

PLANTS AND VEGETATION OF THE
POTENTIAL PAT O'HARA MOUNTAIN RESEARCH NATURAL AREA
WITHIN THE SHOSHONE NATIONAL FOREST,
PARK COUNTY, WYOMING

Prepared for the

Shoshone National Forest, USDA Forest Service

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INTRODUCTION

This report presents information on the rare plants and the vegetation types in the potential Pat O'Hara Mountain Research Natural Area (RNA). The information is arranged in the structure used in a research natural area establishment report, to allow its easy incorporation into an RNA establishment report for Pat O'Hara Mountain, should the area be designated as a research natural area.

Much of the information in this report is derived from an earlier report about the potential Pat O'Hara Mountain RNA (Jones and Fertig 1999). The information from that earlier report has been updated in several ways. First, the proposed boundary of this potential RNA differs from that shown in the original report, as a result of changes made by Forest Service staff. Second, when necessary, names of vascular plant species have been converted to those used in the PLANTS database (USDA, Natural Resources Conservation Service 2009), which is now the standard for plant names used by U.S. Department of Agriculture agencies. Third, names of plant associations have been brought up to date. Fourth, new information about rare plants, within the potential RNA and outside it, has been included. This information may have changed our understanding of the distribution of some plants in the potential RNA, and may have caused some plant species to be dropped from the list of rare plants in the area. Fifth, the maps of cover-types have been digitized using digital raster graphic files (i.e., digital topographic maps) and true-color aerial photographs as backgrounds, and boundaries of cover-types have been changed slightly during digitizing when the topographic maps and aerial photographs indicated mistakes in the original maps. Consequently, the area covered by each cover-type may have changed slightly.

LAND MANAGEMENT PLANNING

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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 Pat O'Hara Mountain 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.

PRINCIPLE DISTINGUISHING FEATURES

The principal distinguishing features of the potential Pat O'Hara Mountain RNA are an extensive subalpine Engelmann spruce forest and a mosaic of three herbaceous vegetation types transitional between subalpine and alpine vegetation. The area also contains parts of the populations of ten rare vascular plant species.

Pat O'Hara Mountain is located within the southeastern corner of the potential RNA.

LOCATION

The potential Pat O'Hara Mountain RNA is located within the Shoshone National Forest in northwestern Wyoming (Figure 1). The approximate center of the potential RNA is at latitude 44°40'15"N and longitude 109°24'00"W.

The potential RNA includes all or parts of the following sections (all on the 6th Principal Meridian): Township 54 North, Range 104 West, Sections 3, 4, 5, 7, 8, 9, 10, 15, 16, 17, and 18; T54N, R105W, Sections 12 and 13.

BOUNDARY

On the eastern side of the potential Pat O'Hara Mountain RNA, the northern half of the proposed boundary follows a drainage divide and the boundary of the North Absaroka Wilderness Area (Figure 2), and the southern half of the eastern boundary follows the contact between forest vegetation and grassland vegetation as shown on the 7.5-minute topographic quadrangle map and on the true-color aerial photograph for the area. On the southern side of the potential RNA, the boundary is drawn along contour lines and between hilltops. The proposed boundary on the western and northern sides also follows contours and is drawn between hilltops.

AREA

The total area of the potential Pat O'Hara Mountain RNA is ca. 5,005 acres (2,026 ha).¹

ELEVATION

The elevation of the potential Pat O'Hara Mountain RNA ranges from approximately 7,040 feet (2,957 meters) at about the mid-point of the northwestern side to 9,971 feet (3,039 meters) atop Pat O'Hara Peak in the southeastern corner.

ACCESS

The potential Pat O'Hara Mountain RNA may be reached via public roads and trails. From Cody, Wyoming, travel north 13 miles (21 km) on Wyoming Highway 120 to the intersection with Wyoming Highway 296, then west on Highway 296 ca. 13 miles (21 km) to Low Standard Forest Road #103, then south on Road #103 ca. 3 miles (4.8 km) to the end of the road, then south ca. 1 mile (1.6 km) on Forest Trail 633 to the northeastern corner of the potential RNA.

ECOREGION

The potential Pat O'Hara Mountain RNA lies within the Southern Rocky Mountain Steppe-Open Woodland-Coniferous Forest-Alpine Meadow Province, Yellowstone Highlands Section, Absaroka Sedimentary Mountains Subsection (M331Ai) 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.

1. The area of the potential Pat O'Hara Mountain RNA was computed by WYNDD staff using a digital version of the boundary supplied by the Forest Service, with the ESRI® ArcMap™ 9.3 software.

USDI Geological Survey 7.5 minute topographic Quadrangle Maps: Dead Indian Meadows, Wyo. and Pat O'Hara Mountain, Wyo.

AREA BY COVER-TYPE

This information on plant associations, habitat types, Kuchler vegetation types, and Society of American Foresters forest cover-types is based on 1998 field work conducted by Natural Diversity Database biologists, reported in an earlier document (Jones and Fertig 1999), and revised to reflect new names for plant associations. Maps of these cover-types were digitized on-screen by Natural Diversity Database staff, using the ESRI® ArcMap™ 9 software; boundaries are based on the hand-drawn map in the earlier report (Jones and Fertig 1999) and were digitized using digital raster graphic files (digital topographic maps) and 2006 National Agriculture Imagery Program true-color aerial photographs (USDA, Farm Services Administration, Aerial Photography Field Office) as backgrounds. The areas of these various cover-types were computed in the ArcMap™ software.

PLANT ASSOCIATIONS²

The *Picea engelmannii* / *Arnica cordifolia* (Engelmann spruce / heartleaf arnica) forest association is the most common association in the potential RNA (Table 1), growing on the mainly north-facing and west-facing slopes in the northwestern two-thirds of the area (Figure 3). In the northeastern corner, upper slopes and hilltops support grassland vegetation classified in the *Festuca idahoensis* – *Deschampsia caespitosa* (Idaho fescue – tufted hairgrass) herbaceous association. The southeastern corner of the potential RNA, around the summit of Pat O'Hara Mountain, is also primarily the *F. idahoensis* – *D. caespitosa* association, with smaller patches of the *Carex elynoides* – *Potentilla ovina* (curly sedge-sheep fescue) herbaceous association. This latter, shorter plant association includes at least one small patch of the *Dryas octopetala* / *Carex rupestris* dwarf-shrub association growing on windy sites with thin soil derived from limestone or dolomite.

KUCHLER VEGETATION TYPES

The vegetation in the potential Pat O'Hara Mountain RNA is classified into two Kuchler (1966) types (Table 2, Figure 4). The Western Spruce – Fir Forest (*Picea-Abies*) includes the forested vegetation, and the Alpine Meadows and Barrens (*Agrostis*, *Carex*, *Festuca*, *Poa*) type includes the grassland vegetation and the sparsely vegetated or unvegetated cliffs and slopes.

HABITAT TYPES

The forests in the potential Pat O'Hara Mountain RNA grow on the *Picea engelmannii* / *Arnica cordifolia* habitat type described from western Wyoming (Steele *et al.* 1983) (Table 3, Figure 5). The relatively relatively grassland vegetation, dominated by *Festuca idahoensis* and *Deschampsia caespitosa*, grows on the *F. idahoensis* – *D. caespitosa* habitat type described for the Shoshone National Forest (Tweit and Houston 1980). The shrubland and grassland habitat type classification for the Shoshone National Forest (Tweit and Houston 1980) appears to not cover sites that support the the shorter grassland vegetation dominated by *Carex rupestris*.

SOCIETY OF AMERICAN FORESTERS COVER TYPES

The Engelmann Spruce-Subalpine Fir type (206) is the only forest cover-type (Eyre 1980) that grows in the potential Pat O'Hara Mountain RNA (Table 4, Figure 6). The grassland vegetation and the barren areas are not included in that classification.

2. Names of plant associations are from NatureServe (2010).

Table 1. Occurrence of plant associations in the potential Pat O’Hara Mountain Research Natural Area. See Figure 3. “M” in a cell indicates that a plant association is a major component of a complex, and “m” indicates that it is a minor component of the complex.

Plant Association	Map Units and Areas			
	Cliffs & Slopes (183 acres, 74 ha)	Curly sedge – Sheep Cinquefoil (356 acres, 144 ha)	Idaho fescue – Tufted Hairgrass (992 acres, 401 ha)	Engelmann spruce / Heartleaf arnica (3,474 acres, 1,406 ha)
Herbaceous				
<i>Carex rupestris</i> – <i>Potentilla ovina</i> Herbaceous Vegetation	m	M	m	m
<i>Festuca idahoensis</i> – <i>Deschampsia caespitosa</i> Herbaceous Vegetation		m	M	m
Dwarf-shrub				
<i>Dryas octopetala</i> / <i>Carex rupestris</i> Dwarf-shrub Vegetation		m		
Forest & Woodland				
<i>Picea engelmannii</i> / <i>Arnica cordifolia</i> Forest	m			M

Table 2. Kuchler vegetation types in the potential Pat O’Hara Mountain Research Natural Area. See Figure 4.

