PLANTS AND VEGETATION OF THE POTENTIAL ARROW MOUNTAIN RESEARCH NATURAL AREA WITHIN THE SHOSHONE NATIONAL FOREST, FREMONT COUNTY, WYOMING

Prepared for the

Shoshone National Forest, USDA Forest Service

By

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INTRODUCTION

This report presents information on the rare plants and the vegetation types in the potential Arrow 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 Arrow 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 Arrow 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 may differ slightly 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

This section will be written by U.S. Forest Service staff.

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 an Arrow 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 the 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 Arrow Mountain RNA include northeastward-facing, limestone and dolomite mountain slopes and the steep-walled canyons of three northeastward-flowing, perennial streams. A notable feature is the large proportion of the alpine zone underlain by dolomite and conglomerate, and the small proportion on granitic rock. Vegetation in the area varies from grassland and sagebrush shrubland in the foothills, through montane and subalpine woodlands and forests, to alpine tundra. The alpine zone consists mainly of vegetation associated most often with calcareous sandstones and carbonate sediments. Fifteen vascular plant species of limited distribution in the region grow in the alpine zone. Many of these plants have a strong affinity for calcareous substrates.

LOCATION

The potential Arrow Mountain RNA is located within the Shoshone National Forest in west-central Wyoming (Figure 1). The approximate center of the potential RNA is at latitude $43^0$23'30" North and longitude $109^0$31'20" West.

The potential RNA includes all or parts of the following sections (all on the 6th Principal Meridian): T39N, R105W, Sec 4, 5, 6, 7, 8, 9, 16, 17, 18; T39N, R106W, Sec 1, 2, 3, 10, 11, 12, 13, 14, 15; T40N, R105W, Sec 34, 31, 32; T40N, R106W, Sec 13, 23, 24, 25, 26, 27, 34, 35, 36.

BOUNDARY

The proposed boundary of the potential RNA follows administrative boundaries and topographic features (Figure 2). On the east side, the boundary of the potential RNA follows the boundary of the Shoshone National Forest. On the north, the boundary follows the National Forest boundary and the foot of the south wall of the valley of Torrey Creek. On the west, the northern-most ca. 1 mile (1.6 km) of the boundary of the potential RNA follows the divide between drainages of two tributaries of Torrey Creek, and the remainder of the western boundary follows the divide between the drainage of Torrey Creek on the west and the drainages of Blue Hole, Little Red Creek, and Red Creek on the east. On the south, the boundary follows the divide between the drainage of Red Creek on the north and Dinwoody Creek on the south.

AREA

The total area of the potential Arrow Mountain RNA is ca. 14,479 acres (5,860 ha). [1]

ELEVATION

The elevation of the potential Arrow Mountain RNA ranges from ca. 7,600 feet (2,318 m) at the northern end of the area to ca. 11,696 feet (3,567 m) at the southwestern corner.

ACCESS

The potential Arrow Mountain RNA may be reached via foot or horseback across public land from National Forest Trail 801 (the Glacier Trail) along the western boundary.

ECOREGION

The potential Arrow Mountain RNA lies within the Southern Rocky Mountain Steppe-Open Woodland-ConiferoU.S. Forest-Alpine Meadow Province, Wind River Mountains Section (M331J) 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: Blue Holes, Hays Park, Ink Wells, and Torrey Lake quads.

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

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 2009 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 ASSOCIATIONS

Upland Vegetation

In the foothills and the montane zone of the potential RNA, below elevations of approximately 8,600 feet (2,623 m) on north-facing slopes and in valley bottoms to approximately 9,600 feet (2,928 m) on south-facing slopes, the vegetation is a mix of montane woodland and forest with openings of grassland and sagebrush shrubland (Figure 3). The woodland and forest is a mosaic of several associations that blend into one another. Stands of the *Pseudotsuga menziesii/Juniperus communis* association appear to cover the most area (Table 1), primarily on north- and east-facing slopes. South-facing slopes (and the few west-facing exposures) support stands of the *Pinus flexilis/Juniperus communis* association. Both of these woodland associations contain *Picea engelmannii*, especially at the higher elevations. One stand of *Pinus contorta/Juniperus communis* association was identified in the valley of Little Red Creek.

The non-forested vegetation in the foothills and montane zone consists of the *Artemisia tridentata* ssp. *vaseyana/ Pseudoroegneria spicata* association on lower slopes and in valley bottoms, and the *Pseudoroegneria spicata - Poa secunda* association on middle and upper slopes. Stands of these two associations merge into one another. Seedlings and saplings of *Pinus flexilis* are common in the sagebrush shrubland.

In the subalpine zone, the vegetation consists of forest and woodland, usually with a mixed overstory. *Picea engelmannii* dominates in most of the area, and the *Picea engelmannii/Juniperus communis* association and the *P. engelmannii/Ribes montigenum* association apparently are the major subalpine types. *Pinus flexilis* is common at lower elevations and dominates on south-facing slopes, and the vegetation is classified as the *Pinus flexilis/Juniperus communis* association. *Pseudotsuga menziesii* is present in both of these types, and the subalpine forest merges with the *Pseudotsuga* - dominated montane woodland. At higher elevations, *Pinus albicaulis* is present in the forest and dominates on south-facing slopes. These stands are placed in the *P. albicaulis/ Juniperus communis* association. Both *Picea engelmannii* and *Pinus albicaulis* woodlands are found at upper tree-line. Patches of non-forest vegetation in the subalpine zone apparently belong to the *Festuca idahoensis-Carex scirpoidea* association and the *Carex scirpoidea-Potentilla diversifolia* association.

