

ECOLOGICAL EVALUATION 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

By

George P. Jones  
Walter Fertig

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

April 21, 1999

TABLE OF CONTENTS

INTRODUCTION..... 4  
    Land Management Planning..... 4  
OBJECTIVES..... 4  
PRINCIPAL DISTINGUISHING FEATURES..... 5  
LOCATION..... 5  
    Boundary..... 5  
    Area..... 5  
    Elevation..... 6  
    Access..... 6  
    Ecoregion..... 6  
    Maps..... 6  
VEGETATION..... 6  
    Description..... 6  
    Area by Type..... 7  
PHYSICAL AND CLIMATIC CONDITIONS..... 9  
    Physical Setting..... 9  
    Geology..... 9  
DESCRIPTION OF VALUES..... 9  
    Vegetation Types..... 9  
    Flora..... 9  
        Threatened, Endangered, and Sensitive Plant Species..... 9  
        Plant Species List..... 13  
    Fauna..... 18  
        Threatened, Endangered, and Sensitive Vertebrates..... 18  
        Animal Species List..... 18  
    Lands..... 18  
SUITABILITY FOR RESEARCH NATURAL AREA SELECTION..... 19  
    Quality..... 19  
    Condition..... 20  
    Viability..... 20  
    Defensibility..... 21  
Degree to Which the Potential RNA Meets Criteria..... 21  
IMPACTS AND POSSIBLE CONFLICTS..... 21  
    Mineral Resources..... 21  
    Grazing..... 21  
    Timber..... 21  
    Watershed Values..... 22  
    Recreation Values..... 22  
    Wildlife and Plant Values..... 22  
    Transportation Values..... 22  
MANAGEMENT CONCERNS..... 22  
REFERENCES..... 23  
APPENDIXES..... 26  
    Appendix 1. Maps of the potential Pat O'Hara Mountain Research  
    Natural Area..... 27  
    Appendix 2. Photographs from the potential Pat O'Hara Mountain  
    RNA..... 30  
    Appendix 3. Canopy cover of plants in plots in the potential  
    Pat O'Hara Mountain Research Natural Area..... 31

|  |    |
|--|----|
| Appendix 4. Explanations of ranks used by the Wyoming Natural Diversity Database.....                                    | 43 |
| Appendix 5. Plant community types in the potential Pat O'Hara Mountain Research Natural Area.....                        | 45 |
| Appendix 6. Element Occurrence Records for Plant Species of Special Concern in the potential Pat O'Hara Mountain RNA.... | 47 |

ECOLOGICAL EVALUATION OF  
THE POTENTIAL PAT O'HARA MOUNTAIN RESEARCH NATURAL AREA  
WITHIN THE SHOSHONE NATIONAL FOREST,  
PARK COUNTY, WYOMING

INTRODUCTION

The potential Pat O'Hara Mountain Research Natural Area (RNA) is located at the western edge of Pat O'Hara Mountain in the eastern Absaroka Mountain Range. 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 in the Forest for use by the Forest Service in examining the suitability of the areas as research natural areas. The evaluation of the Pat O'Hara Mountain area was done by the Wyoming Natural Diversity Database. This report presents the results of that evaluation.

LAND MANAGEMENT PLANNING

In 1997, Pat O'Hara Mountain 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 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.

## PRINCIPAL 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 seven rare vascular plant species.

## LOCATION

The potential Pat O'Hara Mountain RNA is located within the Shoshone National Forest in northwestern Wyoming. 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, 18; T54N, R105W, Sections 12 and 13.

## BOUNDARY

See Figure 1.

The proposed boundary of the potential RNA follows drainage divides on the north, the east, and (for the most part) the south. On the west, the boundary is indefinite and runs along the lower slope above the bottom of the valley of Dead Indian Creek.

Starting in the southeastern part of the area, on Pat O'Hara Peak, the boundary runs generally west about 1.5 miles (2.4 km) along a drainage divide between Dead Indian Creek to the north (within the potential RNA) and Rattlesnake Creek to the south, thence west ca. 1.5 miles (2.4 km) across the valley of a tributary to Dead Indian Creek, thence generally northwest ca. 1.5 miles (2.4 km) down a ridge into the valley of Dead Indian Creek to an elevation several hundred feet (several hundred meters) above the valley bottom, thence east and north ca. 2.5 miles (4 km) along the slope at a roughly constant height above the valley bottom, thence east ca. 2.5 miles (4 km) to the divide between the basin of Dead Indian Creek on the west and Pat O'Hara Creek to the east, then south ca. 2 miles (3.2 km) to the starting point on Pat O'Hara Peak.

## AREA

The total area of the potential Pat O'Hara Mountain RNA is ca. 3976 acres (1610 ha).

## ELEVATION

The elevation of the potential Pat O'Hara Mountain RNA ranges from ca. 7000 feet (2133 m) at the northwestern corner to 9971 feet (3039 m) atop Pat O'Hara Peak at 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.

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

## VEGETATION

### DESCRIPTION

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

### Upland vegetation

Most of the potential RNA is vegetated with Engelmann spruce forest belonging to the Engelmann spruce/heartleaf arnica community. On limestone and dolomite bedrock, the tree overstory generally contains only Engelmann spruce (Appendix 3, Table 3-1, plots 2, 8, and 9), although limber pine may grow in the overstory, usually (but not solely) near tops of ridges (Appendix 3, Locations 7 and 10a). The 1997 field work indicates that most of the spruce are typical Engelmann spruce (*Picea engelmannii*), but trees with cones suggesting the presence of white spruce (*Picea glauca*) genes also grow in the potential RNA.

Small stands of woodland with a limber pine overstory also grow in the area (Appendix 3, Location 11), but this woodland is of very limited extent. On volcanic rock, the Engelmann spruce forest often contains subalpine fir and lodgepole pine (Appendix 3, Table 3-1).

Herbaceous vegetation occurs on the upper parts of ridges and on slopes (primarily south-facing) in the eastern, higher-elevation part of the potential RNA. The Idaho fescue - tufted hairgrass community grows mainly on northerly and easterly slopes, where it forms a dense meadow. On ridge tops and upper south-facing slopes, the vegetation belongs to the curly sedge-sheep cinquefoil community. These two herbaceous types merge into each other, and drawing sharp boundaries between them is impossible. A small area of mountain avens-curly sedge vegetation occurs in a windblown saddle along the eastern boundary of the area. This sparse vegetation type merges with the curly sedge-sheep cinquefoil community, both of which grow on harsher sites than does the Idaho fescue - tufted hairgrass meadow (Cooper et al. 1997).

Limestone cliffs and talus slopes with little vegetation occur throughout the area.

#### Riparian vegetation

The 1997 field survey did not reveal any riparian vegetation in the potential RNA. If riparian vegetation does occur in the area, it probably is limited to narrow fringes along the steep stream courses in the western part of the area and along the northern boundary.

#### 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 community type (Table 2) were estimated in the same manner.

Table 1. Areas of Kuchler Types (Kuchler 1966) in the potential Pat O'Hara Mountain RNA. See Figure 1.

| Cover Type  | Acres | Hectares |
|---|-------|----------|
| 14 Western spruce-fir forest<br>(Picea-Abies)                   | 3260  | 1320     |
| 45 Alpine meadows and barren<br>(Agrostis, Carex, Festuca, Poa) | 611   | 247      |
| Sparsely vegetated cliffs and slopes                            | 105   | 45       |

Table 2. Areas of SAF cover type (Eyre 1980) in the potential Pat O'Hara Mountain RNA. See Figure 1.

| Cover Type                           | Acres | Hectares |
|--------------------------------------|-------|----------|
| Engelmann spruce-subalpine fir (206) | 3260  | 1320     |
| Other types (no SAF equivalent)      | 611   | 247      |
| Sparsely vegetated cliffs and slopes | 105   | 45       |

Table 3. Areas of plant community types in the potential Pat O'Hara Mountain RNA. Appendix 5 contains synonyms.

| Community                            | Acres | Hectares |
|--------------------------------------|-------|----------|
| Engelmann spruce/heartleaf arnica    | 3260  | 1320     |
| Idaho fescue - Idaho fescue          | 349   | 141      |
| Curly sedge-sheep cinquefoil         | 253   | 102      |
| Mountain avens-curly sedge           | 11    | 5        |
| Sparsely-vegetated cliffs and slopes | 105   | 45       |

## PHYSICAL AND CLIMATIC CONDITIONS

### PHYSICAL SETTING

The potential Pat O'Hara Mountain RNA is located in the drainage basin of Clark's Fork of the Yellowstone River, in the valley of Dead Indian Creek, a major tributary flowing into the river from the south. The topography in the southeastern part of the area (on the western end of Pat O'Hara Mountain) and along the eastern boundary contains some gentle slopes, but the slopes in most of the area are steep and face primarily north and northwest. Streams in the area drain west and north and have steep gradients.