Vegetation Type (Kuchler 1964)	Acres	Hectares
Alpine meadows and barren (<i>Agrostis</i> , <i>Carex</i> , <i>Festuca</i> , <i>Poa</i>)	1,531	619
Western spruce-fir forest (<i>Picea-Abies</i>)	3,474	1,406

Table 3. Occurrence of habitat types mapped in the potential Pat O’Hara Mountain Research Natural Area. See Figure 5. “M” in a cell indicates that a habitat type is a major component of a complex, and “m” indicates that it is a minor component of the complex.

Habitat Types	Map Units and Areas			
	<i>Festuca idahoensis</i> / <i>Deschampsia caespitosa</i> (992 acres, 401 ha)	<i>Picea engelmannii</i> / <i>Arnica cordifolia</i> (3,474 acres, 1,406 ha)	Unknown (Curly sedge Herbaceous Vegetation) (356 acres, 144 ha)	Cliffs & Slopes (183 acres, 74 ha)
Herbaceous				
<i>Festuca idahoensis</i> / <i>Deschampsia caespitosa</i>	M		m	
Forest & Woodland				
<i>Picea engelmannii</i> / <i>Arnica cordifolia</i>	m	M		m
None or Unknown			M	M

Table 4. Society of American Foresters Cover Types in the potential Pat O’Hara Mountain Research Natural Area. See Figure 6.

Cover Type (Eyre 1980)	Acres	Hectares
Engelmann spruce – subalpine fir (206)	3,474	1406

ECOLOGICAL SYSTEMS

The U.S. Forest Service’s Landscape Fire and Resource Management Planning Tools Project (Landfire) Project (<http://www.landfire.gov/>) uses ecological systems as a way to display general vegetation/environment types nation-wide. Descriptions of ecological systems are available at <http://www.natureserve.org/explorer/servlet/NatureServe?init=Ecol>. Figure 7 shows the distribution of ecological systems in the potential Pat O’Hara Mountain RNA. This figure was produced from data extracted from the nation-wide map of ecological systems and a few additional cover-types, updated to 2008 (<http://landfire.cr.usgs.gov/viewer/>). Two changes were made to those data in producing Figure 7: the area originally mapped as the *Pseudotsuga menziesii* Plant Alliance was re-classified to the Middle Rocky Mountains Montane Douglas-fir Forest and Woodland Ecological System, and the area originally mapped as the *Artemisia tridentata* ssp. *vaseyana* Plant Alliance was re-classified as the Inter-Mountain Basins Montane Sagebrush Steppe Ecological System. Table 5 shows the area of each ecological system within the potential RNA.

Ten ecological systems have been mapped in at least 1% (each) of the potential RNA (Table 5). In general, the distribution of these systems resembles the distributions shown on the maps of other cover-types, with forest and woodland systems covering most of the northwestern two-thirds of the potential RNA and non-forested systems covering the southeastern third. The forested systems are primarily the

Middle Rocky Mountains Montane Douglas-fir Forest and Woodland Ecological System (at lower elevations in the western part of the area), the Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland system (on northerly and westerly slopes and higher elevations), and the Northern Rocky Mountain Subalpine Woodland and Parkland system (mainly on the upper parts of northerly and westerly slopes). The southeastern part of the potential RNA is primarily the Rocky Mountain Subalpine-Montane Mesic Meadow system and the Northern Rocky Mountain Subalpine-Upper Montane Grassland system.

Researchers in the Landfire Program caution that the national Landfire Project information should be augmented with knowledge of local conditions (http://www.landfire.gov/dp_quality_assessment.php), and the field survey suggests that the mapping of the forested ecological systems is in error: the area mapped as the Northern Rocky Mountain Subalpine Woodland and Parkland system would be better mapped as the Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland system.

Two additional systems – Agriculture-Pasture and Hay, and Northern Rocky Mountain Conifer Swamp – also are erroneously mapped in the area. The potential RNA contains no agricultural land, and field survey turned up no evidence of swamp vegetation. The putative presence of these systems is an artifact of the automatic classification of pixels on satellite images

Table 5. Ecological systems in the potential Pat O’Hara Mountain Research Natural Area. See Figure 7. Normal type-face indicates systems that each cover at least 1% of the area, and italic type-face indicates systems that each cover < 1% of the area.

Ecological System	Acres	Ha
Barren	132	53
Inter-Mountain Basins Montane Sagebrush Steppe	98	40
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	591	239
Northern Rocky Mountain Subalpine Deciduous Shrubland	107	43
Northern Rocky Mountain Subalpine Woodland and Parkland	740	299
Northern Rocky Mountain Subalpine-Upper Montane Grassland	438	177
Rocky Mountain Lodgepole Pine Forest	159	64
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	1664	673
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	203	82
Rocky Mountain Subalpine-Montane Mesic Meadow	819	332
<i>Agriculture-Cultivated Crops and Irrigated Agriculture</i>	<i>0</i>	<i>0</i>
<i>Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland</i>	<i>0</i>	<i>0</i>
<i>Northern Rocky Mountain Conifer Swamp</i>	<i>2</i>	<i>1</i>
<i>Northern Rocky Mountain Mesic Montane Mixed Conifer Forest</i>	<i>3</i>	<i>1</i>
<i>Northern Rocky Mountain Montane-Foothill Deciduous Shrubland</i>	<i>2</i>	<i>1</i>
<i>Rocky Mountain Alpine Dwarf-Shrubland</i>	<i>0</i>	<i>0</i>
<i>Rocky Mountain Aspen Forest and Woodland</i>	<i>30</i>	<i>12</i>
<i>Rocky Mountain Montane Riparian Systems</i>	<i>1</i>	<i>0</i>
<i>Rocky Mountain Subalpine/Upper Montane Riparian Systems</i>	<i>11</i>	<i>4</i>

PHYSICAL AND CLIMATIC CONDITIONS

PHYSICAL SETTING

The potential Pat O'Hara Mountain RNA lies along the divide between Dead Indian Creek (a tributary of the Clark's Fork of the Yellowstone River) to the north, Pat O'Hara Creek (also a tributary of the Clark's Fork) to the east, and the North Fork of the Shoshone River to the south. Most of the area lies within the drainage of Dead Indian Creek. Topographic features include moderately sloping to steep slopes and narrow drainages over most of the area, with broad ridge-tops extending north and west from Pat O'Hara Peak in the southeastern part of the area.

GEOLOGY

The bedrock in the proposed RNA is primarily Paleozoic dolomite and limestone (Love and Christiansen 1985). The north-facing slopes in the western part of the area lie atop Quaternary landslide deposits. Andesitic volcanoclastic rocks of the Tertiary-age Washburn Formation lie atop the Paleozoic rocks in the southeastern corner of the area and along the eastern boundary.

SOILS

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DESCRIPTION OF VALUES

VEGETATION

In general terms, the sequence of vegetation types in the potential RNA is typical of the mountains of this region: Douglas-fir dominates the overstories in woodlands and forests at the lower, montane, elevations, and gives way to Engelmann spruce and subalpine fir in the higher, subalpine zone. Meadows dominated by Idaho fescue and tufted hairgrass grow in openings in those woodlands and forests, and cover the south-facing slopes. Ridge-tops with shallow soils support graminoid-dominated vegetation. Plant species composition changes gradually with increasing elevation, and more abruptly with sharp changes in aspect.

The subalpine forests in the potential RNA illustrate an effect of substrate that has been described by Steele *et al.* (1983): on limestone and dolomite, the tree overstory in the subalpine forest is dominated strongly by Engelmann spruce and contains little or no subalpine fir, while the subalpine forest growing on volcanic rock contains a substantial amount of subalpine fir (Jones and Fertig 1999). Limber pine grows in the subalpine forest on both types of substrate.

FLORA

Plant Species List

A list of 158 vascular plant species documented in the potential Pat O'Hara Mountain Research Natural Area is included in Appendix 1.

Threatened, Endangered, and Sensitive Plant Species

There are no federally listed Threatened or Endangered plant species found in the potential Pat O'Hara Mountain Research Natural Area. Four USDA Forest Service Region 2 Sensitive plant species (Houston *et al.* 2001) are known from the area. Six additional plant species tracked by the Wyoming Natural Diversity Database as species of concern or on the Database's watch list (Heidel 2007) are also

known from the area. The status of each of these species is briefly summarized below. The heritage ranks, assigned by the Wyoming Natural Diversity Database, are explained in Appendix 2.

Agrostis mertensii (Northern bentgrass)

Synonym: *Agrostis borealis*

Heritage Rank: G5/S2.

Federal Status: None.

Geographic Range: Alaska east to Newfoundland, south to the northeastern United States and in the the Rocky Mountains to Colorado and Utah. In Wyoming, it is known from the Northern Absaroka, Beartooth and Wind River Mountains in Park and Fremont Counties.