Above upper tree-line, the *Carex elynoides* association appears to be far and away the most common vegetation type, forming a turf over most of the alpine zone on carbonate substrates. Other types covering small areas within the matrix of *C. elynoides* turf are the *Carex rupestris – Potentilla ovina* association on various landscape positions, the *Carex scirpoidea - Potentilla diversifolia* association on northerly aspects, sparse *Dryas octopetala - Carex rupestris* dwarf-shrub vegetation on a dolomite dip-slope at the head of Blue Hole Creek, and the *Geum rossii - Trifolium* spp. association, apparently restricted to sandstone and igneous rocks.

Riparian and Wetland Vegetation

Field survey and aerial photographs indicate that riparian and wetland vegetation are minor types in the potential RNA, consisting of narrow fringes of shrubland and woodland along streams in the montane and subalpine zone and patches of herbaceous vegetation and shrubland in the alpine zone. A stand of the *Populus angustifolia/Rosa woodsii* woodland association was observed in the montane zone, and patches of *Salix drummondiana* shrub vegetation (tentatively classified as the *S. drummondiana* / Mesic Forbs association) and *Mertensia ciliata* herbaceous association were observed in the upper subalpine zone. In the alpine zone, patches of herbaceous wetland dominated by *Carex nelsonii* (plant association is unknown) and the *Salix planifolia/Carex scopulorum* shrub association were both observed.

Table 1. Occurrence of plant associations in complexes mapped in the potential Arrow 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.

	Complexes of Plant Associations (and areas)			
Plant Association	Foothill Grassland& Sagebrush (2,169 acres, 878 ha)	Limber pine & Douglas-fir Woodland (4,230 acres, 1,712 ha)	Engelmann spruce & Limber pine Woodland (4,402 acres, 1,782 ha)	Alpine Herbaceous & Shrub Types (3,672 acres, 1,486 ha)
Herbaceous				
Carex elynoides herbaceous				M
Carex rupestris - Potentilla ovina herbaceous				m
Carex nelsonii				m
Carex scirpoidea - Potentilla diversifolia herbaceous			m	m
Festuca idahoensis - Carex scirpoidea herbaceous?			m	
Geum rossii - Trifolium spp.				m
Mertensia ciliata herbaceous			m	
Pseudoroegneria spicata - Poa secunda Herbaceous	M	m		
Shrub				
Artemisia tridentata ssp. *vaseyana* / *Pseudoroegneria spicata* shrub	M			
Dryas octopetala - Carex rupestris dwarf-shrub				m
Salix arctica/Geum rossii dwarf-shrub				m
Salix planifolia / *Carex scopulorum* shrub				m
Salix drummondiana / Mesic Forbs shrub?			m	
Forest & Woodland				
Picea engelmannii / *Juniperus communis* Woodland			M	
Picea engelmannii / *Ribes montigenum* Woodland			M	
Pinus albicaulis / *Juniperus communis* Woodland			m	
Pinus contorta / *Juniperus communis* woodland		m		
Pinus flexilis / *Juniperus communis* Woodland		M		
Pseudotsuga menziesii / *Juniperus communis* Woodland		M		
Populus angustifolia / *Rosa woodsii* Woodland		m		

KUCHLER VEGETATION TYPES

Four Kuchler types (Kuchler 1966) comprise the vegetation types in the potential RNA (Table 2, Figure 4). The forest and woodland vegetation belong to two Kuchler types: the Douglas-fir Forest (*Pseudotsuga*) type (mainly in the montane elevations) and the Western spruce-fir forest (*Picea – Abies*) type (mainly in the subalpine elevations). Grass- and shrub-dominated vegetation in the foothills and the montane zone belongs to the Foothills Prairie (*Agropyron-Festuca-Stipa*) type. The mix of alpine turf, dwarf-shrub, and shrub vegetation belongs to the Alpine Meadows and Barrens (*Agrostis, Carex, Festuca, Poa*) type.

Table 2. Kuchler vegetation types in the potential Arrow Mountain Research Natural Area. See Figure 4.

Vegetation Type (Kuchler 1964)	Acres	Hectares
Foothills Prairie (*Agropyron-Festuca-Stipa*)	2,169	878
Douglas fir Forest (*Pseudotsuga*)	4,230	1,712
Western spruce-fir Forest (*Picea – Abies*)	4,402	1,782
Alpine Meadows & Barrens (*Agrostis, Carex, Festuca, Poa*)	3,672	1,486

HABITAT TYPES

The foothill and non-forested montane vegetation grows on two non-forest habitat types (Tweit and Houston 1980), the *Artemisia tridentata* ssp. *vaseyana / Agropyron spicatum* type and the *Agropyron spicatum – Poa sandbergii* type (Table 3, Figure 5). The forest and woodland stands at lower and intermediate elevations grow on the *Pinus flexilis / Juniperus communis* habitat type and the *Pseudotsuga menziesii / Juniperus communis* habitat type (Steele *et al.* 1983). Higher-elevation forest and woodland grows on the *Picea engelmannii / Juniperus communis* type and the *Pinus albicaulis / Juniperus communis* type.