### 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.

## 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

There are no federally listed Threatened or Endangered plant species found in the potential Pat O'Hara Mountain RNA. Three USDA Forest Service Region 2 Sensitive plant species (*Festuca hallii*, *Pyrrocoma carthamoides* var. *subsquarrosa*, and *Shoshonea pulvinata*) are known from the area (Estill 1993; Fertig 1997). Four other plants listed as "species of special concern" or "watch list species" by WYNDD are also known from the potential RNA (Fertig and Beauvais 1999). 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 A.

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

Heritage Rank: G5T4/S1S2.

Federal Status: Bridger-Teton and Targhee NFs: Sensitive.

Geographic Range: Alaska and western Canada south in the Rocky Mountains to Colorado. In Wyoming, known from the Absaroka, Owl Creek, and Wind River Mountain Ranges (Fertig *et al.* 1994).

Habitat: Montane rock crevices, hummocks in semi-moist, calcareous meadows, and gravelly limestone flats with cushion plants or shrubs (Fertig *et al.* 1994; Fertig 1997).

Comments: The authors 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 plateau of Pat O'Hara Mountain. Hollis Marriott estimated this population to contain "thousands" of plants in 1988 (WYNDD records). Following a recent revision of statewide occurrence data, sweet-flowered rock jasmine is now known from five extant occurrences in Wyoming, including four on the Shoshone National Forest. The Forest populations all occur in existing wilderness areas or potential research natural areas (including Bald Ridge and Arrow Mountain).

***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, known from the Beartooth, Absaroka, Bighorn, Wind River, Gros Ventre, and Wyoming/Salt River Mountain Ranges.

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 the authors on the north side of Pat O'Hara Peak in 1997. This species is known from over two dozen locations in Wyoming, at least 9 of which are found in existing national forest wilderness areas or potential research natural areas. Due to low threats at most sites, aromatic pussytoes has been downlisted to "watch" status by WYNDD (Fertig 1997).

***Draba porsildii* var. *porsildii*** (Porsild's draba)

Heritage Rank: G3G4T3T4/S1.

Federal Status: None.

Geographic Range: Rocky Mountains from Yukon to Colorado.

Habitat: Occurs on 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. Four other populations occur in Wyoming, several of which occur in or near designated wilderness areas on Bridger-Teton and Shoshone National Forests (Fertig 1998).

***Festuca hallii*** (Hall's fescue)

Heritage Rank: G3G4/S1.

Federal Status: USFS Region 2 Sensitive.

Geographic Range: Northern Alberta to Ontario south to North Dakota and Colorado. In Wyoming, it is known from the Absaroka, Bighorn, and Medicine Bow Mountains (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. Hall's fescue is known from 7 extant populations on the Shoshone National Forest, only two of which are currently protected (both in wilderness areas).

***Lomatium attenuatum*** (Absaroka biscuitroot)

Heritage Rank: G3/S2.

Federal Status: None.

Geographic Range: Regional endemic of the Absaroka and Tendoy mountains of northwestern Wyoming and southwestern Montana (Mills and Fertig 1996).

Habitat: Semi-barren volcanic or calcareous mountain slopes and cliffs in sparsely vegetated sagebrush or cushion plant/bunchgrass communities 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). These populations were not re-surveyed in 1997. Range-wide, this species is now known from 22 occurrences and 20,000-100,000 individuals (Vanderhorst and Heidel 1998). Wyoming populations are largely secure at the present time due to their rugged habitat and low threats (Fertig 1998). Larger populations occur in the Grizzly Creek and Sheep Mesa potential RNAs and in wilderness areas along the North Fork of the Shoshone River (WYNDD records).

***Pyrrocoma carthamoides* var. *subsquarrosa*** (Absaroka goldenweed)

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

Heritage Rank: G5T2T3/S2.

Federal Status: USFS Region 2 Sensitive.

Geographic Range: Regional endemic of the Absaroka, Beartooth, and Pryor Mountains of northwestern Wyoming and south-central Montana (Lesica 1995).

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

Comments: Four small to medium-sized colonies of Absaroka goldenweed were discovered by the authors 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 (WYNDD records). The total population in the potential RNA and immediate vicinity is estimated at 200-300 plants, although much additional unsurveyed habitat is present. This species is known from 13 extant occurrences in Wyoming, including an extensive population in the potential Bald Ridge RNA (Fertig and Bynum 1994; Fertig 1998).

***Shoshonea pulvinata*** (Shoshonea)

Heritage Rank: G2G3/S2.

Federal Status: USFS Region 2 Sensitive.

Geographic Range: Regional endemic of northwest Wyoming and south-central Montana. In Wyoming, known from the Absaroka and Owl Creek mountains.

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

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 (WYNDD records). None of the nine occurrences of shoshonea in the state are currently protected, although a population on Bald Ridge is found within a proposed RNA (Fertig and Bynum 1994).

The Pat O'Hara Mountain potential RNA also contains populations of *Aquilegia jonesii* and *Kelseya uniflora*, two species that were formerly tracked as species of concern by WYNDD.

## Plant Species List

The following species checklist is based on field surveys conducted by the authors in mid-August 1997. For more information on the vascular flora of the Absaroka Range, consult Evert (1991), Kirkpatrick (1987), and Snow (1992-94). 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  |                        |     |
| <i>Abies lasiocarpa</i>  | Subalpine fir          | PIN |
| <i>Picea engelmannii</i>   | Engelmann spruce       | PIN |
| <i>Picea glauca</i>  | White spruce           | PIN |
| <i>Pinus contorta</i> var.<br><i>latifolia</i>                       | Lodgepole pine         | PIN |
| <i>Pinus flexilis</i>  | Limber pine            | PIN |
| Shrubs   |                        |     |
| <i>Artemisia tridentata</i> var.<br><i>vaseyana</i>                  | Mountain big sagebrush | AST |
| <i>Juniperus communis</i> var.<br><i>depressa</i>                    | Common juniper         | CUP |
| <i>Pentaphylloides floribunda</i><br>[ <i>Potentilla fruticosa</i> ] | Shrubby cinquefoil     | ROS |
| <i>Salix bebbiana</i>  | Bebb willow            | SAL |
| <i>Salix rotundifolia</i> var.<br><i>dodgeana</i>                    | Dodge willow           | SAL |
| <i>Shepherdia canadensis</i>   | Canada buffaloberry    | ELE |
| <i>Vaccinium scoparium</i>   | Grouse whortleberry    | ERI |
| Forbs  |                        |     |
| <i>Achillea millefolium</i>  | Common yarrow          | AST |
| <i>Agoseris glauca</i> var.<br><i>dasycephala</i>                    | Short-beaked agoseris  | AST |
| <i>Allium cernuum</i>  | Nodding onion          | LIL |

|   |                             |     |
|---|-----------------------------|-----|
| <i>Androsace chamaejasme</i> var.<br><i>carinata</i>                          | Sweet-flowered rock jasmine | PRM |
| <i>Androsace septentrionalis</i><br>var. <i>subulifera</i>                    | Northern rock jasmine       | PRM |
| <i>Anemone multifida</i>  | Cutleaf anemone             | RAN |
| <i>Antennaria aromatica</i>   | Aromatic pussytoes          | AST |
| <i>Antennaria corymbosa</i>   | Flat-topped pussytoes       | AST |
| <i>Antennaria media</i>   | Alpine pussytoes            | AST |
| <i>Antennaria microphylla</i>   | Small-leaf pussytoes        | AST |
| <i>Antennaria racemosa</i>  | Raceme pussytoes            | AST |
| <i>Antennaria rosea</i>   | Rosy pussytoes              | AST |
| <i>Aquilegia jonesii</i>  | Jones' columbine            | RAN |
| <i>Arabis confinis</i><br>[ <i>Arabis divaricarpa</i> ]                       | Spreadingpod rockcress      | BRA |
| <i>Arabis drummondii</i>  | Drummond's rockcress        | BRA |
| <i>Arabis glabra</i>  | Towermustard                | BRA |
| <i>Arenaria congesta</i> var.<br><i>congesta</i>                              | Ballhead sandwort           | CRY |
| <i>Arenaria hookeri</i> var.<br><i>hookeri</i>                                | Hooker's sandwort           | CRY |
| <i>Arenaria nuttallii</i><br>[ <i>Minuartia nuttallii</i> ]                   | Nuttall's sandwort          | CRY |
| <i>Arenaria obtusiloba</i><br>[ <i>Minuartia obtusiloba</i> ]                 | Arctic sandwort             | CRY |
| <i>Arnica cordifolia</i>  | Heartleaf arnica            | AST |
| <i>Arnica latifolia</i> var.<br><i>gracilis</i><br>[ <i>Arnica gracilis</i> ] | Slender arnica              | AST |
| <i>Arnica latifolia</i> var.<br><i>latifolia</i>                              | Mountain arnica             | AST |
| <i>Aster alpigenus</i> var.<br><i>haydenii</i>                                | Hayden's alpine aster       | AST |
| <i>Aster ascendens</i>  | Long-leaved aster           | AST |
| <i>Aster conspicuus</i>   | Showy aster                 | AST |
| <i>Aster foliaceus</i>  | Leafy aster                 | AST |
| <i>Aster sibiricus</i> var.<br><i>meritus</i>                                 | Arctic aster                | AST |
| <i>Astragalus miser</i> var.<br><i>hylophilus</i>                             | Weedy milkvetch             | FAB |
| <i>Besseyia wyomingensis</i>  | Wyoming kittentails         | SCR |
| <i>Bupleurum americanum</i>   | American thoroughwax        | API |