Habitat: Alpine to subalpine turf, tundra, wet meadows and margins of lakes and rivers, from 8,800-11,500 ft.

Comments: In the potential Pat O'Hara Mountain Research Natural Area, northern bentgrass was collected by Erwin Evert in two locales, one near the top of Pat O'Hara Peak.

Androsace chamaejasme var. carinata (Sweet-flowered rock jasmine)

Heritage Rank: G5T4/S1S2.

Federal Status: Bridger-Teton National Forest Sensitive; Caribou-Targhee National Forest Sensitive.

Geographic Range: Alaska and western Canada south in the Rocky Mountains to Colorado. In Wyoming, it is known from the Absaroka, Owl Creek, Teton, and Wind River Mountains in Fremont, Hot Springs, Park and Teton Counties.

Habitat: Montane rock crevices and rocky soils derived from limestone or dolomite, or occasionally in moist limey meadows or beneath shrub cover (Fertig *et al.* 1994).

Comments: Fertig observed several hundred late-flowering and fruiting plants on limestone talus slopes and cushion plant communities on the north side of Pat O'Hara Peak in August, 1997 (Fertig 1998). This colony is part of a larger population that covers most of the summit of Pat O'Hara Mountain. Hollis Marriott estimated this population to contain thousands of plants in 1988.

Antennaria aromatica (Aromatic pussytoes)

Heritage Rank: G3G4/S2 (WYNDD Watch List).

Federal Status: None.

Geographic Range: Regional endemic of the northern Rocky Mountains from Alberta to northwestern Wyoming (Bayer 1989). In Wyoming, it is known from the Beartooth, Absaroka, Bighorn, Wind River, Gros Ventre, Salt River and Wyoming Mountains in Big Horn, Fremont, Lincoln, Park, Sublette and Teton Counties.

Habitat: Limestone scree, talus, and rocky crevices near or above timberline (Scott 1997).

Comments: Four main colonies are found on the summit and upper slopes of Pat O'Hara Mountain, including a population of several thousand clones observed by Walt Fertig and George Jones on the north side of Pat O'Hara Peak in 1997.

Castilleja nivea (Snow paintbrush)

Heritage Rank: G3/S2

Federal Status: None.

Geographic Range: Regional endemic of Montana and northwestern Wyoming. In Wyoming, it is known only from the Beartooth and Absaroka Mountains in Park and Hot Springs Counties.

Habitat: Alpine and subalpine rocky meadows, often on calcareous substrates. In Wyoming it is found in montane and alpine habitats including rocky tundra, meadows, and fellfields on gravelly limestone soils at 6,600-9,200 feet.

Comments: Snow paintbrush was collected in the potential Pat O'Hara Mountain Research Natural Area in 1981 by Erwin Evert in sparse vegetation on limestone.

Draba porsildii (Porsild's draba)

Heritage Rank: G3G4T3T4/S1.

Federal Status: None.

Geographic Range: Rocky Mountains, from Yukon to Colorado. In Wyoming, it is known from the Absaroka and northern Wind River Mountains in Park and Sublette Counties.

Habitat: Alpine scree and gravel slopes. Wyoming populations are found on limestone, shale, or volcanic slopes.

Comments: Ron Hartman discovered a small population of this species on Pat O'Hara Peak in 1985.

Festuca hallii (Hall's fescue)

Heritage Rank: G3G4/S1.

Federal Status: USDA Forest Service Region 2 Sensitive.

Geographic Range: Northern Alberta east to Ontario, south to North Dakota and Colorado. In Wyoming, it is known from the Absaroka, Bighorn, and Medicine Bow Mountains in Albany, Johnson, and Park Counties (Fertig 1998).

Habitat: Meadows, slopes, and open woods, usually on calcareous soils.

Comments: Ron Hartman collected this species 0.5-2 miles west of Pat O'Hara Peak in 1985. It has not been relocated since, although large areas of potential limestone grassland habitat exist across the summit of Pat O'Hara Mountain.

Lomatium attenuatum (Absaroka biscuitroot)

Heritage Rank: G3/S2.

Federal Status: None.

Geographic Range: Regional endemic of the Absaroka Mountains in Park County, Wyoming and four mountain ranges in southwestern Montana (Mills and Fertig 1996, Vanderhorst and Heidel 1998).

Habitat: volcanic or calcareous mountain slopes and cliffs, in sparsely vegetated sagebrush or cushion plant/bunchgrass communities or in openings in Douglas-fir/limber pine woodlands.

Comments: Absaroka biscuitroot has been documented from two sites on the south side of Pat O'Hara Peak on dry, rocky, volcanic or limestone slopes (Evert 1983).

Parnassia kotzebuei (Kotzebue's grass-of-Parnassus)

Heritage Rank: G5/S2

Federal Status: USDA Forest Service Region 2 Sensitive.

Geographic Range: Circumboreal in Siberia and Alaska to Greenland, south in the Rocky Mountains to Colorado and Nevada. In Wyoming it is known from the Absaroka, Big Horn, Gros Ventre, Owl Creek and Wind River Mountains of Park, Teton, Fremont, Hot Springs, Johnson, and Sublette Counties.

Habitat: On wet cliffs and alpine slopes at 8,100-12,000 feet. Plants usually occur on barren, steep slopes with little competition from other vegetation. In the potential Pat O'Hara Mountain Research Natural Area, Kotzebue's grass-of-Parnassus was found in open areas around springs in wet, gravelly soil.

Comments: Erwin Evert collected this species in 1988 on slopes south of Pat O'Hara Peak.

Pyrocoma carthamoides* var. *subsquarrosa (Absaroka goldenweed)

Synonym: *Haplopappus carthamoides* var. *subsquarrosus*.

Heritage Rank: G5T2T3/S2.

Federal Status: USDA Forest Service Region 2 Sensitive

Geographic Range: Regional endemic of the Absaroka, Beartooth, and Pryor Mountains of northwestern Wyoming and south-central Montana (Lesica 1995). In Wyoming, it is known from the Absaroka Mountains in Park County.

Habitat: Open meadows, slopes, and ridges on sandstone, limestone, or volcanic substrates (Mills and Fertig 1996, Houston *et al.* 2001).

Comments: Four small to medium-sized colonies of Absaroka goldenweed were discovered by Walt Fertig on the north side of Pat O'Hara Peak in 1997. These populations were observed on sparsely vegetated volcanic summits, muddy roadcuts, and calcareous Idaho fescue meadows (Fertig 1998). Additional colonies are also found near Trough Spring and on the south side of Pat O'Hara Peak. The total population in the potential RNA and immediate vicinity is estimated at 200-300 plants, although much additional unsurveyed habitat is present.

Shoshonea pulvinata (Shoshonea)

Heritage Rank: G2G3/S2.

Federal Status: USDA Forest Service Region 2 Sensitive

Geographic Range: Regional endemic of northwestern Wyoming and adjoining south-central Montana (Lyman 2005). In Wyoming, it is known from the Absaroka and Owl Creek Mountains in Park and Washakie Counties.

Habitat: Cushion plant communities in shallow, stony, calcareous soils, exposed limestone outcrops, and talus slopes (Fertig *et al.* 1994, Houston *et al.* 2001).

Comments: A small colony of Shoshonea is found on the south side of Pat O'Hara Mountain, 0.6 miles north of Spout Springs. This population is part of a larger occurrence that extends from Pat O'Hara Mountain to the southern end of Rattlesnake Mountain.

FAUNA

Threatened, Endangered, and Sensitive Vertebrates

Grizzly bear (*Ursos arctos*).

The grizzly bear is listed as threatened under the provisions of the federal Endangered Species Act (USDI Fish and Wildlife Service, No date). The approximate distribution area of the bear in Wyoming, as mapped by the Wyoming Game and Fish Department, includes the potential Pat O'Hara Mountain RNA (Wyoming Game and Fish Department, No date). The potential RNA also lies within the Conservation Strategy Management Area for the Yellowstone Distinct Population Segment of the grizzly bear, and within the area occupied by bears in 2004 (USDI Fish and Wildlife Service, No date).

Gray wolf (*Canis lupus*).

The potential Pat O'Hara Mountain RNA is within the Greater Yellowstone Recovery Area for the Northern Rocky Mountain Distinct Population Segment of the gray wolf (*Canis lupus*) (USDI, Fish and Wildlife Service 1987), which is protected under the provisions of the federal Endangered Species Act.

Animal Species List

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LANDS

The potential Pat O'Hara Mountain 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 (Figure 1). Eighty-five percent of the potential RNA (4,243 acres, or 1,717 hectares) lies within the North Absaroka Wilderness Area.

IMPACTS AND POSSIBLE CONFLICTS

MINERAL RESOURCES

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GRAZING

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TIMBER

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WATERSHED VALUES

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RECREATION VALUES

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WILDLIFE AND PLANT VALUES

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TRANSPORTATION VALUES

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MANAGEMENT CONCERNS

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FIGURES

Figure 1. Location of the potential Pat O'Hara Mountain Research Natural Area.
The inset map shows position of the potential RNA within the Shoshone National Forest and the State of Wyoming.