SOCIETY OF AMERICAN FORESTERS COVER TYPES

Three Society of American Foresters forest cover types (Eyre 1980) occur in the potential RNA (Table 4 and Figure 6). The Limber Pine type and the Interior Douglas-fir type include the forests and woodlands at lower elevations, and the the Engelmann spruce-subalpine fir type includes the higher-elevation forests and woodlands. The herbaceous and shrub-dominated vegetation in the foothills and the alpine zone do not fall into the SAF forest cover type classification.

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 those 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 Arrow 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

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Table 3. Occurrence of habitat types mapped in complexes in the potential Arrow 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 Type	Complexes of Habitat Types (and areas)			
	Agropyron/Poa Type & Sagebrush Type (2,169 acres, 878 ha)	*Pinus flexilis* Type & *Pseudotsuga* Type (4,230 acres, 1,712 ha)	*Picea* Type & *Pinus* types (4,402 acres, 1,782 ha)	Alpine Series (3,672 acres, 1,486 ha)
Herbaceous				
Agropyron spicatum - Poa sandbergii Habitat Type	M	m		
Geum rossii Turf Community Type				M
Shrub				
Artemisia tridentata ssp. *vaseyana* / *Elymus spicatus* Habitat Type	M			
Forest & Woodland				
Pinus flexilis / Juniperus communis Habitat Type		M		
Pseudotsuga menziesii / *Juniperus communis* Habitat Type		M		
Picea engelmannii / *Juniperus communis* Habitat Type			M	
Pinus albicaulis / *Juniperus communis* Habitat Type			m	

Table 4. Society of American Foresters Cover Types in the potential Arrow Mountain Research Natural Area. See Figure 6.

Cover Type (Eyre 1980)	**Acres**	**Hectares**
Limber Pine (219) & Interior Douglas-fir (210)	4,230	1,712
Engelmann Spruce – Subalpine Fir (206) & Limber Pine (219)	4,402	1,782

Basins Montane Sagebrush Steppe Ecological System. Table 5 shows the area of each ecological system within the potential RNA.

Twelve ecological systems have each been mapped over at least 1% of the potential RNA, and an additional 14 ecological systems each have been mapped on less than 1% of the area (Table 5). The Inter-Mountain Basins Montane Sagebrush Steppe system, the Middle Rocky Mountain Montane Douglas-fir Forest and Woodland system, and the Northern Rocky Mountain Subalpine Woodland and Parkland system each accounts for approximately 20% of the area.

Table 5. Ecological systems in the potential Arrow 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 Systems	Acres	Ha
Barren	537	217
Inter-Mountain Basins Montane Sagebrush Steppe 20	2895	1172
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland 19	2756	1115
Northern Rocky Mountain Mesic Montane Mixed Conifer Forest	262	106
Northern Rocky Mountain Subalpine Deciduous Shrubland	528	214
Northern Rocky Mountain Subalpine Woodland and Parkland 20	2877	1164
Northern Rocky Mountain Subalpine-Upper Montane Grassland	263	107
Rocky Mountain Alpine Dwarf-Shrubland	491	199
Rocky Mountain Alpine Turf	761	308
Rocky Mountain Lodgepole Pine Forest 9	1257	509
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	565	229
Rocky Mountain Subalpine-Montane Mesic Meadow	758	307
Agriculture-Pasture and Hay	*3*	*1*
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	*73*	*29*
Inter-Mountain Basins Big Sagebrush Shrubland	*1*	*0*
Northern Rocky Mountain Conifer Swamp	*13*	*5*
Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland	*0*	*0*
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	*104*	*42*
Open Water	*4*	*2*
Rocky Mountain Aspen Forest and Woodland	*123*	*50*
Rocky Mountain Bigtooth Maple Ravine Woodland	*2*	*1*
Rocky Mountain Foothill Limber Pine-Juniper Woodland	*79*	*32*
Rocky Mountain Montane Riparian Systems	*16*	*7*
Rocky Mountain Poor-Site Lodgepole Pine Forest	*15*	*6*
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	*78*	*32*
Rocky Mountain Subalpine/Upper Montane Riparian Systems	*32*	*13*

Researchers in the Landfire Project caution that the information from the project should be augmented with knowledge of local conditions (http://www.landfire.gov/dp_quality_assessment.php), and the information gathered during field survey (and reported in Jones and Fertig 1999) suggests two substantial errors in the Landfire data layer. First, much of the higher-elevation forest and woodland is mapped as the Northern Rocky Mountain Subalpine Woodland and Parkland system, but the species composition of those stands suggests that they should be mapped as the Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland system. Second, lodgepole pine is rare in the potential RNA, and consequently the vegetation mapped as the Rocky Mountain Lodgepole Pine Forest system (almost 9% of

the potential RNA) also should be mapped as the Dry-Mesic Spruce-Fir Forest and Woodland system. Hence a much higher percentage of the potential RNA should be mapped as this conifer forest and woodland system.