|   |                                  |     |
|---|----------------------------------|-----|
| <i>Calochortus gunnisonii</i>                           | Gunnison's mariposa-lily         | LIL |
| <i>Campanula rotundifolia</i>                           | Scotch bellflower                | CAM |
| <i>Castilleja cusickii</i>                              | Cusick's paintbrush              | SCR |
| <i>Cerastium arvense</i>                                | Field chickweed                  | CRY |
| <i>Cerastium beeringianum</i><br>var. <i>capillare</i>  | Alpine chickweed                 | CRY |
| <i>Chimaphila umbellata</i> var.<br><i>occidentalis</i> | Common pipsissewa                | ERI |
| <i>Cirsium arvense</i>                                  | Canada thistle                   | AST |
| <i>Cirsium eatonii</i>                                  | Eaton's thistle                  | AST |
| <i>Clematis columbiana</i> var.<br><i>tenuiloba</i>     | Matted purple virgin's-<br>bower | RAN |
| <i>Clematis hirsutissima</i>                            | Leatherflower                    | RAN |
| <i>Cymopterus longilobus</i>                            | Mountain spring-parsley          | API |
| <i>Delphinium bicolor</i>                               | Little larkspur                  | RAN |
| <i>Dodecatheon pulchellum</i>                           | Pretty shooting-star             | PRM |
| <i>Draba aurea</i>                                      | Golden draba                     | BRA |
| <i>Draba oligosperma</i>                                | Few-seeded draba                 | BRA |
| <i>Dryas octopetala</i> var.<br><i>hookeriana</i>       | White mountain avens             | ROS |
| <i>Epilobium angustifolium</i>                          | Fireweed                         | ONA |
| <i>Erigeron acris</i> var.<br><i>debilis</i>            | Bitter fleabane                  | AST |
| <i>Erigeron caespitosus</i>                             | Tufted fleabane                  | AST |
| <i>Erigeron compositus</i> var.<br><i>discoideus</i>    | Cut-leaved daisy                 | AST |
| <i>Erigeron ochroleucus</i> var.<br><i>ochroleucus</i>  | Buff fleabane                    | AST |
| <i>Erigeron simplex</i>                                 | Alpine daisy                     | AST |
| <i>Eriogonum flavum</i> var.<br><i>flavum</i>           | Yellow buckwheat                 | PLG |
| <i>Eriogonum umbellatum</i> var.<br><i>majus</i>        | Sulfur buckwheat                 | PLG |
| <i>Eritrichium nanum</i> var.<br><i>elongatum</i>       | Pale alpine forget-me-not        | BOR |
| <i>Fragaria virginiana</i>                              | Virginia strawberry              | ROS |
| <i>Gaillardia aristata</i>                              | Blanketflower                    | AST |
| <i>Galium boreale</i>                                   | Northern bedstraw                | RUB |
| <i>Gentiana affinis</i> var.<br><i>affinis</i>          | Prairie gentian                  | GEN |
| <i>Gentianella amarella</i> var.                        | Northern gentian                 | GEN |

|   |                            |     |
|---|----------------------------|-----|
| <i>amarella</i>   |                            |     |
| <i>Geranium viscosissimum</i>   | Sticky geranium            | GER |
| <i>Geum triflorum</i>   | Prairie smoke              | ROS |
| <i>Hedysarum sulphurescens</i>  | Yellow sweetvetch          | FAB |
| <i>Heuchera parvifolia</i>  | Littleleaf alumroot        | SAX |
| <i>Kelseya uniflora</i>   | Kelseya                    | ROS |
| <i>Lesquerella alpina</i> var.<br><i>alpina</i>   | Alpine bladderpod          | BRA |
| <i>Lloydia serotina</i>   | Alpine lily                | LIL |
| <i>Lomatium attenuatum</i>  | Absaroka biscuitroot       | API |
| <i>Lomatium cous</i>  | Cous biscuitroot           | API |
| <i>Lupinus argenteus</i>  | Silvery lupine             | FAB |
| <i>Mertensia viridis</i>  | Green bluebells            | BOR |
| <i>Moneses uniflora</i>   | Woodnymph                  | ERI |
| <i>Myosotis alpestris</i>   | Wood forget-me-not         | BOR |
| <i>Orthilia secunda</i><br>[ <i>Pyrola secunda</i> ]  | Sidebells pyrola           | ERI |
| <i>Osmorhiza depauperata</i>  | Blunt-fruit sweet-cicely   | API |
| <i>Oxytropis campestris</i> var.<br><i>cusickii</i>   | Yellow locoweed            | FAB |
| <i>Pedicularis bracteosa</i> var.<br><i>paysoniana</i>  | Payson's bracted lousewort | SCR |
| <i>Penstemon eriantherus</i>  | Crested beardtongue        | SCR |
| <i>Penstemon procerus</i>   | Small-flower beardtongue   | SCR |
| <i>Penstemon rydbergii</i> var.<br><i>rydbergii</i>   | Rydberg's beardtongue      | SCR |
| <i>Phlox pulvinata</i>  | Cushion phlox              | PLM |
| <i>Polygonum bistortoides</i>   | American bistort           | PLG |
| <i>Polygonum douglasii</i> var.<br><i>douglasii</i>   | Douglas' knotweed          | PLG |
| <i>Polygonum sawatchense</i>  | Sawatch knotweed           | PLG |
| <i>Potentilla diversifolia</i><br>var. <i>diversifolia</i>  | Vari-leaf cinquefoil       | ROS |
| <i>Potentilla gracilis</i>  | Slender cinquefoil         | ROS |
| <i>Potentilla ovina</i> var.<br><i>ovina</i>  | Sheep cinquefoil           | ROS |
| <i>Pyrrocoma carthamoides</i><br>var. <i>subsquarrosa</i><br>[ <i>Haplopappus</i><br><i>carthamoides</i> . var.<br><i>subsquarrosus</i> ] | Absaroka goldenweed        | AST |

|   |                        |     |
|---|------------------------|-----|
| <i>Ranunculus eschscholtzii</i>                                       | Subalpine buttercup    | RAN |
| <i>Ranunculus inamoenus</i>   | Unlovely buttercup     | RAN |
| <i>Saxifraga bronchialis</i> var.<br><i>austromontana</i>             | Spotted saxifrage      | SAX |
| <i>Saxifraga rhomboidea</i>   | Diamondleaf saxifrage  | SAX |
| <i>Sedum integrifolium</i>  | Roseroot               | CRS |
| <i>Sedum lanceolatum</i>  | Lance-leaved stonecrop | CRS |
| <i>Senecio crassulus</i>  | Thick-leaved groundsel | AST |
| <i>Senecio streptanthifolius</i>                                      | Cleft-leaved groundsel | AST |
| <i>Solidago multiradiata</i> var.<br><i>scopulorum</i>                | Northern goldenrod     | AST |
| <i>Swertia radiata</i><br>[ <i>Frasera speciosa</i> ]                 | Green gentian          | GEN |
| ! <i>Taraxacum officinale</i>   | Common dandelion       | AST |
| <i>Telesonix heucheriformis</i><br>[ <i>Boykinia heucheriformis</i> ] | James' saxifrage       | SAX |
| <i>Townsendia parryi</i>  | Parry's Easter-daisy   | AST |
| <i>Trifolium haydenii</i>   | Hayden's clover        | FAB |
| ! <i>Trifolium repens</i>   | White clover           | FAB |
| <i>Valeriana dioica</i>   | Northern valerian      | VAL |
| <i>Valeriana edulis</i>   | Tobacco-root           | VAL |
| <i>Valeriana occidentalis</i>   | Western valerian       | VAL |
| <i>Viola</i> sp.  | Violet sp.             | VIO |
| <i>Zigadenus elegans</i>  | Elegant death-camas    | LIL |