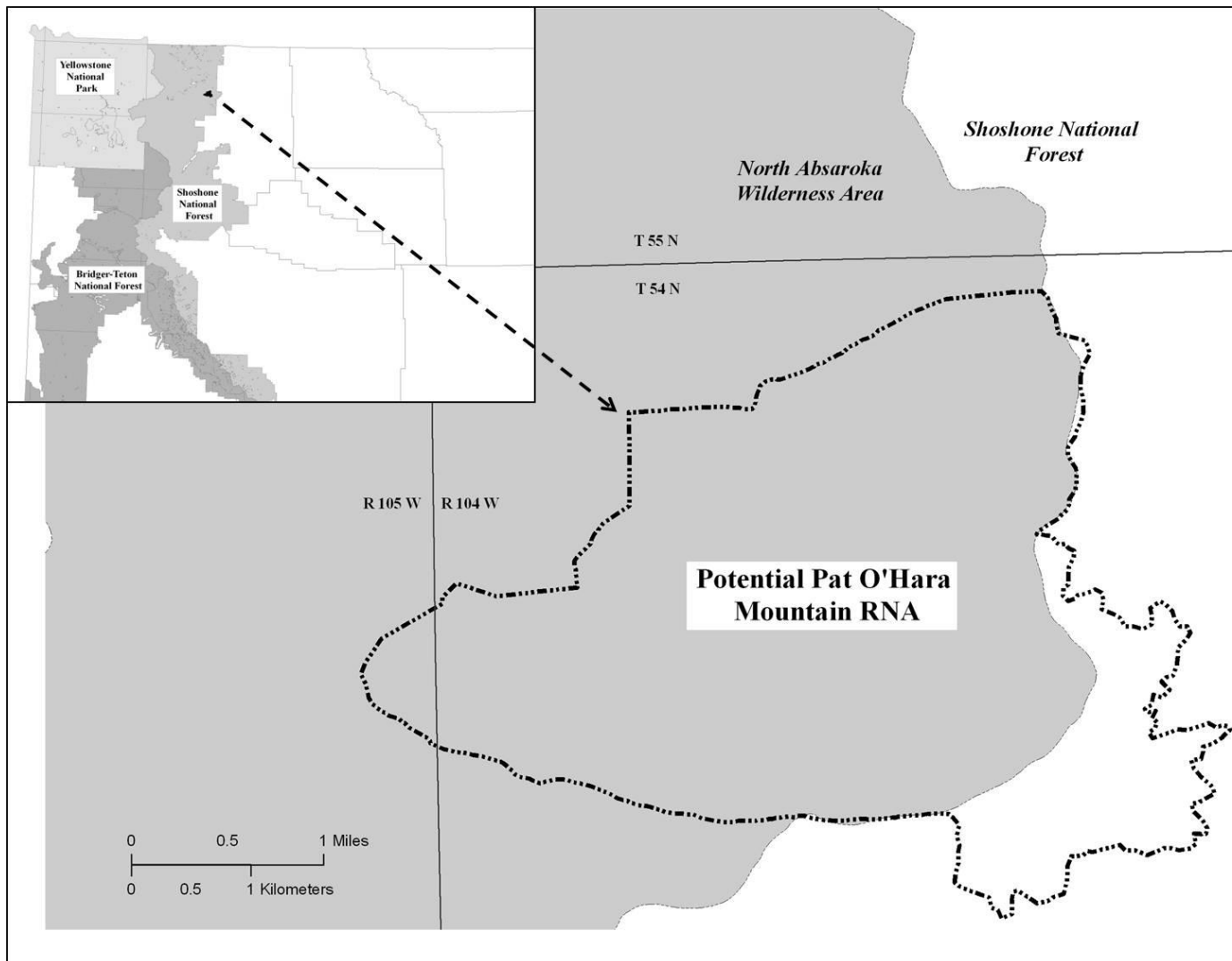


Figure 2. Boundary of the potential Pat O'Hara Mountain Research Natural Area.

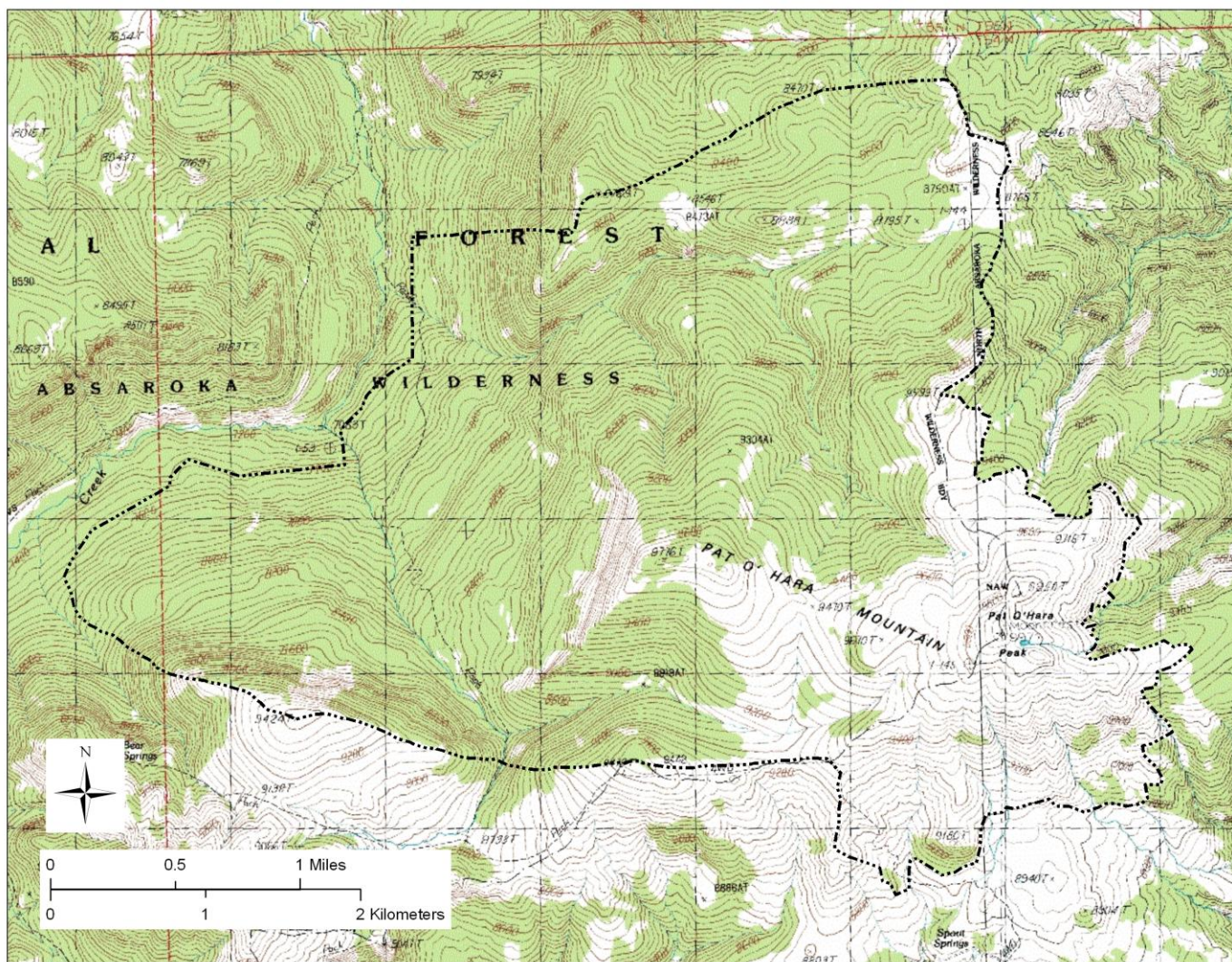


Figure 3. Plant Associations in the Potential Pat O'Hara Mountain Research Natural Area. The area of plant association is shown in Table 1.