Additional errors in the Landfire data-set are the putative presence in this area of the Agriculture-Pasture and Hay system and the Northern Rocky Mountain Conifer Swamp system. There is no agricultural land in the potential RNA, and field work turned up no evidence of swamp vegetation. The putative presence of these systems in the area is a consequence of the automatic classification of pixels on satellite images.

DESCRIPTION OF VALUES

VEGETATION TYPES

In general terms, the sequence of vegetation types in the potential RNA -- from grassland and sagebrush shrubland in the foothills; through limber pine and Douglas-fir woodlands in the montane zone, and spruce- or whitebark-pine dominated woodlands in the subalpine zone; to turf and dwarf-shrub vegetation in the alpine zone – is typical of the mountains in this region. Species composition changes gradually with increasing elevation, and more abruptly from one slope to another. But considered in more detail, the vegetation is unusual for the region, probably because a large proportion of the subalpine and alpine zones lie on sedimentary rock, instead of igneous rock. Two of the tree species that dominate or co-dominate upper montane and subalpine forests throughout the Rocky Mountains, *Abies lasiocarpa* (subalpine fir) and *Pinus contorta* (lodgepole pine), are rare in the potential RNA. Consequently, the overstories in the higher-elevation forest and woodlands are composed almost entirely of *Picea engelmannii* (Engelmann spruce) and *Pinus albicaulis* (whitebark pine). The undergrowths in these forests and woodlands also appear to be unusual in representing predominantly the dry end of the moisture gradient usually found in subalpine forests. In the alpine zone, the large area of turf dominated by *Carex elynoides* (blackroot sedge) may also result from the presence of so much sedimentary rock..

FLORA

Plant Species List

A list of 145 vascular plant species documented in the potential Arrow 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 Arrow Mountain Research Natural Area. No species currently listed as Sensitive in USFS Region 2 are present in the potential RNA, but four species listed as Sensitive in adjoining USFS Region 4, and a fifth considered Sensitive in nearby Bridger-Teton National Forest, have been found in the area. An additional 14 plant species tracked by the Wyoming Natural Diversity Database or included on the watch list maintained by the Database grow in the potential RNA. Many of these plant species of interest are associated high calcium bicarbonate concentrations in the soils, and their presence probably reflects the abundance of limestone and dolomite bedrock in the potential RNA.

The status of each of these 18 plant species is briefly summarized below. The heritage ranks, assigned by the Wyoming Natural Diversity Database, are explained in Appendix 2.

Androsace chamaejasme* var. *carinata (Sweet-flowered rock jasmine)
Heritage Rank: G5T4/S2.
Federal Status: Bridger-Teton National Forest Sensitive; 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: A population estimated at 10,000 individuals occurs on both sparsely vegetation sedimentary gravels and densely vegetated alpine turf communities on the south slopes of Circle Peak within the potential Arrow Mountain Research Natural Area (Fertig 1997).

Antennaria aromatica (Aromatic pussytoes)
Heritage Rank: G3G4/S3 (Watch).
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, and 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 upper tree-line (Scott 1997).
Comments: Several thousand plants were observed on the upper slopes and summit of the ridge connecting Arrow Mountain and Peak 10925 to the east by W. Fertig in 1996 (Fertig 1997). Additional small populations are likely to occur on dolomite ridges in the potential Arrow Mountain Research Natural Area.

Arnica angustifolia* ssp. *tomentosa (Alpine arnica)
Synonym: *Arnica alpina*.
Heritage Rank: G5T5/S1.
Federal Status: None.
Geographic Range: Circumboreal, south in the Rocky Mountains to British Columbia, southwestern Montana, and as far south as Wyoming. In Wyoming, it is known only from Fremont County in the northeastern Wind River Mountains.
Habitat: Bare, rocky alpine slopes and summits (Cronquist 1955). On Arrow Mountain, this species occurs in alpine cushion plant communities on dry, gravelly, calcareous clay soils or in denser vegetation dominated by *Artemisia scopulorum* near upper tree-line.
Comments: Alpine arnica was discovered for the first time in Wyoming on the slopes of Circle Peak in 1996 (Fertig 1997). George Jones located a second colony in the same area during vegetation surveys in 1998. The entire state range of this species is limited to the potential Arrow Mountain Research Natural Area (Fertig 1998).

Braya humilis (Low braya)
Accepted name in PLANTS database: *Neotorularia humilis* (C.A. Mey.) Hedge & J. Leonard?
Heritage Rank: G4/S1.
Federal Status: None.
Geographic Range: Circumboreal, extending across northern Alaska and Canada, south to Vermont and the Great Lakes, with disjunct populations in southwestern Montana, western Wyoming, and central Colorado (Rollins 1993). In Wyoming, it is known only from the northeastern Wind River Mountains in Fremont County.
Habitat: Sandy-gravelly soils of streambanks, lakeshores, moraines, and alpine slopes.

Comments: A sparse population of about 50 individuals was discovered by W. Fertig on whitish gravel beds on the south side of Circle Peak in 1996. This occurrence was the first to be documented for this species in Wyoming (Fertig 1996, 1997), and remains one of only two populations known from the state.