#### Graminoids

|   |                             |     |
|---|-----------------------------|-----|
| <i>Agrostis scabra</i>                                  | Winter bentgrass            | POA |
| <i>Calamagrostis purpurascens</i>                       | Purple reedgrass            | POA |
| <i>Carex atrata</i> var. <i>erecta</i>                  | Blackened sedge             | CYP |
| <i>Carex elynoides</i>                                  | Kobresia-like sedge         | CYP |
| <i>Carex filifolia</i>                                  | Thread-leaved sedge         | CYP |
| <i>Carex haydeniana</i>                                 | Hayden's sedge              | CYP |
| <i>Carex macloviana</i>                                 | Maclovian sedge             | CYP |
| <i>Carex nardina</i>                                    | Spikenard sedge             | CYP |
| <i>Carex rossii</i>                                     | Ross sedge                  | CYP |
| <i>Carex rupestris</i>                                  | Curly sedge                 | CYP |
| <i>Carex scirpoidea</i> var.<br><i>pseudoscirpoidea</i> | Canadian single-spike sedge | CYP |
| <i>Carex vallicola</i>                                  | Valley sedge                | CYP |

|   |                      |     |
|---|----------------------|-----|
| <i>Danthonia intermedia</i>             | Timber oatgrass      | POA |
| <i>Elymus scribneri</i>                 | Scribner wheatgrass  | POA |
| <i>Elymus spicatus</i>                  | Bluebunch wheatgrass | POA |
| <i>Elymus trachycaulus</i>              | Bearded wheatgrass   | POA |
| <i>Festuca brachyphylla</i>             | Alpine sheep fescue  | POA |
| <i>Festuca idahoensis</i>               | Idaho fescue         | POA |
| <i>Juncus hallii</i>                    | Hall's rush          | JUN |
| <i>Koeleria macrantha</i>               | Prairie junegrass    | POA |
| <i>Leucopoa kingii</i>                  | Spike-fescue         | POA |
| <i>Luzula spicata</i>                   | Spiked woodrush      | JUN |
| <i>Phleum alpinum</i>                   | Alpine timothy       | POA |
| ! <i>Phleum pratense</i>                | Common timothy       | POA |
| <i>Poa alpina</i>                       | Alpine bluegrass     | POA |
| <i>Poa interior</i>                     | Inland bluegrass     | POA |
| <i>Poa rupicola</i>                     | Timberline bluegrass | POA |
| <i>Poa secunda</i> var. <i>elongata</i> | Canby bluegrass      | POA |
| <i>Poa secunda</i> var. <i>incurva</i>  | Curly bluegrass      | POA |
| <i>Stipa nelsonii</i>                   | Nelson's needlegrass | POA |

#### Ferns and Fern Allies

|                             |                      |     |
|-----------------------------|----------------------|-----|
| <i>Cystopteris fragilis</i> | Brittle bladder fern | ASL |
| <i>Selaginella densa</i>    | Compact spike-moss   | SEL |

#### FAUNA

##### Threatened, Endangered, and Sensitive Vertebrates

Grizzly bears (*Ursos arctos*) may occur in the potential Pat O'Hara Mountain RNA sporadically, but the area is not particularly good habitat and bears do not frequent it (Larry Roop, Wyoming Game and Fish Department, personal communication, August 1997).

##### Animal Species List

The field work in the potential Pat O'Hara Mountain RNA did not include identification of the animal species present, but elk were observed at the southern end of the area.

#### 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.

The entire potential RNA lies within the North Absaroka 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.

The Engelmann spruce forest in the potential Pat O'Hara Mountain RNA grows on a habitat type widespread in the Absaroka and Wind River Mountains (Steele et al. 1983). The forest in the potential RNA appears to represent this vegetation in several respects (Steele et al. 1983): the overstory is nearly pure spruce on calcareous substrates but contains subalpine fir and lodgepole pine on volcanics, the spruces show some evidence of hybridization between Engelmann spruce and white spruce, and the forest borders non-forest vegetation on drier sites. The 1997 field survey suggests that the structure of the tree overstory varies only slightly in the forest on calcareous substrates, but the composition of the understory varied between plots. The field survey was restricted to the higher-elevation parts of the area, and the structure of the overstory may vary more between the higher-elevation and lower-elevation parts of the forest.

The non-forest vegetation of the potential RNA, west and northwest of Pat O'Hara Mountain, appears to be transitional to the type of alpine vegetation described from mountains in southwestern Montana. The species composition of all three of the herbaceous community types in this potential RNA -- the Idaho fescue - tufted hairgrass, the curly sedge-sheep cinquefoil, and the mountain avens-curly sedge communities -- suggests that each is a low-elevation variation of an alpine community type of the same name in Montana (Cooper et al. 1997). The three community types in the potential RNA also resemble the alpine community types in their distribution patterns, with the mountain avens-curly sedge type and the curly sedge-sheep cinquefoil type growing on dry, windblown sites with calcareous substrates, and the Idaho fescue - tufted hairgrass type on more protected sites, sometimes on volcanic rocks. Thus the non-forest types in the potential Pat O'Hara Mountain RNA also appear to represent a regional pattern in vegetation types.

## CONDITION

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

### - Fire suppression

The possible effect of fire suppression on the forest of the potential RNA can be inferred by comparing the vegetation to similar types studied elsewhere. The Engelmann spruce forest in the potential RNA grows on the *Picea engelmannii*/*Arnica cordifolia* habitat type, which is similar to the *Picea/Senecio streptanthifolius* habitat type from Montana (Steele et al. 1983).

The latter habitat type belongs to Fischer's and Clayton's fire group 10, in which the fires that affect the forest are stand-replacing fires with a return interval (probably) greater than 200 years (Fischer and Clayton 1983). This evidence suggests that fire suppression has had little effect on the forest in the potential RNA.

- Grazing: Cattle graze the non-forest vegetation in the potential RNA, and elk apparently also use the area (a herd of ca. 150 animals was observed along the southern boundary during the 1997 field survey). The degree to which the current grazing regime differs from the pre-settlement regime, and the effects of any difference, are unknown.

## VIABILITY

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

As is generally true of Rocky Mountain subalpine ecosystems on favorable sites (Peet 1988), the forest and non-forest types of the potential RNA apparently are relatively stable and do not depend on frequent disturbance for their maintenance. Rather, as Fischer and Clayton (1983) suggest for their fire group 10 (which seems to apply to the Engelmann spruce forest of the potential RNA), site factors, rather than disturbance, exert the main control on the landscape. If this interpretation is true, then the viability of the ecosystems in the area does not depend on close attention from resource managers.

The 1997 field work revealed no obvious threats to the viability of the ecosystems in the potential RNA, such as populations of exotic plants that might overwhelm the native vegetation, heavy livestock grazing, or heavy recreational use.

## 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.

No immediate threats to the ecosystems in the potential RNA were obvious during the 1997 field work. The lack of easy access to the area, and the prohibition on motor vehicles, will greatly reduce the number of visitors. The topography of the area should limit foot and horseback traffic in the area to the trail in the western part of the area and the primitive road along the southern boundary.

## DEGREE TO WHICH THE POTENTIAL RNA MEETS CRITERIA

The potential Pat O'Hara Mountain RNA contains vegetation types that appear to represent regional ecosystems: Engelmann spruce forest primarily on calcareous substrates, with a small amount of forest on volcanic rock, and high-elevation herbaceous vegetation on relatively favorable sites and on harsh sites. No evidence was observed to suggest that the condition of these ecosystems differs substantially from pre-settlement condition, and no obvious threats exist to their viability. The isolation of most of the area means that it should be easy to limit unwanted human impacts.

## 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

In 1997, cattle were observed grazing in the herbaceous vegetation along the boundary in the southeastern part of the potential RNA. The animals apparently venture only a short way into the area, and no evidence (such as barren areas or unusual vegetation) was observed to suggest that the cattle have a significant effect on the values for which the area is being considered for RNA designation.

## TIMBER

All of the potential Pat O'Hara Mountain RNA is within the North Absaroka Wilderness Area, where timber harvest is prohibited.

#### WATERSHED VALUES

The northern part of the potential RNA includes nearly the entire basin of an unnamed, second-order tributary (calculated from the 7.5' map) to Dead Indian Creek. The southern and western part contains a portion of a larger, third-order tributary to Dead Indian Creek. No evidence was observed during field survey to suggest that RNA designation would conflict with watershed values.

#### RECREATION VALUES

The field survey of the area suggests that it receives little recreational use. Hunting in the fall and horseback riding on the Forest trail probably are the main uses of the area, and the steep topography probably restricts these uses to the established trails. The western boundary of the area has been drawn to exclude the Forest trail along Dead Indian Creek. Hence RNA designation apparently would not conflict with recreational use of the area.

#### WILDLIFE AND PLANT VALUES

The potential RNA contains six species of rare vascular plants that would appear to benefit from RNA designation. No evidence was observed during field survey to suggest that RNA designation would conflict with management of the area for wildlife and plant values.