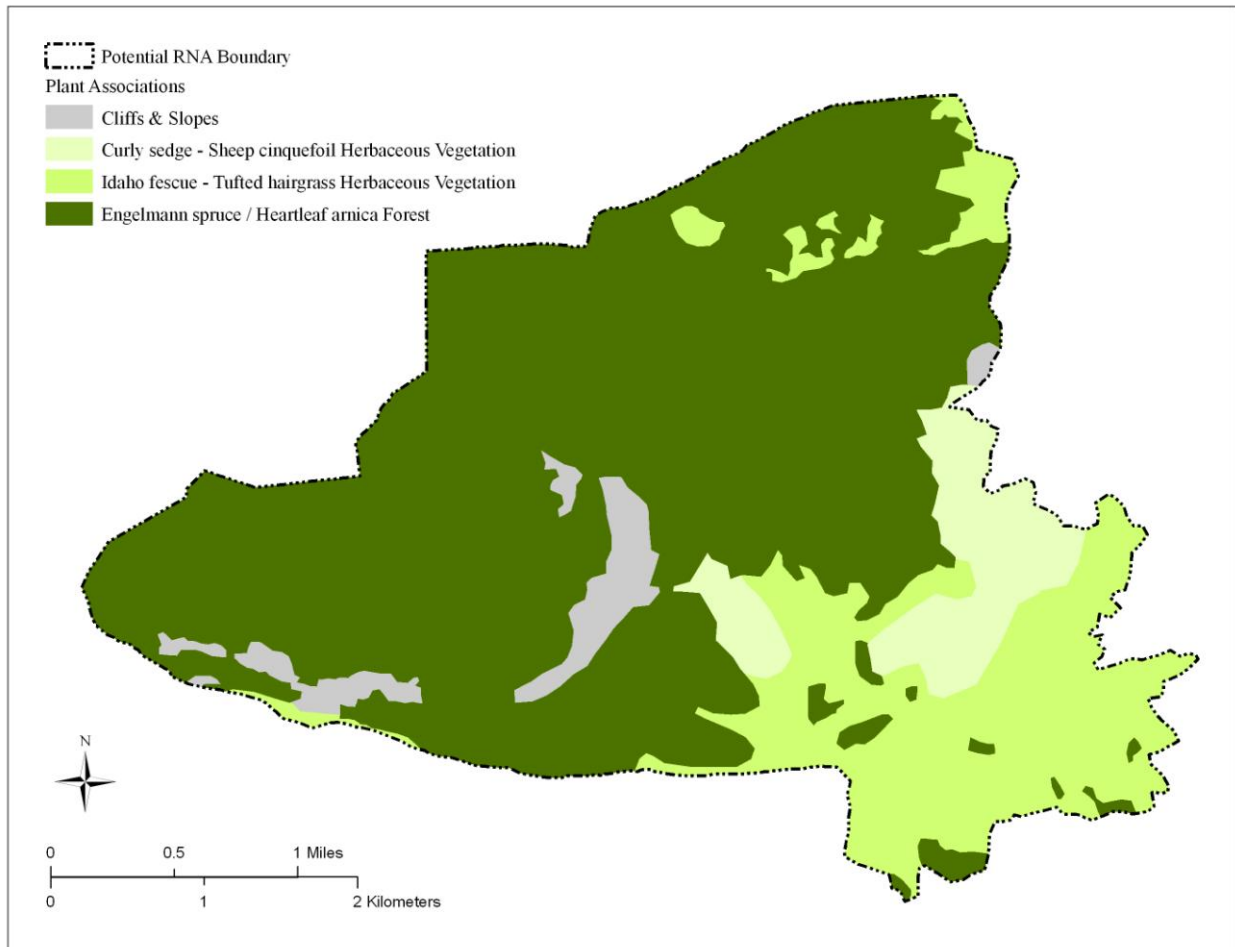


Figure 4. Kuchler cover-types in the potential Pat O'Hara Mountain Research Natural Area. The area of each type is shown in Table 2.

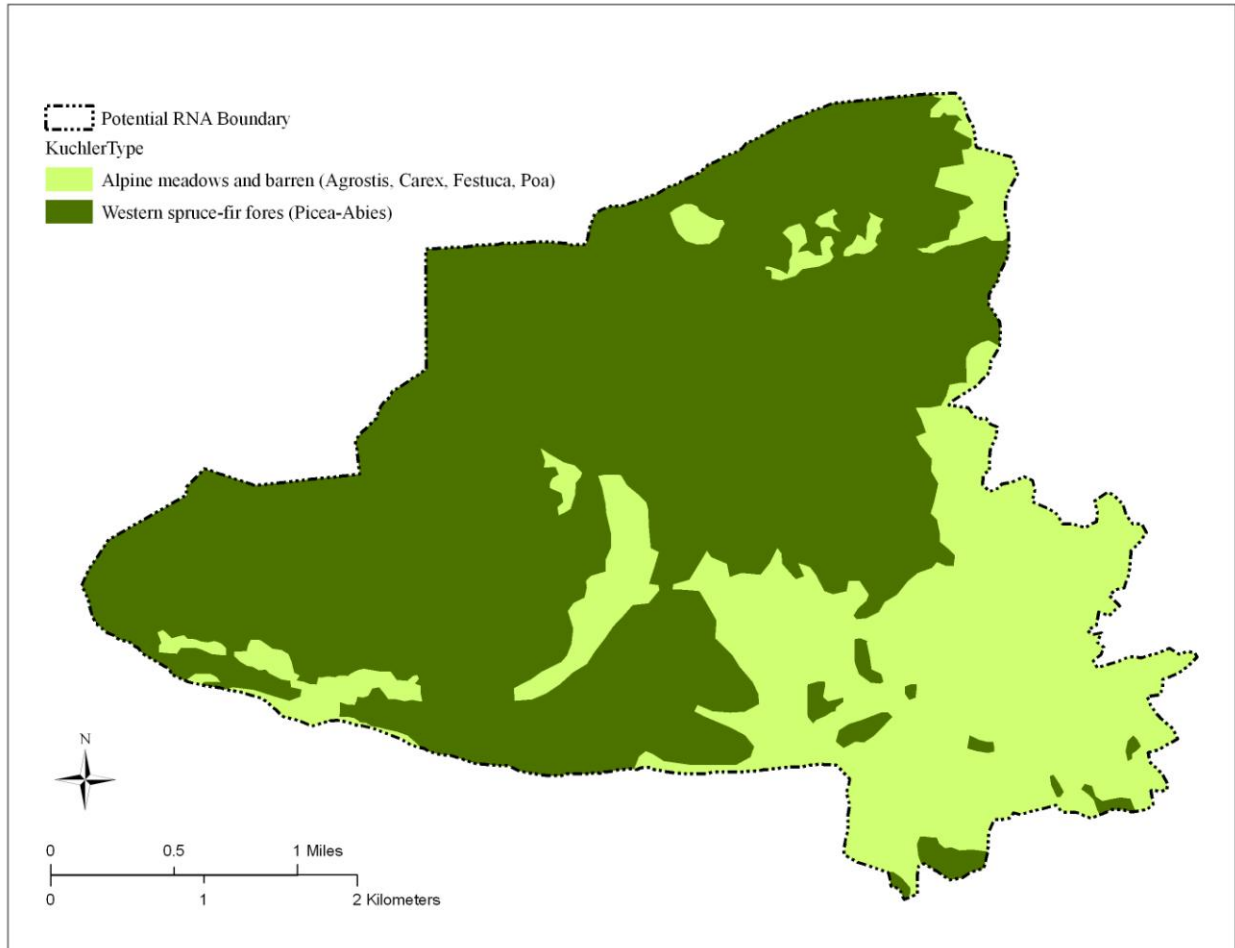


Figure 5. Habitat types in the potential Pat O'Hara Mountain Research Natural Area. The area of each type is shown in Table 3.