Carex incurviformis var. ***danaensis*** (Incurved sedge)
Synonym: Carex maritime
Heritage Rank: G4G5T3/S2
Federal Status: USFS R4 Sensitive.
Geographic Range: Carex incurviformis (*sensu stricto*) occurs sporadically from central Alberta to northwestern Montana, east-central Idaho, and northwestern Wyoming, with disjunct populations in the Sierra Nevada of central California and in central Colorado (Fertig 1999b). In Wyoming, it is known from the Absaroka and Wind River Mountains in Fremont, Park, and Sublette Counties.
Habitat: Moist alpine or subalpine tundra, wet rock ledges, frost scars, or fellfields (Fertig 1999b; Scott 1997).
Comments: Richard Scott documented this species from Arrow Mountain in 1985.

Carex microglochin (False uncinia sedge)
Heritage Rank: G5?/S2.
Federal Status: None.
Geographic Range: From Greenland to Alaska and south to Alberta and Quebec, with disjunct populations in the Rocky Mountains of Montana, Wyoming, Colorado, and Utah. In Wyoming, it is known from the Absaroka, Beartooth and Wind River Mountains and Yellowstone Plateau in Fremont, Park, and Sublette Counties.
Habitat: Moist, often calcareous wetlands and fens, from montane valleys to the alpine.
Comments: George Jones discovered a new population of this species in a small wetland on the north side of Mount 11696 within the potential Arrow Mountain Research Natural Area in 1998.

Carex misandra (Short-leaf sedge)
Heritage Rank: G5/S2.
Federal Status: None.
Geographic Range: Circumboreal, south to Quebec, Alberta, Utah, and Colorado. In Wyoming, it is known from the Bighorn, Beartooth, and Wind River Mountains in Fremont, Johnson, and Park Counties.
Habitat: Alpine meadows and open slopes. In the Arrow Mountain area, this species occurs in an alpine wetland dominated by *Carex nelsonii*.
Comments: George Jones discovered a new population of this species on the north side of Mount 11696 with 3 other rare wetland graminoids in August 1998.

Carex nelsonii (Nelson's sedge)
Heritage Rank: G3?/S2.
Federal Status: None.
Geographic Range: Regional endemic of Wyoming, Montana, Colorado, and Utah. In Wyoming, it is known from the Medicine Bow, Beartooth, and Wind River Mountains and the Sierra Madre in Albany, Carbon, Fremont, and Park Counties.
Habitat: Subalpine or alpine moist meadows and slopes. In the Arrow Mountain area, this species may be locally dominant in alpine wetlands.
Comments: Nelson's sedge was first discovered in the potential Arrow Mountain Research Natural Area by George Jones in 1998.

Draba globosa (Rockcress draba)
Heritage Rank: G3/S3.
Federal Status: USFS R4 Sensitive.
Geographic Range: Regional endemic of southwestern Montana, central Colorado, northwestern Utah and western and southern Wyoming (Fertig *et al.* 1994). In Wyoming, it is known from the Absaroka, Teton, Wind River, Beartooth, Medicine Bow, Gros Ventre, and Salt River Mountains in Albany, Fremont, Lincoln, Park, Sublette, and Teton Counties.
Habitat: Moist, gravelly alpine meadows, slopes, summits, swales, talus, and tundra, often on limestone-derived soils at elevations of 9,600-12,000 feet. The Arrow Mountain habitat was described as rocky, alpine meadow on limestone.
Comments: Rockcress draba was first collected in the potential Arrow Mountain Research Natural Area by Rob Massatti in 2006.

Draba paysonii var. treleasei (Trelease's draba)
Heritage Rank: G5T4T5/S2.
Federal Status: None.
Geographic Range: Alaska and Alberta south to California and northwestern Wyoming. In Wyoming, it is known from the Absaroka, Beartooth, and eastern slope of the Wind River Mountains.
Habitat: Fellfields and other rocky places on hardpan clay and sand, dry turf, bare talus slopes, and tundra at medium-high to high elevations (Scott 1997, Rollins 1993). The habitat on Arrow Mountain was variously described as alpine turf on calcareous substrate and as rocky, alpine meadow on limestone.
Comments: Trelease's draba was first collected in the potential Arrow Mountain Research Natural Area by Erwin Evert in 1998, and most recently by Rob Massatti in 2006.

Draba porsildii (Porsild's draba; little snow draba)]
Synonym: Includes *Draba porsildii var. brevicula*.
Heritage Rank: G3G4/S2.
Federal Status: None.
Geographic Range: Yukon and the Northwest Territories south in the high Rocky Mountains to Colorado (Rollins 1993). In Wyoming, it is known from the northern Absaroka and northern Wind River Mountains in Park and Sublette Counties.
Habitat: Scree and grassy meadows, along ridges, slopes, and summits in the alpine zone at 9,600-13,100 feet.
Comments: Porsild's draba was first collected on Arrow Mountain by Hollis Marriott in 1988. It was initially identified as *Draba porsildii* var. *brevicula*, the only putative record for the Wind River Mountains. It was later determined to be the type variety. More recently, *D. porsildii* var. *brevicula* was rejected by Dorn (2001).