#### TRANSPORTATION VALUES

The potential RNA contains two mapped Forest Trails. Trail #761 ascends the south side of the valley of Dead Indian Creek through the western part of the area, and a portion of Trail #633 passes through the eastern edge of the area. Because the area is within the North Absaroka Wilderness Area, only horses and hikers may use these trails. Low Standard Forest Road #401 runs along the ridge-line immediately outside the southern boundary of the area. RNA designation apparently would not conflict with use of these trails and the road.

#### MANAGEMENT CONCERNS

The location of the potential Pat O'Hara Mountain RNA in the North Absaroka Wilderness Area minimizes management concerns. The only concern indicated by the 1997 field work is a potential for conflict with livestock grazing. The effects of grazing on the area appear to be minor, though, and there is no obvious impact.

## REFERENCES

- Anderson, M., P. Bourgeron, M.T. Bryer, R. Crawford, L. Engelking, D. Faber-Langendoen, M. Gallyoun, K. Goodin, D.H. Grossman, S. Landaal, K. Metzler, K.D. Patterson, M. Pyne, M. Reid, L. Sneddon, and A.S. Weakley. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume II: the national vegetation classification system: list of types. The Nature Conservancy, Arlington VA, USA.
- Bailey, R. G. et al. 1994. Ecoregions and subregions of the United States. 1:7,500,000-scale map. USDA Forest Service.
- Bayer, R. J. 1989. A systematic and phytogeographic study of *Antennaria aromatica* and *A. densifolia* (Asteraceae: Inuleae) in the western North American cordillera. *Madrono* 36 (4):248-259.
- Cooper, Stephen V., Peter Lesica, and Deborah Page-Dumroese. 1997. Plant community classification for alpine vegetation on the Beaverhead National Forest, Montana. USDA Forest Service General Technical Report INT-GTR-362. Intermountain Research Station, Ogden UT. 61 pp.
- Dorn, R. D. 1992. Vascular Plants of Wyoming, second edition. Mountain West Publishing, Cheyenne, WY. 340 pp.
- Estill, E. 1993. Interim directive 2600-93-1. USDA Forest Service Region 2, Denver, CO. (Interim directive establishing Sensitive species in Region 2).
- Evert, E. F. 1983. A new species of *Lomatium* (Umbelliferae) from Wyoming. *Madrono* 30(3): 143-146.
- Evert, E. F. 1991. Annotated checklist of the vascular plants of the North Fork Shoshone River drainage, northwest Wyoming. Unpublished report. 64 pp.
- Federal Geographic Data Committee. 1997. National vegetation classification standard. FGDC-STD-005. Vegetation subcommittee, June 1997.
- Fertig, W. 1997. Plant species of special concern on Shoshone National Forest: 1996 survey results. Unpublished report prepared by the Wyoming Natural Diversity Database, Laramie, WY.

Fertig, W. 1998. The Status of rare plants on Shoshone National Forest: 1995-97 survey results. Report prepared by the Wyoming Natural Diversity Database, Laramie, WY.

Fertig, W. and G. Beauvais. 1999. Wyoming Plant and Animal Species of Special Concern. Wyoming Natural Diversity Database, Laramie, WY.

Fertig, W. and M. Bynum. 1994. Biological report on the proposed Bald Ridge Research Natural Area. Report prepared for Shoshone National Forest. Wyoming Natural Diversity Database, Laramie, WY. 49 pp.

Fertig, W., C. Refsdal, and J. Whipple. 1994. Wyoming Rare Plant Field Guide. Wyoming Rare Plant Technical Committee, Cheyenne, WY. No pagination.

Fischer, William C. and Bruce D. Clayton. 1983. Fire ecology of Montana forest habitat types east of the Continental Divide. USDA Forest Service General Technical Report INT-141. Intermountain Forest and Range Experiment Station, Ogden UT. 83 pp.

Freeouf, Jerry A. (editor). 1996. Ecoregions and subregions of Region 2 - subsections, State of Wyoming. 1:1,000,000-scale map prepared by USDA Forest Service, Natural Resource Information Team. Revised May 1996.

Hitchcock, C. L. and A. Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press, Seattle, WA. 730 pp.

Johnston, B.C. 1987. Plant Associations of Region Two. Edition 4. USDA Forest Service Rocky Mountain Region. R2-ECOL-87-2. Lakewood CO. 429 pp.

Kirkpatrick, R. S. 1987. A flora of the southeastern Absarokas, Wyoming. Unpublished Master's Thesis, University of Wyoming, Laramie, WY.

Kuchler, A. W. 1966. Potential natural vegetation. Pp. 90-91 in: Gerlach, A. D. (ed.). 1970. The national atlas of the United States of America. USDI Geological Survey, Washington, DC.

Lesica, P. 1995. Conservaton status of *Haplopappus carthamoides* var. *subsquarrosus* in Montana. Unpublished report prepared for the USDA Forest Service Region 1 and the Bureau of Land Management Montana State Office by the Montana Natural Heritage Program, Helena, MT. 40 pp.

- Love, J. D. and A. C. Christiansen. 1985. Geologic Map of Wyoming. USDI Geological Survey, Reston, VA. 1:500,000 scale.
- Mills, S. and W. Fertig. 1996. Field guide to rare and sensitive plants of the Shoshone National Forest. Unpublished report prepared by the Wyoming Natural Diversity Database, Laramie, WY. No pagination.
- Peet, Robert K. 1988. Forests of the Rocky Mountains. Chapter 3 in: Barbour, Michael G. and William Dwight Billings (editors). 1988. North American terrestrial vegetation. Cambridge University Press. 434 pp.
- Scott, R. W. 1997. The Alpine Flora of the Rocky Mountains: Volume 1 The Middle Rockies. Univ. of Utah Press, Salt Lake City, UT. 901 pp.
- Snow, N. 1992-1994. The vascular flora of southeastern Yellowstone National Park and the headwaters region of the Yellowstone River, Wyoming. The Wasmann Journal of Biology 50(1-2): 52-95.
- Steele, Robert, Stephen V. Cooper, David M. Ondov, David W. Roberts, and Robert D. Pfister. 1983. Forest habitat types of eastern Idaho - western Wyoming. USDA Forest Service General Technical Report INT-144. Intermountain Forest and Range Experiment Station, Ogden UT. 122 pp.
- Tweit, Susan J. and Kent E. Houston. 1980. Grassland and shrubland habitat types of the Shoshone National Forest. USDA Forest Service, Shoshone National Forest, Cody WY. 143 pp.
- USDA Forest Service Region 2. 1993. Research Natural Area Guide for the Rocky Mountain Region, USDA Forest Service, review draft. Rocky Mountain Region, Lakewood, CO. 38 pp.
- Vanderhorst, J. and B. L. Heidel. 1998. Conservation status of *Lomatium attenuatum* Evert (Apiaceae) in Montana. Unpublished report prepared for the Bureau of Land Management by the Montana Natural Heritage Program, Helena, MT. 20 pp. + app.
- Weber, W. A. 1982. Mnemonic three-letter acronyms for the families of vascular plants: a device for more effective herbarium curation. Taxon 31 (1): 74-88.
- Welsh, S. L., N. D. Atwood, S. Goodrich, and L. C. Higgins. 1993. A Utah Flora, second edition, revised. Brigham Young University, Provo, UT. 986 pp.

## APPENDIXES

APPENDIX 1. MAPS OF THE POTENTIAL PAT O'HARA MOUNTAIN RESEARCH  
NATURAL AREA

Figure 1. Contour map showing Kuchler (1966) and vegetation types and SAF cover types (Eyre 1980) in the potential Pat O'Hara Mountain RNA.

| Kuchler/SAF Types   | Map Symbol |
|---|------------|
| Kuchler Western spruce-fir forest (14)/<br>SAF Engelmann spruc-subalpine fir (206)            | 14/206     |
| Alpine meadows and barrne<br>( <i>Agrostis</i> , <i>Carex</i> , <i>Festuca</i> , <i>Poa</i> ) | 45         |
| Sparsely-vegetated cliffs<br>and slopes   | C          |

Figure 2. Contour map showing plant community types in the potential Pat O'Hara Mountain RNA. Synonyms for community type names are listed in Appendix 5.

| Communities                          | Map<br>Symbol |
|--------------------------------------|---------------|
| Engelmann spruce/heartleaf arnica    | 1             |
| Idaho fescue - tufted hairgrass      | 2             |
| Curly sedge-sheep cinquefoil         | 3             |
| Mountain avens-curly sedge           | 4             |
| Sparsely-vegetated cliffs and slopes | C             |

#### Sample plots

Locations of vegetation descriptions

APPENDIX 2. PHOTOGRAPHS FROM THE POTENTIAL PAT O'HARA MOUNTAIN  
RNA

All photos by G. Jones

Photo 97GJ5.2

Eastern boundary of area, looking west at Engelmann spruce forest (vegetation in most of the area) in background on northeast-facing slope; limestone pavement in mid-ground, behind Engelmann spruce stand in foreground. August 16, 1997.

