermittently-flooded, natural/semi-natural, cold-deciduous shrubland
-- Kuchler (1966): Unknown
-- Eyre (1980): None

Grayleaf willow
-- Johnston (1987): Salix glauca/Acomastylis rossii plant association?
-- Anderson et al. (1998): Salix glauca shrubland
-- Steele et al. (1983): None
-- Tweit and Houston (1980): None
-- Federal Geographic Data Committee (1997): III.B.2.N.b.; subalpine or subpolar, natural/semi-natural, cold-deciduous shrubland
-- Kuchler (1966): Unknown
-- Eyre (1980): None

Net-leaf willow
-- Johnston (1987): Salix reticulata ssp. nivalis/Acomastylis rossii plant association?
-- Anderson et al. (1998): Salix reticulata/Caltha leptosepala dwarf-shrubland?
-- Steele et al. (1983): None
-- Tweit and Houston (1980): None
-- Federal Geographic Data Committee (1997): IV.B.2.N.d.; saturated, natural/semi-natural, cold-deciduous dwarf-shrubland
-- Kuchler (1966): Alpine meadows and barren (Agrostis,Carex, Festuca,Poa)
-- Eyre (1980): None

Arctic willow/American bistort
-- Johnston (1987): Salix arctica/Acomastylis rossii plant association?
-- Anderson et al. (1998): Salix arctica/Polygonum bistortoides dwarf-shrubland
-- Steele et al. (1983): None
-- Tweit and Houston (1980): None
-- Federal Geographic Data Committee (1997): IV.B.2.N.b.; creeping or matted, natural/semi-natural, cold-deciduous dwarf-shrubland
-- Kuchler (1966): Alpine meadows and barren (Agrostis,Carex, Festuca,Poa)
-- Eyre (1980): None

Mountain avens-curly sedge
-- Johnston (1987): Dryas octopetala/Carex rupestris plant association
-- Anderson et al. (1998): Dryas octopetala-Carex rupestris herbaceous vegetation
-- Steele et al. (1983): None
-- Tweit and Houston (1980): Cushion plant habitat type?
-- Federal Geographic Data Committee (1997): V.A.8.N.a.; short, natural/semi-natural, temperate or subpolar, perennial graminoid vegetation with a sparse shrub layer
-- Kuchler (1966): Alpine meadows and barren (Agrostis,Carex, Festuca,Poa)
-- Eyre (1980): None

Idaho fescue - vari-leaf cinquefoil
-- Johnston (1987): Festuca idahoensis/Deschampsia cespitosa plant association?
-- Anderson et al. (1998): Festuca idahoensis-Potentilla diversifolia herbaceous vegetation
-- Steele et al. (1983): None
-- Tweit and Houston (1980): Festuca idahoensis/Deschampsia caespitosa habitat type?
-- Federal Geographic Data Committee (1997): V.A.5.N.d.; medium-tall, natural/semi-natural, temperate or subpolar, perennial graminoid vegetation
-- Kuchler (1966): Alpine meadows and barren (Agrostis,Carex, Festuca,Poa)
-- Eyre (1980): None

Idaho fescue
-- Johnston (1987): *Festuca idahoensis/Elymus trachycaulus* plant association?
-- Anderson et al. (1998): *Festuca idahoensis/Elymus trachycaulus* herbaceous vegetation?
-- Steele et al. (1983): none
-- Tweit and Houston (1980): Festuca idahoensis/Agropyron caninum habitat type, Geranium viscosissimum phase?
-- Federal Geographic Data Committee (1997): V.A.5.N.c.; medium-tall, natural/semi-natural, temperate or subpolar, perennial grassland
-- Kuchler (1966): Fescue-wheatgrass (Festuca-Agropyron) 43
-- Eyre (1980): None

Pumpelly brome
-- Johnston (1987): Festuca idahoensis/Deschampsia cespitosa plant association?
-- Anderson et al. (1998): Festuca idahoensis-Potentilla diversifolia herbaceous vegetation?
-- Tweit and Houston (1980): Festuca idahoensis/Deschampsia

caespitosa habitat type?
-- Steele et al. (1983): None
-- Federal Geographic Data Committee (1997): V.A.5.N.d.; medium-tall, natural/semi-natural, temperate or subpolar, perennial graminoid vegetation
-- Kuchler (1966): Alpine meadows and barren (Agrostis,Carex, Festuca,Poa)?
-- Eyre (1980): None

Tufted hairgrass-alpine timothy
-- Johnston (1987): Deschampsia cespitosa/Acomastylis rossii plant association?
-- Anderson et al. (1998): Deschampsia cespitosa-Phleum alpinum herbaceous vegetation
-- Tweit and Houston (1980): Deschampsia caespitosa Meadow community type?
-- Steele et al. (1983): None
-- Federal Geographic Data Committee (1997): V.A.5.N.j.; temporarily-flooded, natural/semi-natural, temperate or subpolar, perennial grassland
-- Kuchler (1966):
-- Eyre (1980): None

Kobresia-like sedge
-- Johnston (1987): Unknown
-- Anderson et al. (1998): Carex elynoides herbaceous vegetation?
-- Tweit and Houston (1980): Cushion plant community type?
-- Steele et al. (1983): None
-- Federal Geographic Data Committee (1997): V.A.5.N.h.; natural/semi-natural, short, alpine or subalpine, dry bunch perennial grassland
-- Kuchler (1966): Alpine meadows and barren (Agrostis,Carex, Festuca,Poa)
-- Eyre (1980): None

Cushion phlox
-- Johnston (1987): Phlox sibirica/Trifolium dasyphyllum plant association?
-- Anderson et al. (1998): Phlox pulvinata-Trifolium dasyphyllum herbaceous vegetation?
-- Tweit and Houston (1980): Cushion plant community type
-- Steele et al. (1983): None
-- Federal Geographic Data Committee (1997): V.B.2.N.b.; low, natural/semi-natural, temperate or subpolar, perennial forb vegetation
-- Kuchler (1966): Alpine meadows and barren (Agrostis,Carex, Festuca,Poa)
-- Eyre (1980): None

Mountain bluebells

-- Johnston (1987): No apparent equivalent
-- Anderson et al. (1998): *Mertensia ciliata* herbaceous vegetation
-- Steele et al. (1983): none
-- Tweit and Houston (1980): none
-- Federal Geographic Data Committee (1997): V.B.2.N.a.; Tall, natural/semi-natural, temperate or subpolar, perennial forb vegetation
-- Kuchler (1966): Western spruce-fir forest (14)?
-- Eyre (1980): None

Forb meadow
-- Johnston (1987): Unknown
-- Anderson et al. (1998): Unknown
-- Tweit and Houston (1980): Unknown
-- Steele et al. (1983):
-- Federal Geographic Data Committee (1997): V.B.2.N.a.; tall, natural/semi-natural, temperate or subpolar, perennial forb vegetation
-- Kuchler (1966): Alpine meadows and barren (Agrostis,Carex, Festuca,Poa)
-- Eyre (1980): None

APPENDIX 6. ELEMENT OCCURRENCE RECORDS FOR PLANT SPECIES OF SPECIAL CONCERN IN THE POTENTIAL BEARTOOTH BUTTE RNA.