Helictotrichon mortonianum (Alpine oatgrass)
Heritage Rank: G4/S1.
Federal Status: None.
Geographic Range: Southern Rocky Mountains of central Colorado and northern New Mexico, with disjunct populations in the Uinta Mountains of Utah and northeastern Wind River Mountains of Fremont County, Wyoming.
Habitat: Alpine meadows. Populations on Arrow Mountain occur on both granitic and calcareous substrates with *Geum rossii, Trifolium nanum,* and *Artemisia scopulorum*.

Comments: Ron Hartman first discovered this species on Arrow Mountain in 1996, but it remained unknown until relocated by George Jones in 1998 (Fertig 1999a). The Arrow Mountain colony is the only population currently known from Wyoming.

Juncus triglumis* var. *albescens (Northern white rush)
Accepted name in PLANTS database: *Juncus albescens* (Lange) Fernald
Heritage Rank: G5T5/S2.
Federal Status: None.
Geographic Range: Circumpolar, south in North America to Utah and Colorado. In Wyoming, it is known from the Medicine Bow, Wind River, and Absaroka Mountains in Albany, Fremont, and Sublette Counties.
Habitat: Wet alpine meadows and streambanks.
Comments: George Jones discovered a new population of this species in an alpine wetland on the north side of Peak 11696 in 1998. Previously, northern white rush had been collected by Ron Hartman and David Rosenthal from the vicinity of Circle Peak (Rosenthal 1998).

Lesquerella fremontii (Fremont bladderpod)
Heritage Rank: G2/S2.
Federal Status: None.; formerly C2 candidate for listing
Geographic Range: Endemic to the eastern slope of the Wind River Mountains and the Beaver Rim area of Fremont County, Wyoming.
Habitat: Occurs primarily in sparsely vegetated montane meadows on slopes and ridges with scattered *Pinus flexilis, Artemisia tripartita* var. *rupicola*, bunchgrasses, and low cushion plants (Fertig 1995). Less frequently, populations can be found in soil-filled cracks of limestone boulders and bedrock. The Arrow Mountain population occurs in an alpine cushion plant community on limey-sandstone gravels covering clay-shale soils (Fertig 1997).
Comments: The Arrow Mountain population is the northernmost known occurrence of Fremont bladderpod, and the only one from an alpine habitat.

Parrya nudicaulis (Naked-stemmed parrya)
Heritage Rank: G5/S2.
Federal Status: USFS R4 Sensitive; formerly USFS R2 Sensitive.
Geographic Range: Siberia to Alaska and northern Canada, with disjunct populations in Wyoming. In Wyoming, it is known from the Beartooth, Gros Ventre, and Wind River Mountains of Fremont, Park and Sublette Counties. Similar populations in the Uinta Mountains of Utah have been referred to as *P. rydbergii*.
Habitat: Alpine talus slopes and scree fields, often on limestone (Fertig 1997; Houston *et al.* 2001), although also found on quartzites in the Uinta Range.
Comments: Ron Hartman and David Rosenthal discovered a new population of this species while conducting a floristic survey of the area in 1996 (Fertig 1997, Rosenthal 1998).

Pedicularis pulchella (Mountain lousewort)
Heritage Rank: G3/S2 (Watch).
Federal Status: None.
Geographic Range: Regional endemic of southwestern Montana and northwestern Wyoming. In Wyoming, it is known from the Bighorn, Beartooth, Absaroka, Gros Ventre, and northern Wind River Mountains in Big Horn, Fremont, Hot Springs, Johnson, Park, Sublette, and Teton Counties.

Habitat: Alpine meadows dominated by *Geum rossii* turf and talus/scree slopes of granitic or calcareous parent material at 10,300-12,460 feet. In Arrow Mountain its habitat was described as rocky, alpine meadow on limestone.
Comments: Mountain lousewort was first collected in the potential Arrow Mountain Research Natural Area by Ronald Hartman in 1996, and most recently by Rob Massattii in 2006.

Saussurea weberi (Weber's saw-wort)
Synonym: Included in *Saussurea densa* by some authors.
Heritage Rank: G3Q/S2.
Federal Status: USFS R4 Sensitive.
Geographic Range: Regional endemic of southwestern Montana, western Wyoming, and central Colorado. In Wyoming, it is known from the Gros Ventre and Wind River Mountains in Fremont, Sublette, and Teton Counties.
Habitat: Alpine talus and gravel slopes, often on limestone. Populations on Arrow Mountain are found in alpine cushion plant communities on calcareous clay soils, steep talus slopes of limey slate, and openings amid stunted mats of *Betula glandulosa* and *Salix glauca* on dry, loamy soils over quartz gravel (Fertig 1997).
Comments: The Arrow Mountain populations of Weber's saw-wort were first discovered by Hollis Marriott and Richard Scott in 1988. Marriott estimated the population at several thousand individuals. Comparable numbers were found by Walter Fertig in July 1996.