Photo 97GJ5.13

West-facing slope above saddle at southern end of area. Vegetation is Idaho fescue grassland (plot 102.4) typical of much of the southeastern corner of the area. August 21, 1997.

Photo 97GJ5.17

Bench on south-facing limestone slope, southeastern part of area. Vegetation is dominated by curly sedge. August 21, 1997.

Photo 97GJ4.31

South facing limestone slope, east-central part of area. Opening of Sandberg bluegrass and Idaho fescue in Engelmann spruce forest. August 16, 1997.

Photo 97GJ4.33

Northwest-facing limestone talus slope along eastern boundary of area. Habitat for *Androsace chamaejasme*, *Antennaria aromatica*. August 16, 1997.

Photo 97GJ5.4

Limestone pavement on gentle, west-facing slope in east-central part of area. Sparse dryas-curly sedge vegetation. August 16, 1997.

APPENDIX 3. CANOPY COVER OF PLANTS IN PLOTS IN THE POTENTIAL PAT  
O'HARA MOUNTAIN 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:

| <u>Cover Value</u> | <u>Range of Canopy Cover</u> |
|--------------------|------------------------------|
| 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.

Table 3-1. Canopy cover (and height, for trees) of plants in the Engelmann spruce sample plots in the potential Pat O'Hara Mountain RNA. Single numbers in cells are canopy cover values; for trees, numerators are canopy cover values, and denominators are height in meters.

|   | 1                 | 2                 | 8                 | 9                 |
|---|-------------------|-------------------|-------------------|-------------------|
|   | Piceng/<br>Arncor | Piceng/<br>Arncor | Piceng/<br>Arncor | Piceng/<br>Arncor |
| Species                                 |                   |                   |                   |                   |
| TREES                                   |                   |                   |                   |                   |
| <i>Abies lasiocarpa</i>                 | 10/30             |                   |                   |                   |
| <i>Picea engelmannii</i>                | 30/35             | 50/30             | 30/15             | 40/40             |
| <i>Pinus contorta</i>                   | 3/35              |                   |                   |                   |
|   |                   |                   |                   |                   |
|   |                   |                   |                   |                   |
| SHRUBS                                  |                   |                   |                   |                   |
| <i>Abies lasiocarpa</i>                 | 30                |                   |                   |                   |
| <i>Pinus flexilis</i>                   |                   |                   | 3                 |                   |
|   |                   |                   |                   |                   |
| DWARF SHRUBS                            |                   |                   |                   |                   |
| <i>Juniperus communis</i>               |                   | 1                 | 1                 |                   |
| <i>Pentaphylloides floribunda</i>       |                   |                   | 1                 |                   |
|   |                   |                   |                   |                   |
| GRAMINOIDS                              |                   |                   |                   |                   |
| <i>Carex rossii</i>                     | 1                 |                   | 1                 |                   |
| <i>Festuca idahoensis</i>               | 1                 |                   |                   |                   |
| <i>Leucopoa kingii</i>                  |                   |                   | 1                 |                   |
| <i>Poa interior</i>                     |                   |                   | 1                 |                   |
| <i>Poa secunda</i> var. <i>elongata</i> |                   |                   | 1                 |                   |
| <i>Trisetum spicatum</i>                |                   |                   | 1                 |                   |
|   |                   |                   |                   |                   |
| FORBS                                   |                   |                   |                   |                   |
| <i>Achillea millefolium</i>             |                   | 1                 | 1                 | 1                 |
| <i>Agoseris</i> sp.                     |                   |                   | 1                 |                   |
| <i>Anemone multifida</i>                |                   | 1                 |                   |                   |
| <i>Antennaria microphyllum</i>          |                   |                   | 1                 |                   |
| <i>Antennaria racemosa</i>              |                   | 10                |                   | 1                 |
| <i>Arabis drummondii</i>                | 1                 |                   |                   |                   |
| <i>Arnica cordifolia</i>                | 3                 |                   | 1                 |                   |
| <i>Arnica latifolia</i>                 |                   | 3                 |                   | 30                |
| <i>Aster foliaceus</i>                  | 3                 | 3                 | 3                 |                   |
| <i>Astragalus miser</i>                 |                   | 1                 |                   |                   |
| <i>Bupleurum americanum</i>             |                   |                   | 1                 |                   |
| <i>Castilleja</i> sp.                   |                   |                   |                   | 1                 |

|                           |    |    |    |    |
|---------------------------|----|----|----|----|
| Cirsium sp.               |    |    | 1  |    |
| Clematis columbiana       |    |    | 1  |    |
| Epilobium angustifolium   | 3  | 1  |    |    |
| Erigeron sp.              |    |    | 1  | 1  |
| Fragaria virginiana       | 3  | 1  |    |    |
| Galium boreale            |    | 1  | 1  |    |
| Hedysarum sulphurescens   |    | 1  | 10 |    |
| Lomatium sp.              |    |    | 1  |    |
| Lupinus aregenteus        | 1  |    |    | 1  |
| Mertensia ciliata         |    |    |    | 1  |
| Moneses uniflora          |    |    |    | 1  |
| Orthilia secunda          |    |    |    | 1  |
| Penstemon sp.             |    |    | 1  |    |
| Phlox multiflora          |    |    | 1  |    |
| Polygonum bistortoides    | 1  |    |    |    |
| Potentilla diversifolia   | 1  |    |    |    |
| Potentilla ovina          |    |    | 1  |    |
| Potentilla sp.            |    |    |    | 1  |
| Ranunculus sp.            |    |    |    | 1  |
| Sedum lanceolatum         |    |    | 1  |    |
| Senecio canus             |    |    | 1  |    |
| Senecio crassulus         |    | 1  |    |    |
| Senecio integerrimus      |    |    |    | 1  |
| Senecio streptanthifolius | 3  | 3  |    | 1  |
| Solidago multiradiata     |    |    | 3  |    |
| Swertia perennis          |    |    | 3  |    |
| Taraxacum sp.             |    |    |    | 1  |
| Trifolium haydenii        |    |    |    | 30 |
| Valeriana sp.             |    | 1  |    |    |
| Viola sp.                 |    | 1  |    |    |
| Zigadenus elegans         |    | 1  | 1  |    |
|                           |    |    |    |    |
| GROUND COVER              |    |    |    |    |
| Bare ground               | 2  | 1  | 15 | 2  |
| Gravel                    |    |    | 30 |    |
| Rock                      |    | 1  | 10 |    |
| Litter                    | 59 | 73 | 40 | 85 |
| Wood                      | 25 | 7  | 1  | 7  |
| Moss                      | 10 | 15 |    | 3  |
| Basal vegetation          | 4  | 3  | 3  | 3  |

**Association acronyms:**

Piceng/Arncor = *Picea engelmannii*/*Arnica cordifolia* (Engelmann spruce/heartleaf arnica)

**Notes**

- Plot 1: Middle part of gentle, northwest-facing slope on volcanic substrate. 10 m x 25 m. Photo 97GJ4.29
- Plot 2: Lower part of moderately-steep, north-facing slope on limestone. Plot 10 m x 25 m. Photo 97GJ4.32.
- Plot 8: Plot represents sparse woodland on upper half of south-facing slopes on limestone. 10 m x 15 m. Photo 97GJ5.19.
- Plot 9: Plot represents Engelmann spruce forest with little deadfall on north-facing slope on limestone. 10 m x 15 m.  
No photo

Table 3-2. Size-class structure of trees in the Engelmann spruce sample plots.

| Plot 1; 10 m x 25 m             |                   |     |     | DBH, | INCHES |      |
|---------------------------------|-------------------|-----|-----|------|--------|------|
| SPECIES                         | <Breast<br>Height | <5" | <9" | <14" | <21"   | <36" |
| <i>Abies lasiocarpa</i> , live  | 85                | 17  | 3   | 3    |        |      |
| <i>Abies lasiocarpa</i> , dead  | 6                 | 2   | 1   |      |        |      |
| <i>Picea engelmannii</i> , live | 2                 | 4   | 4   |      | 4      | 1    |
| <i>Picea engelmannii</i> , dead |                   | 1   | 3   | 2    | 4      |      |

| Plot 2; 10 m x 25 m             |                   |     |     | DBH, | INCHES |      |
|---------------------------------|-------------------|-----|-----|------|--------|------|
| SPECIES                         | <Breast<br>Height | <5" | <9" | <14" | <21"   | <36" |
| <i>Picea engelmannii</i> , live | 1                 | 8   | 19  | 8    |        |      |
| <i>Picea engelmannii</i> , dead |                   | 19  | 16  |      |        |      |

| Plot 8; 10 m x 15 m             |                   |     |     | DBH, | INCHES |      |
|---------------------------------|-------------------|-----|-----|------|--------|------|
| SPECIES                         | <Breast<br>Height | <5" | <9" | <14" | <21"   | <36" |
| <i>Picea engelmannii</i> , live | 7                 | 12  | 8   | 2    |        |      |
| <i>Picea engelmannii</i> , dead |                   | 1   |     |      |        |      |
| <i>Pinus flexilis</i> , live    | 8                 | 13  | 2   |      |        |      |

| Plot 9; 10 m x 15 m             |                   |     |     | DBH, | INCHES |      |
|---------------------------------|-------------------|-----|-----|------|--------|------|
| SPECIES                         | <Breast<br>Height | <5" | <9" | <14" | <21"   | <36" |
| <i>Picea engelmannii</i> , live | 8                 | 18  | 2   | 2    | 1      |      |
| <i>Picea engelmannii</i> , dead | 1                 | 8   |     | 2    |        |      |