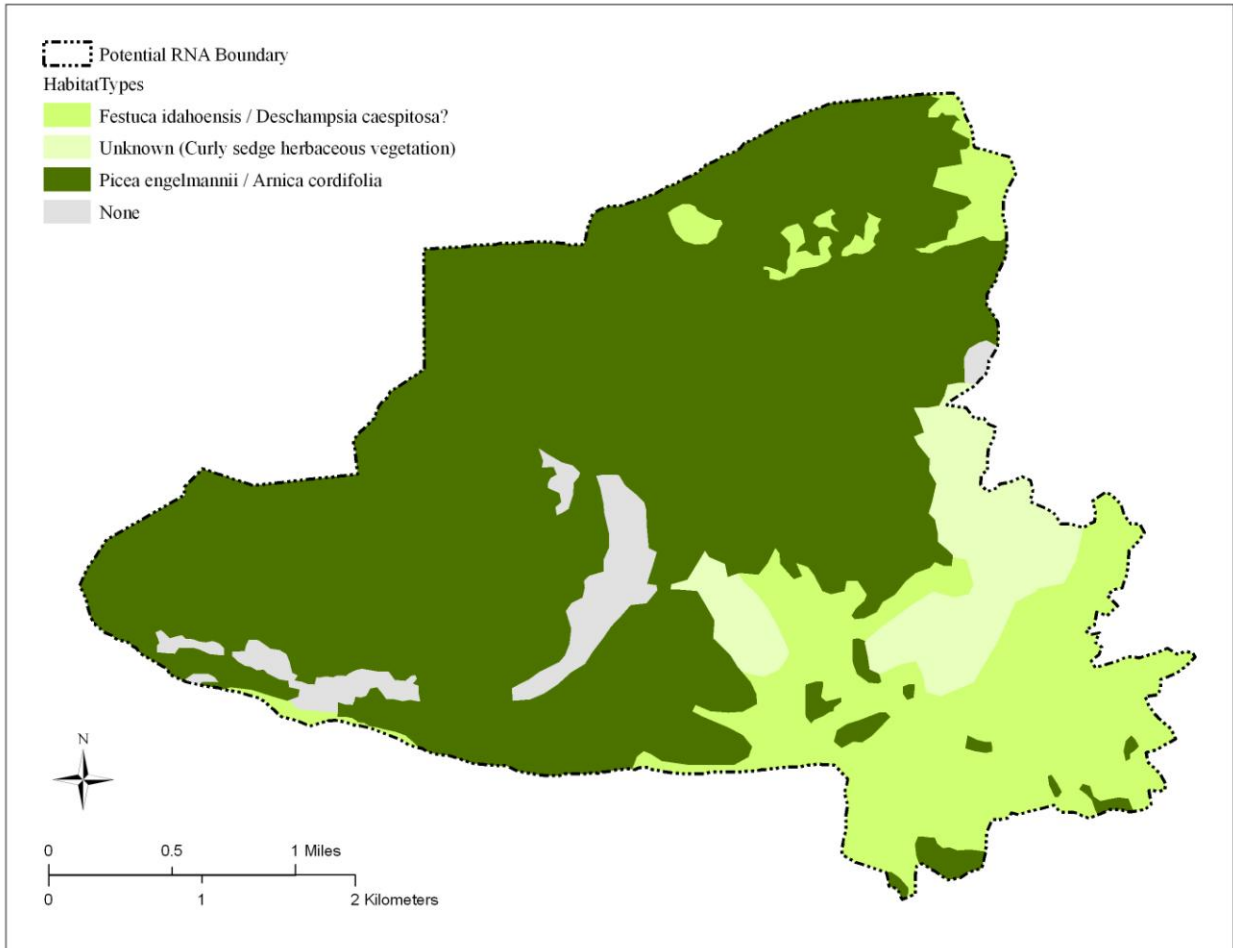


Figure 6. Society of American Foresters cover-types in the potential Pat O'Hara Mountain Research Natural Area. The area of each type is shown in Table 4.

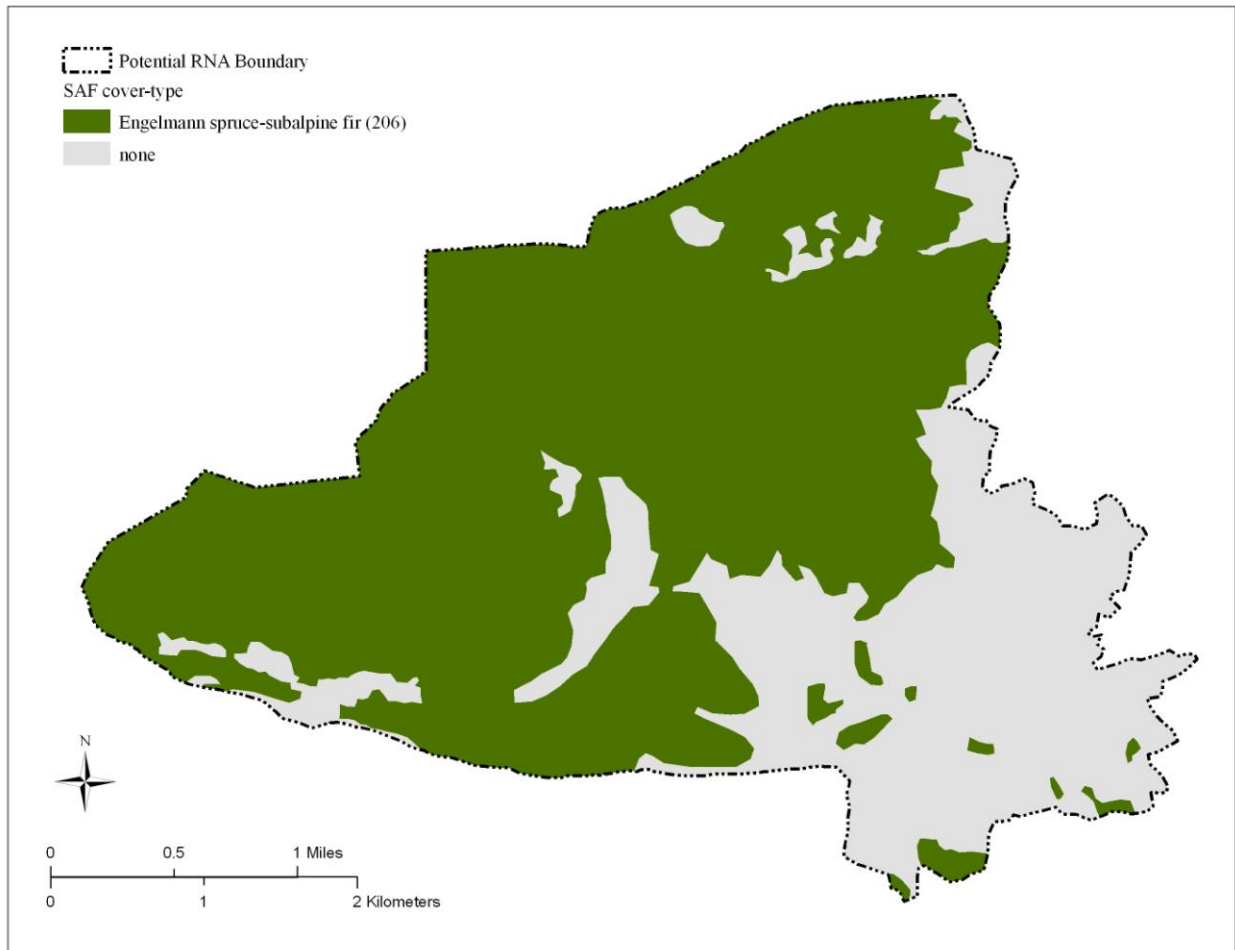


Figure 7. Ecological systems in the potential Pat O'Hara Mountain Research Natural Area. The area of each system is shown in Table 5.

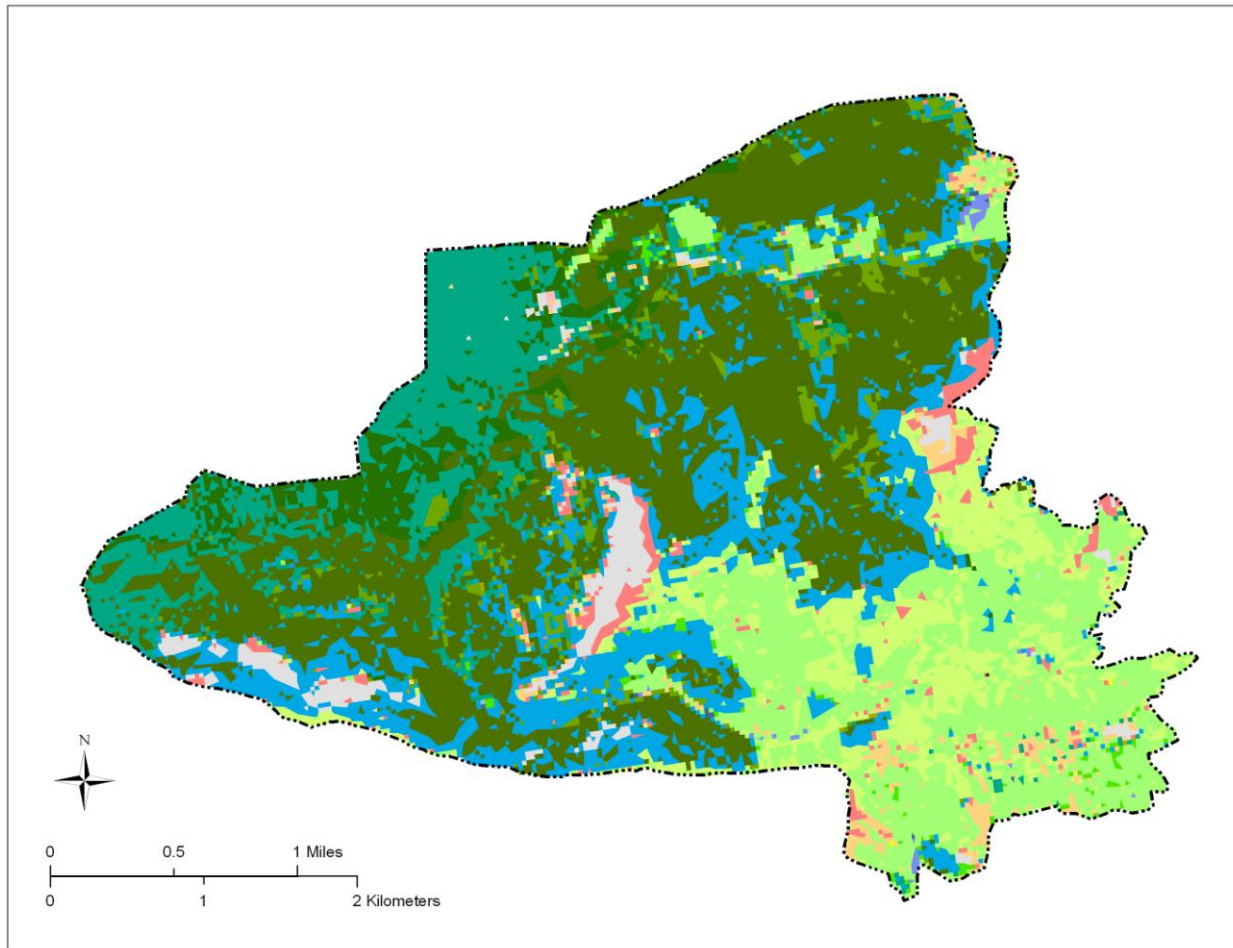
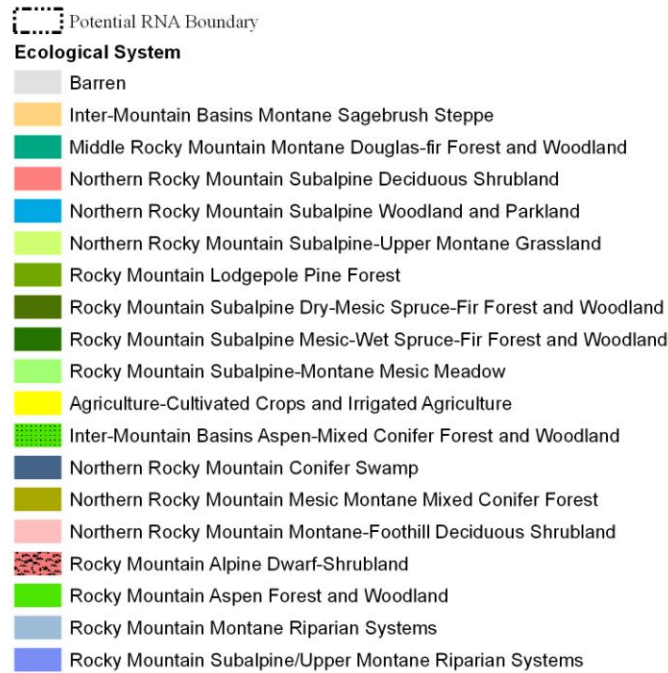