Silene kingii (King's campion)
Synonym: Includes var. kingii and an "undescribed variety" (Dorn 2001).
Heritage Rank: G2G4QT?/S2 (type variety) S1 (undescribed variety).
Federal Status: None.
Geographic Range: Circumpolar, in North America extending from Alaska to northern Quebec, and south in the Rocky Mountains to Alberta, northwestern Wyoming, and central Colorado. In Wyoming, it is known from the Absaroka and Wind River Mountains in Fremont and Park Counties.
Habitat: Alpine and subalpine talus slopes and fellfields. On Arrow Mountain, populations have been found on igneous and metamorphic boulder fields and alpine meadows.
Comments: Arrow Mountain appears to contain a mixed population of "var. *kingii*" (recognized by its downward-pointing non-glandular hairs on the lower leaves) and the undescribed "var. *novum*" (with spreading, glandular hairs on the lower leaves). Var. *novum* may be a local endemic of the Absaroka Mountains and northeastern Wind River Mountains (Dorn 2001) and Arrow Mountain is the only place where both varieties overlap. Both varieties are tracked by the Wyoming Natural Diversity Database as taxa of concern, so might be considered as representing two rare plant taxa.

FAUNA

Threatened, Endangered, and Sensitive Vertebrates

U.S. Forest Service staff may add information to this section.

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 Arrow Mountain RNA (Wyoming Game and Fish Department, No date). The area also is within the

conservation strategy management area for the Greater Yellowstone Area Distinct Population Segment of the grizzly bear, but outside the primary conservation area for that Distinct Population Segment (USDI Fish and Wildlife Service, No date).

Animal Species List

This section will be written by U.S. Forest Service staff.

LANDS

The potential Arrow Mountain RNA is National Forest System land in the Wind River Ranger District of the Shoshone National Forest. Approximately 96% of the area (13,737 acres, or 5,559 ha) is within the Fitzpatrick Wilderness Area (Figure 1).

IMPACTS AND POSSIBLE CONFLICTS

MINERAL RESOURCES

This section will be written by U.S. Forest Service staff.

GRAZING

This section will be written by U.S. Forest Service staff.

TIMBER

This section will be written by U.S. Forest Service staff.

WATERSHED VALUES

This section will be written by U.S. Forest Service staff.

RECREATION VALUES

This section will be written by U.S. Forest Service staff.

WILDLIFE AND PLANT VALUES

This section will be written by U.S. Forest Service staff.

TRANSPORTATION VALUES

This section will be written by U.S. Forest Service staff.

MANAGEMENT CONCERNS

A small patch of knapweed (probably Russian knapweed [hardheads in PLANTS database], *Acroptilon repens*) was discovered along Blue Hole Creek by George Jones in the late 1990s, within 100 meters of the Shoshone National Forest boundary and the boundary of the potential Arrow Mountain

RNA. This discovery was reported to Shoshone National Forest managers. If this patch of noxious weed still remains, its presence may cause concern in management of a research natural area.

U.S. Forest Service staff may add information to this section.