Table 3-3. Canopy cover of plants in the Idaho fescue sample plots in the potential Pat O'Hara Mountain RNA.

|  | 4                 | 5                 |
|--|-------------------|-------------------|
|  | Fesida-<br>Potdiv | Fesida-<br>Potdiv |
| Species  |                   |                   |
| GRAMINOIDS   |                   |                   |
| <i>Agrostis scabra</i>                                 | 1                 | 1                 |
| <i>Carex atrata</i>                                    |                   | 10                |
| <i>Carex macloviana</i>                                |                   | 30                |
| <i>Carex scirpoidea</i>                                | 30                | 3                 |
| <i>Danthonia intermedia</i>                            | 1                 | 3                 |
| <i>Deschampsia cespitosa</i>                           |                   | 10                |
| <i>Elymus trachycaulus</i> var.<br><i>trachycaulus</i> | 1                 | 1                 |
| <i>Festuca idahoensis</i>                              | 50                | 40                |
| <i>Juncus hallii</i>                                   | 40                | 30                |
| <i>Leucopoa kingii</i>                                 | 1                 |                   |
| <i>Luzula spicata</i>                                  | 1                 | 1                 |
| <i>Phleum alpinum</i>                                  |                   | 1                 |
| <i>Poa alpina</i>                                      |                   | 1                 |
| <i>Poa rupicola</i>                                    | 1                 |                   |
| <i>Poa secunda</i> var. <i>elongata</i>                |                   | 1                 |
| <i>Trisetum spicatum</i>                               | 1                 | 1                 |
|  |                   |                   |
| FORBS  |                   |                   |
| <i>Achillium millefolium</i>                           | 3                 | 1                 |
| <i>Agoseris</i> sp.                                    | 1                 | 1                 |
| <i>Allium</i> sp.                                      | 1                 |                   |
| <i>Antennaria corymbosa</i>                            |                   | 1                 |
| <i>Antennaria micropylha</i>                           | 1                 |                   |
| <i>Arenaria congesta</i>                               | 3                 |                   |
| <i>Aster foliaceus?</i>                                | 1                 | 3                 |
| <i>Campanula rotundifolia</i>                          | 1                 |                   |
| <i>Castilleja cusickii</i>                             |                   | 1                 |
| <i>Geum triflorum</i>                                  | 10                | 3                 |
| <i>Lupinus</i> sp.                                     | 3                 | 10                |
| <i>Oxytropis</i> sp.                                   | 1                 |                   |
| <i>Penstemon</i> sp.                                   | 1                 | 30                |
| <i>Phlox pulvinata</i>                                 | 1                 |                   |
| <i>Polemonium</i> sp.                                  | 1                 |                   |
| <i>Polygonum bistortoides</i>                          | 1                 | 1                 |
| <i>Potentilla diversifolia</i>                         | 1                 | 1                 |
| <i>Senecio</i> sp.                                     | 1                 |                   |
| <i>Trifolium haydenii</i>                              | 1                 |                   |

|                  |    |    |
|------------------|----|----|
| GROUND COVER     |    |    |
| Bare ground      | 15 | 15 |
| Gravel           | 5  | 1  |
| Rock             |    |    |
| Litter           | 70 | 87 |
| Wood             |    |    |
| Moss             |    |    |
| Basal vegetation | 10 | 7  |

**Association acronyms:**

Fesida-Potdiv = *Festuca idahoensis*-*Potentilla diversifolia* (Idaho fescue-sheep cinquefoil)

Plot 4: Dense meadow on middle of west-facing limestone slope. Pocket gopher diggings are common. 10 m x 20 m. Photos 97GJ5.13 & 5.14.

Plot 5: Dense meadow in middle of southeast-facing limestone slope. 10 m x 20 m. Photo 97GJ5.15

Table 3-4. Canopy cover of plants in the curly sedge sample plots in the potential Pat O'Hara Mountain RNA.

|                                   | 3                 | 6                 | 7                 |
|-----------------------------------|-------------------|-------------------|-------------------|
|                                   | Dryoct-<br>Carrup | Carrup-<br>Potovi | Carrup-<br>Potovi |
| Species                           |                   |                   |                   |
| DWARF SHRUBS                      |                   |                   |                   |
| <i>Dryas octopetala</i>           | 10                |                   |                   |
| <i>Picea engelmannii</i>          |                   |                   | 1                 |
| <i>Pinus flexilis</i>             |                   |                   | 1                 |
| <i>Pentaphylloides floribunda</i> | 1                 | 1                 | 1                 |
| GRAMINOIDS                        |                   |                   |                   |
| <i>Agrostis scabra</i>            |                   |                   |                   |
| <i>Calamagrostis purpurascens</i> |                   | 1                 |                   |
| <i>Carex elynoides</i>            | 1                 |                   |                   |
| <i>Carex nardina</i>              |                   | 1                 | 10                |
| <i>Carex rupestris</i>            | 10                | 30                | 20                |
| <i>Deschampsia atropurpurea</i>   | 1                 |                   |                   |
| <i>Elymus scribneri</i>           | 1                 |                   |                   |
| <i>Juncus hallii</i>              |                   | 1                 |                   |
| <i>Leucopoa kingii</i>            |                   | 1                 |                   |
| <i>Poa rupicola</i>               |                   | 1                 |                   |
| <i>Trisetum spicatum</i>          |                   |                   | 3                 |
| FORBS                             |                   |                   |                   |
| <i>Androsace chamaejasme</i>      | 1                 | 1                 | 1                 |
| <i>Antennaria aromatica</i>       | 1                 |                   |                   |
| <i>Antennaria micropophylla</i>   |                   | 1                 |                   |
| <i>Arenaria hookeri</i>           |                   | 1                 | 1                 |
| <i>Arenaria obtusiloba</i>        | 1                 | 10                | 3                 |
| <i>Aquilegia jonesii</i>          | 1                 |                   |                   |
| <i>Besseya wyomingensis</i>       |                   | 1                 |                   |
| <i>Bupleurum americanum</i>       | 1                 | 1                 | 1                 |
| <i>Campanula rotundifolia</i>     |                   | 1                 | 1                 |
| <i>Erigeron sp.</i>               | 1                 | 1                 | 1                 |
| <i>Eriogonum flavum</i>           | 1                 |                   |                   |
| <i>Eritrichium nanum</i>          | 1                 | 1                 |                   |
| <i>Galium boreale</i>             | 1                 |                   |                   |
| <i>Gentianella amarella</i>       |                   | 1                 | 1                 |
| <i>Hedysarum sulphurescens</i>    | 1                 |                   | 10                |
| <i>Lesquerella alpina</i>         | 1                 |                   |                   |
| <i>Lesquerella sp.</i>            |                   | 1                 |                   |
| <i>Lupinus sp.</i>                |                   | 1                 |                   |
| <i>Oxytropis sp.</i>              | 1                 |                   | 1                 |

|  |    |    |    |
|--|----|----|----|
| <i>Polygonum bistortoides</i>                          |    | 1  |    |
| <i>Potentilla ovina</i>                                | 1  | 1  |    |
| <i>Pyrrocoma carthamoides</i> var. <i>subsquarrosa</i> | 1  |    |    |
| <i>Saxifraga rhomboidea</i>                            | 3  |    |    |
| <i>Sedum lanceolatum</i>                               |    | 1  |    |
| <i>Sedum</i> sp.                                       |    |    | 1  |
| <i>Senecio canus</i>                                   | 1  | 1  | 1  |
| <i>Solidago</i> sp.                                    |    |    | 1  |
| <i>Valeriana</i> sp.                                   |    | 1  |    |
| <i>Zigadenus elegans</i>                               | 1  | 1  | 10 |
|  |    |    |    |
| GROUND COVER   |    |    |    |
| Bare ground  | 12 | 5  | 10 |
| Gravel   | 80 | 50 | 59 |
| Rock   | 5  | 36 | 12 |
| Litter   | 1  | 5  | 5  |
| Wood   |    | 1  |    |
| Moss   | 1  |    | 10 |
| Basal vegetation                                       | 1  | 4  | 4  |

**Association acronyms:**

Dryoct-Carrup = *Dryas octopetala*-*Carex rupestris* (Mountain avens-Curly sedge)

Carrup-Potovi = *Carex rupestris*-*Potentilla ovina* (Curly sedge-sheep cinquefoil)

Plot 3: Gentle, southwest-facing slope in windblown saddle on limestone. 30 m x 30 m. Photo 97GJ5.3, 5.4, 5.5, 5.6

Plot 6: Middle of gentle, windblown, south-facing slope on limestone, with shallow soil. 10 m x 20 m. Photo 97GJ4.16

Plot 7: Limestone bench sloping gently to the south. 10 m x 20 m. Photo 97GJ5.17

## VEGETATION DESCRIPTIONS

Numbers following species names indicate canopy cover classes shown on page 28.