Figure 7 (continued). Legend for map of ecological systems in the potential Pat O’Hara Mountain Research Natural Area. System names are listed alphabetically in two groups. Systems in the first group (“Barren” through “Rocky Mountain Subalpine Montane Mesic Meadow”) each cover $\geq 1\%$ of the area; systems in the second group each cover $<1\%$ of the area.



APPENDICES

APPENDIX 1. VASCULAR PLANT SPECIES DOCUMENTED IN THE POTENTIAL PAT O'HARA MOUNTAIN RESEARCH NATURAL AREA.

This list of plant species was compiled from several surveys of the area. Scientific and common names are from the PLANTS Database, September 2009 (USDA, Natural Resources Conservation Service, 2009). “!” indicates an introduced taxon.

PLANTS Accepted Scientific Name with Author	PLANTS Common Name
Trees	
<i>Abies lasiocarpa</i> (Hook.) Nutt.	subalpine fir
<i>Picea engelmannii</i> Parry ex Engelm.	Engelmann spruce
<i>Picea glauca</i> (Moench) Voss	white spruce
<i>Pinus contorta</i> Douglas ex Louden	lodgepole pine
<i>Pinus flexilis</i> James	limber pine
Shrubs	
<i>Artemisia tridentata</i> Nutt. ssp. <i>vaseyana</i> (Rydb.) Beetle	mountain big sagebrush
<i>Juniperus communis</i> L. var. <i>depressa</i> Pursh	common juniper
<i>Salix bebbiana</i> Sarg.	Bebb willow
<i>Salix rotundifolia</i> Trautv. ssp. <i>dodgeana</i> (Rydb.) Argus	timberline willow
<i>Shepherdia canadensis</i> (L.) Nutt.	russet buffaloberry
<i>Vaccinium scoparium</i> Leiberg ex Coville	grouse whortleberry
Forbs	
<i>Achillea millefolium</i> L.	common yarrow
<i>Agoseris glauca</i> (Pursh) Raf. var. <i>dasycephala</i> (Torr. & A. Gray) Jeps.	pale agoseris
<i>Allium cernuum</i> Roth	nodding onion
<i>Androsace chamaejasme</i> Wulfen ssp. <i>carinata</i> (Torr.) Hultén	sweetflower rockjasmine
<i>Androsace septentrionalis</i> L. ssp. <i>subulifera</i> (A. Gray) G.T. Robbins	pygmyflower rockjasmine
<i>Anemone multifida</i> Poir.	Pacific anemone
<i>Antennaria aromatica</i> Evert	scented pussytoes
<i>Antennaria corymbosa</i> E.E. Nelson	flat-top pussytoes
<i>Antennaria media</i> Greene	Rocky Mountain pussytoes
<i>Antennaria microphylla</i> Rydb.	littleleaf pussytoes
<i>Antennaria racemosa</i> Hook.	raceme pussytoes
<i>Antennaria rosea</i> Greene	rosy pussytoes
<i>Aquilegia jonesii</i> Parry	Jones' columbine
<i>Arabis xdivaricarpa</i> A. Nelson (pro. sp.) [<i>drummondii</i> x <i>holboellii</i>]	spreadingpod rockcress
<i>Arabis drummondii</i> A. Gray	Drummond's rockcress
<i>Arabis glabra</i> (L.) Bernh.	tower rockcress
<i>Arenaria congesta</i> Nutt. var. <i>congesta</i>	ballhead sandwort
<i>Arenaria hookeri</i> Nutt. ssp. <i>hookeri</i>	Hooker's sandwort
<i>Arnica cordifolia</i> Hook.	heartleaf arnica
<i>Arnica gracilis</i> Rydb.	smallhead arnica
<i>Arnica latifolia</i> Bong.	broadleaf arnica
<i>Astragalus miser</i> Douglas ex Hook. var. <i>hylophilus</i> (Rydb.) Barneby	woody milkvetch
<i>Besseyia wyomingensis</i> (A. Nelson) Rydb.	Wyoming besseyia
<i>Bupleurum americanum</i> J.M. Coult. & Rose	American thorow wax
<i>Calochortus gunnisonii</i> S. Watson	Gunnison's mariposa lily
<i>Campanula rotundifolia</i> L.	bluebell bellflower

Appendix I (continued).

PLANTS Accepted Scientific Name with Author	PLANTS Common Name
<i>Castilleja cusickii</i> Greenm.	Cusick's Indian paintbrush
<i>Castilleja nivea</i> Pennell & Ownbey	snow Indian paintbrush
<i>Cerastium arvense</i> L.	field chickweed
<i>Cerastium beeringianum</i> Cham. & Schltld. ssp. <i>earlei</i> (Rydb.) Hultén	Bering chickweed
<i>Chamerion angustifolium</i> (L.) Holub ssp. <i>angustifolium</i>	fireweed
<i>Chimaphila umbellata</i> (L.) W. Bartram ssp. <i>occidentalis</i> (Rydb.) Hultén	pipsissewa
<i>Cirsium arvense</i> (L.) Scop.	Canada thistle
<i>Cirsium eatonii</i> (A. Gray) B.L. Rob.	Eaton's thistle
<i>Clematis columbiana</i> (Nutt.) Torr. & A. Gray var. <i>tenuiloba</i> (A. Gray) J. Pringle	rock clematis
<i>Clematis hirsutissima</i> Pursh	hairy clematis
<i>Delphinium bicolor</i> Nutt.	little larkspur
<i>Dodecatheon pulchellum</i> (Raf.) Merr.	darkthroat shootingstar
<i>Draba aurea</i> Vahl ex Hornem.	golden draba
<i>Draba oligosperma</i> Hook.	fewseed draba
<i>Draba porsildii</i> G. Mulligan	Porsild's draba
<i>Dryas octopetala</i> L. ssp. <i>hookeriana</i> (Juz.) Hultén	Hooker's mountain-avens
<i>Erigeron acris</i> L. ssp. <i>debilis</i> (A. Gray) Piper	bitter fleabane
<i>Erigeron caespitosus</i> Nutt.	tufted fleabane
<i>Erigeron compositus</i> Pursh	cutleaf daisy
<i>Erigeron ochroleucus</i> Nutt. var. <i>ochroleucus</i>	buff fleabane
<i>Erigeron simplex</i> Greene	onestem fleabane
<i>Eriogonum flavum</i> Nutt. var. <i>flavum</i>	alpine golden buckwheat
<i>Eriogonum umbellatum</i> Torr. var. <i>majus</i> Hook.	sulphur-flower buckwheat
<i>Eritrichium nanum</i> (Vill.) Schrad. ex Gaudin var. <i>elongatum</i> (Rydb.) Cronquist	arctic alpine forget-me-not
<i>Eurybia conspicua</i> (Lindl.) G.L. Nesom	western showy aster
<i>Eurybia merita</i> (A. Nelson) G.L. Nesom	subalpine aster
<i>Fragaria virginiana</i> Duchesne	Virginia strawberry
<i>Frasera speciosa</i> Douglas ex Griseb.	elkweed
<i>Gaillardia aristata</i> Pursh	common gaillardia
<i>Galium boreale</i> L.	northern bedstraw
<i>Gentiana affinis</i> Griseb.	pleated gentian
<i>Gentianella amarella</i> (L.) Boerner	autumn dwarf gentian
<i>Geranium viscosissimum</i> Fisch. & C.A. Mey. ex C.A. Mey.	sticky purple geranium
<i>Geum triflorum</i> Pursh	old man's whiskers
<i>Hedysarum sulphurescens</i> Rydb.	white sweetvetch
<i>Heuchera parvifolia</i> Nutt. ex Torr. & A. Gray	littleleaf alumroot
<i>Kelseya uniflora</i> (S. Watson) Rydb.	oneflower kelseya
<i>Lesquerella alpina</i> (Nutt.) S. Watson var. <i>alpina</i>	alpine bladderpod
<i>Lloydia serotina</i> (L.) Salisb. ex Rehb.	common alplily
<i>Lomatium attenuatum</i> Evert	tapertip desertparsley
<i>Lomatium cous</i> (S. Watson) J.M. Coult. & Rose	cous biscuitroot
<i>Lupinus argenteus</i> Pursh	silvery lupine
<i>Mertensia oblongifolia</i> (Nutt.) G. Don	oblongleaf bluebells