**LOCATION 1.** Open, south-facing slope on limestone in northeastern part of area.

VEGETATION TYPE: Idaho fescue grassland.

ELEVATION: 8920 feet (2719 meters). ASPECT: South

TOPOGRAPHIC POSITION: Slope

DESCRIPTION: Low vegetation of graminoids and forbs, surrounded by Engelmann spruce forest.

Trees:

Shrubs:

Dwarf Shrubs:

Graminoids & Forbs: *Poa secunda* var. *elongata*, *Festuca idahoensis*, *Arenaria hookeri*, *Galium boreale*

NOTES: Photos 97GJ4.30 & 4.31

**LOCATION 2.** Northwestern side of limestone knob in northeastern part of area.

VEGETATION TYPE: Englemann spruce

ELEVATION: 9450 feet (2880 meters). ASPECT: Northwest

TOPOGRAPHIC POSITION: Upper slope

DESCRIPTION: Open Englemann spruce woodland

Trees: *Picea engelmannii*

Shrubs:

Dwarf Shrubs: *Salix rotundifolia*, *Dryas octopetala*

Graminoids & Forbs: *Poa secunda* var. *incurva*, *Carex* spp., *Cymopterus longiloba*, *Sedum integrifolium*

NOTES: Several rare plants are present: *Aquilegia jonesii*, *Androsace chamaejasme*, *Antennaria aromatica*. Photos 97GJ4.33 & 4.34

**LOCATION 4.** Along eastern boundary in southeastern corner of area.

VEGETATION TYPE: Rock sedge

ELEVATION: 9400 feet (2865 meters). ASPECT: West

TOPOGRAPHIC POSITION: Upper slope

DESCRIPTION: Low herbaceous vegetation with scattered shrubs.

Trees:

Shrubs:

Dwarf Shrubs: *Pentaphylloides floribunda* (scattered)

Graminoids & Forbs: *Geum rossii*, *Danthonia intermedia*, *Carex rupestris*, *Arenaria congesta*, *Carex scirpoidea*, *Lupinus argenteus*

NOTES:

**LOCATION 5.** Upper part of south-facing slope along southern boundary.

VEGETATION TYPE: Engelmann spruce

ELEVATION: 9200-9400 feet (2804-2865 meters). ASPECT: North

TOPOGRAPHIC POSITION: Upper half of slope

DESCRIPTION: Moderately dense Engelmann spruce forest.

Trees: *Picea engelmannii*

Shrubs:

Dwarf Shrubs:

Graminoids & Forbs:

NOTES: Observed through binoculars from across valley, ca. 0.5 mile (0.8 km) to north. Limestone substrate.

**LOCATION 6.**

VEGETATION TYPE: Engelmann spruce

ELEVATION: 9280-9450 feet (2828-2880 meters). ASPECT:

Northwest

TOPOGRAPHIC POSITION: Upper slope

DESCRIPTION: Patch of Engelmann spruce woodland, surrounded by herbaceous meadow

Trees: *Picea engelmannii*

Shrubs:

Dwarf Shrubs:

Graminoids & Forbs:

NOTES: Observed through binoculars from across valley, ca., 0.9 mile (1.4 km) to northwest. Limestone substrate

**LOCATION 7.** Slope in drainage near southern boundary.

VEGETATION TYPE: Engelmann spruce

ELEVATION: 9200-9360 feet (2804-2853 meters). ASPECT:

Southwest

TOPOGRAPHIC POSITION: Lower slope

DESCRIPTION: Patch of Engelmann spruce woodland in valley.

Trees: *Picea engelmannii*, *Pinus flexilis*

Shrubs:

Dwarf Shrubs:

Graminoids & Forbs:

NOTES: Observed through binoculars from across valley, ca., 0.9 mile (1.4 km) to northwest. Limestone substrate

**LOCATION 10.** Knob on western end of Pat O'Hara Mountain, in southeastern part of area.

**10a.**

VEGETATION TYPE: Engelmann spruce

ELEVATION: 9760 feet (2975 meters). ASPECT: North

TOPOGRAPHIC POSITION: Saddle

DESCRIPTION: Patch of woodland.

Trees: *Picea engelmannii*, *Pinus flexilis*

Shrubs:  
Dwarf Shrubs:  
Graminoids & Forbs:  
NOTES: Limestone substrate

**10b.**

VEGETATION TYPE: Idaho fescue-prairie smoke  
ELEVATION: 9700 feet (2956 meters). ASPECT: North  
TOPOGRAPHIC POSITION: Upper slope  
DESCRIPTION: Dense herbaceous meadow below ridge line.  
Trees: *Picea engelmannii*, *Pinus flexilis*  
Shrubs:  
Dwarf Shrubs:  
Graminoids & Forbs: *Festuca idahoensis*, *Geum triflorum*  
NOTES: Limestone substrate

**LOCATION 11.** Northeastern side of knob on the western end of Pat  
O'Hara Mountain

VEGETATION TYPE: Limber pine  
ELEVATION: 9680 feet (2950 meters). ASPECT: Northeast  
TOPOGRAPHIC POSITION: Upper slope  
DESCRIPTION: Patches of trees in dense herbaceous meadow  
Trees: *Pinus flexilis* (20%)  
Shrubs: *Artemisia tridentata* ssp. *vaseyana* (very sparse)  
Dwarf Shrubs:  
Graminoids & Forbs: *Festuca idahoensis*, *Geum triflorum*, *Arenaria  
congesta*  
NOTES: Limestone substrate

## 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 PAT O'HARA MOUNTAIN 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/heartleaf arnica

-- Johnston (1987): *Picea engelmannii*/*Arnica cordifolia* plant association  
-- Anderson et al. (1998): *Picea engelmannii*/*Arnica cordifolia* forest  
-- Tweit and Houston (1980): None  
-- Steele et al. (1983): *Picea engelmannii*/*Arnica cordifolia* habitat type  
-- Federal Geographic Data Committee (1997): I.A.8.N.c.; conical-crowned, natural/semi-natural, temperate or subpolar, needle-leaved, evergreen, closed tree canopy forest  
-- Kuchler (1966): Western spruce-fir forest (*Picea-Abies*)  
-- Eyre (1980): Engelmann spruce-Subalpine fir

Idaho fescue - tufted hairgrass

-- Johnston (1987): *Festuca idahoensis*/*Deschampsia cespitosa* plant association?  
-- Anderson et al. (1998): *Festuca idahoensis*-*Deschampsia cespitosa* herbaceous vegetation  
-- Tweit and Houston (1980): *Festuca idahoensis*/*Deschampsia cespitosa* habitat type?  
-- Steele et al. (1983):  
-- 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

Mountain avens-curly sedge

-- Johnston (1987): *Dryas octopetala*/*Carex rupestris* plant

- association
- Anderson et al. (1998): *Dryas octopetala*-*Carex rupestris*  
herbaceous vegetation
  - Tweit and Houston (1980): Unknown
  - Steele et al. (1983):
  - Federal Geographic Data Committee (1997): V.A.8.N.a.; short,  
natural/semi-natural, temperat or subpolar, perennial  
graminoid vegetation with a sparse shrub layer
  - Kuchler (1966): Alpine meadows and barren (*Agrostis*,*Carex*,  
*Festuca*,*Poa*)
  - Eyre (1980): None

Curly sedge-sheep cinquefoil

- Johnston (1987): Unknown
- Anderson et al. (1998): *Carex rupestris*-*Potentilla ovina*  
herbaceous vegetation
- Tweit and Houston (1980): Unknown
- Steele et al. (1983):
- Federal Geographic Data Committee (1997): V.A.5.N.g.; short  
sod, natural/semi-natural, alpine or subalpine, temperate or  
subpolar, perennial graminoid 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 PAT O'HARA MOUNTAIN RNA.