Appendix I (continued).

PLANTS Accepted Scientific Name with Author	PLANTS Common Name
<i>Minuartia nuttallii</i> (Pax) Briq.	Nuttall's sandwort
<i>Minuartia obtusiloba</i> (Rydb.) House	twinflower sandwort
<i>Moneses uniflora</i> (L.) A. Gray	single delight
<i>Myosotis asiatica</i> (Vesterg.) Schischkin & Sergievskaja	Asian forget-me-not
<i>Oreostemma alpinum</i> (Torr. & A. Gray) Greene var. <i>haydenii</i> (Porter) G.L. Nesom	tundra aster
<i>Orthilia secunda</i> (L.) House	sidebells wintergreen
<i>Osmorhiza depauperata</i> Phil.	bluntseed sweetroot
<i>Oxytropis campestris</i> (L.) DC. var. <i>cusickii</i> (Greenm.) Barneby	Cusick's locoweed
<i>Packera streptanthifolia</i> (Greene) W.A. Weber & A. Löve	Rocky Mountain groundsel
<i>Parnassia kotzebuei</i> Chan. ex Spreng.	Kotzebue's grass of Parnassus
<i>Pedicularis bracteosa</i> Benth. var. <i>paysoniana</i> (Pennell) Cronquist	Payson's lousewort
<i>Penstemon eriantherus</i> Pursh	fuzzytongue penstemon
<i>Penstemon procerus</i> Douglas ex Graham	littleflower penstemon
<i>Penstemon rydbergii</i> A. Nelson var. <i>rydbergii</i>	swollen penstemon
<i>Phlox pulvinata</i> (Wherry) Cronquist	cushion phlox
<i>Polygonum bistortoides</i> Pursh	American bistort
<i>Polygonum douglasii</i> Greene ssp. <i>douglasii</i>	Douglas' knotweed
<i>Polygonum douglasii</i> Greene ssp. <i>johnstonii</i> (Munz) J.C. Hickman	Johnston's knotweed
<i>Potentilla diversifolia</i> Lehm. var. <i>diversifolia</i>	varileaf cinquefoil
<i>Potentilla gracilis</i> Douglas ex Hook.	slender cinquefoil
<i>Potentilla ovina</i> Macoun ex J.M. Macoun var. <i>ovina</i>	sheep cinquefoil
<i>Pteryxia hendersonii</i> (J.M. Coult. & Rose) Mathias & Constance	Henderson's wavewing
<i>Pulsatilla patens</i> (L.) Mill. ssp. <i>multifida</i> (Pritz.) Zamels	cutleaf anemone
<i>Pyrocoma carthamoides</i> Hook. var. <i>subsquarrosa</i> (Greene) G.Brown & Keil	largeflower goldenweed
<i>Ranunculus eschscholtzii</i> Schldl.	Eschscholtz's buttercup
<i>Ranunculus inamoenus</i> Greene	graceful buttercup
<i>Rhodiola integrifolia</i> Raf. ssp. <i>integrifolia</i>	ledge stonecrop
<i>Saxifraga bronchialis</i> L. ssp. <i>austromontana</i> (Wiegand) Piper	matted saxifrage
<i>Saxifraga rhomboidea</i> Greene	diamondleaf saxifrage
<i>Sedum lanceolatum</i> Torr.	spearleaf stonecrop
<i>Senecio crassulus</i> A. Gray	thickleaf ragwort
<i>Shoshonea pulvinata</i> Evert & Constance	Shoshone carrot
<i>Solidago multiradiata</i> Aiton var. <i>scopulorum</i> A. Gray	manyray goldenrod
<i>Symphotrichum ascendens</i> (Lindl.) G.L. Nesom	western aster
<i>Symphotrichum foliaceum</i> (Lindl. ex DC.) G.L. Nesom var. <i>foliaceum</i>	Parry's aster
<i>Taraxacum officinale</i> F.H. Wigg.	common dandelion
<i>Telesonix heucheriformis</i> Rydb.	alumroot brookfoam
<i>Townsendia parryi</i> D.C. Eaton	Parry's Townsend daisy
<i>Trifolium haydenii</i> Porter	Hayden's clover
<i>Trifolium repens</i> L.	white clover
<i>Valeriana dioica</i> L.	marsh valerian
<i>Valeriana edulis</i> Nutt. ex Torr. & A. Gray	tobacco root
<i>Valeriana occidentalis</i> A. Heller	western valerian

Appendix I (continued).

PLANTS Accepted Scientific Name with Author	PLANTS Common Name
<i>Viola</i> L.	violet
<i>Zigadenus elegans</i> Pursh	mountain deathcamas
Graminoids	
<i>Achnatherum nelsonii</i> (Scribn.) Barkworth ssp. <i>nelsonii</i>	Columbia needlegrass
<i>Agrostis mertensii</i> Trin.	northern bentgrass
<i>Agrostis scabra</i> Willd.	rough bentgrass
<i>Calamagrostis purpurascens</i> R. Br.	purple reedgrass
<i>Carex elynoides</i> T. Holm	blackroot sedge
<i>Carex filifolia</i> Nutt.	threadleaf sedge
<i>Carex haydeniana</i> Olney	cloud sedge
<i>Carex heteroneura</i> W. Boott var. <i>epapillosa</i> (Mack.) F.J. Herm.	different-nerve sedge
<i>Carex macloviana</i> d'Urv.	Thickhead sedge
<i>Carex nardina</i> Fr.	spike sedge
<i>Carex rossii</i> Boott	Ross' sedge
<i>Carex rupestris</i> All.	curly sedge
<i>Carex scirpoidea</i> Michx. ssp. <i>pseudoscirpoidea</i> (Rydb.) Dunlop	western singlespike sedge
<i>Carex vallicola</i> Dewey	valley sedge
<i>Danthonia intermedia</i> Vasey	timber oatgrass
<i>Elymus scribneri</i> (Vasey) M.E. Jones	spreading wheatgrass
<i>Elymus trachycaulus</i> (Link) Gould ex Shinners	slender wheatgrass
<i>Festuca brachyphylla</i> Schult. ex Schult. & Schult. f.	alpine fescue
<i>Festuca hallii</i> (Vasey) Piper	plains rough fescue
<i>Festuca idahoensis</i> Elmer	Idaho fescue
<i>Juncus hallii</i> Engelm.	Hall's rush
<i>Koeleria macrantha</i> (Ledeb.) Schult.	prairie Junegrass
<i>Leucopoa kingii</i> (S. Watson) W.A. Weber	spike fescue
<i>Luzula spicata</i> (L.) DC.	spiked woodrush
<i>Phleum alpinum</i> L.	alpine timothy
<i>Phleum pratense</i> L.	timothy
<i>Poa alpina</i> L.	alpine bluegrass
<i>Poa glauca</i> Vahl ssp. <i>rupicola</i> (Nash ex Rydb.) W.A. Weber	timberline bluegrass
<i>Poa nemoralis</i> L. ssp. <i>interior</i> (Rydb.) W.A. Weber	inland bluegrass
<i>Poa secunda</i> J. Presl	Sandberg bluegrass
<i>Pseudoroegneria spicata</i> (Pursh) A. Löve ssp. <i>spicata</i>	bluebunch wheatgrass
Ferns	
<i>Cystopteris fragilis</i> (L.) Bernh.	brittle bladderfern
<i>Selaginella densa</i> Rydb.	lesser spikemoss

APPENDIX 2. 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.