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FIGURES

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

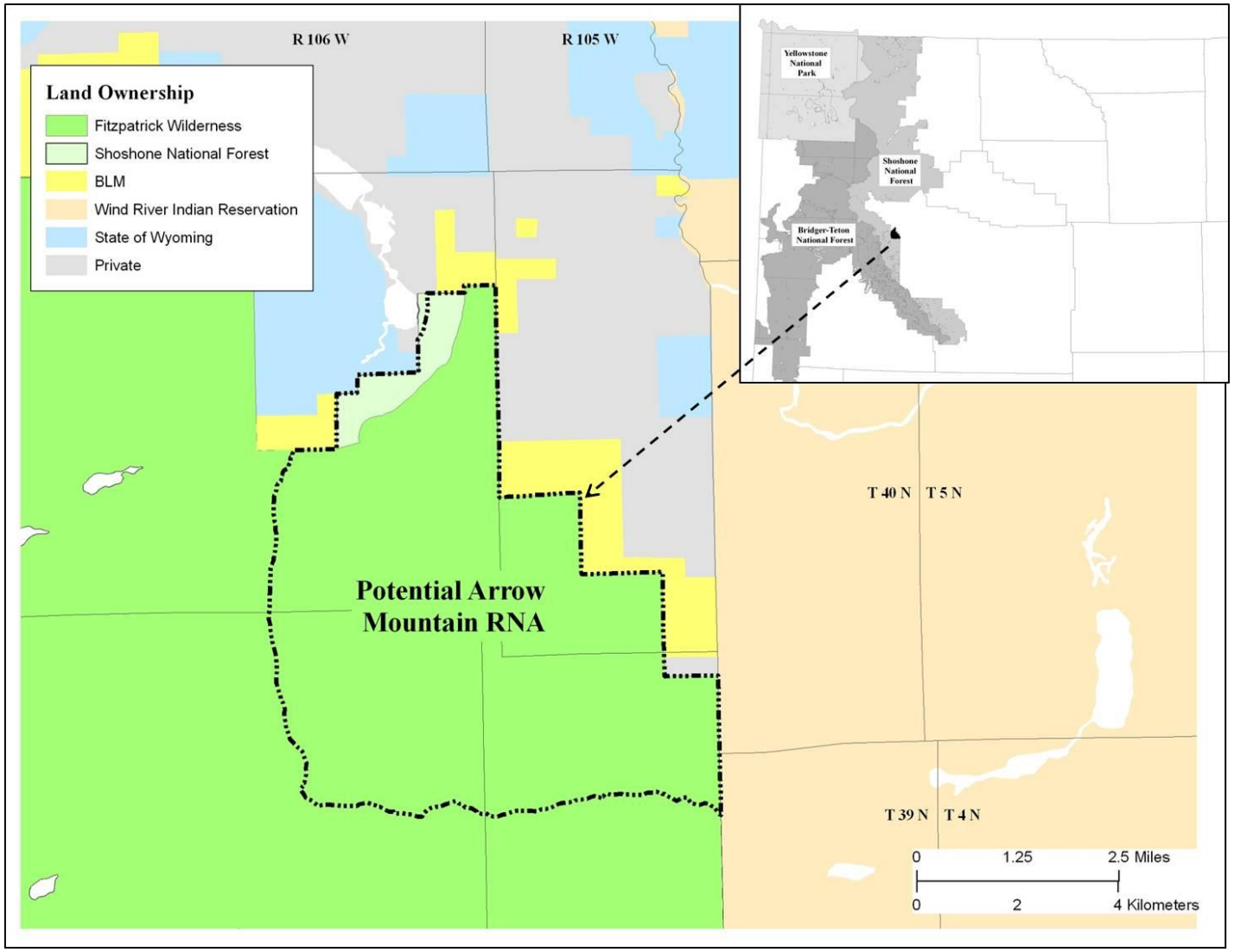

Figure 2. Boundary of the potential Arrow Mountain Research Natural Area.

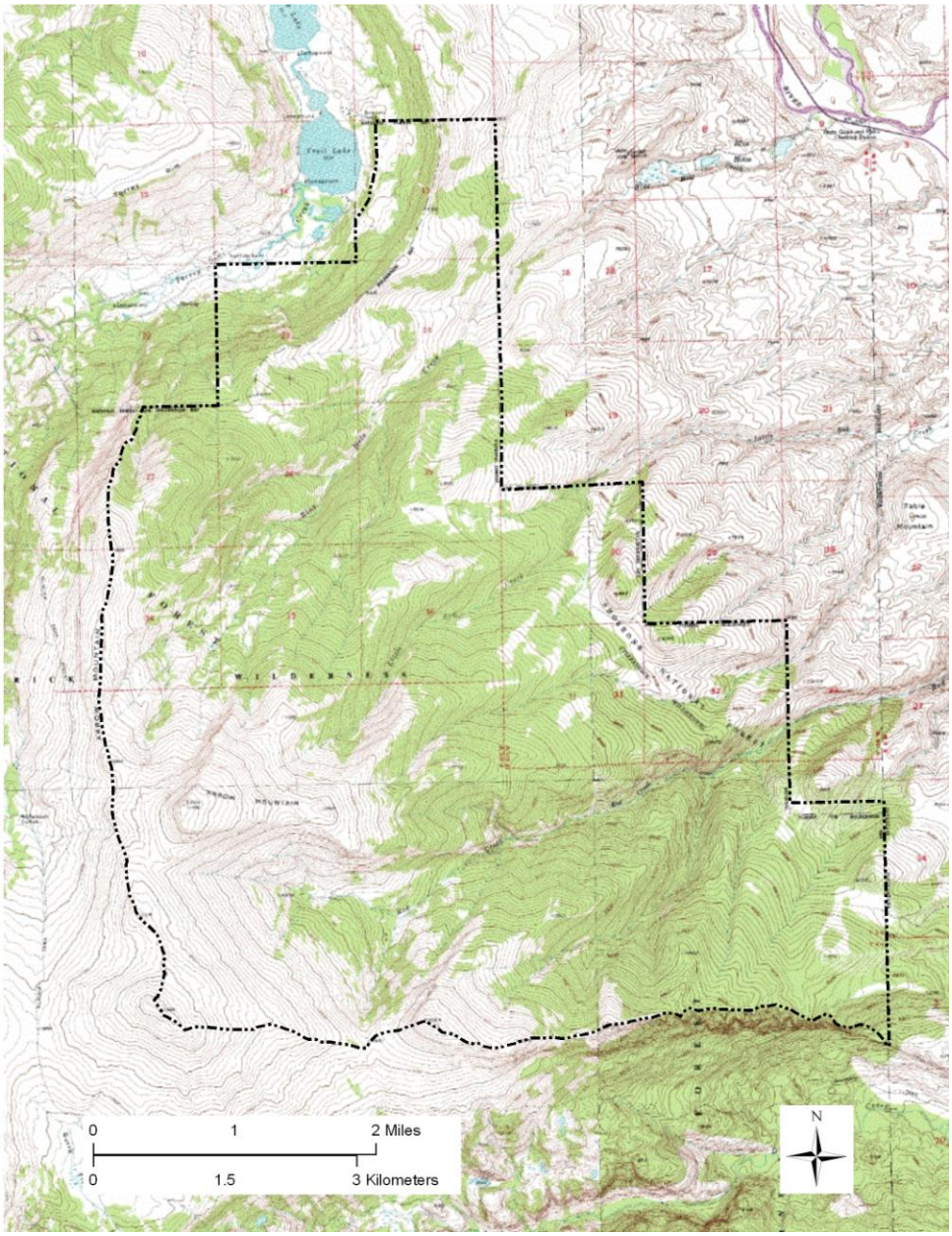

Figure 3. Complexes of plant associations in the potential Arrow Mountain Research Natural Area The plant associations present in each complex are listed in Table 1.

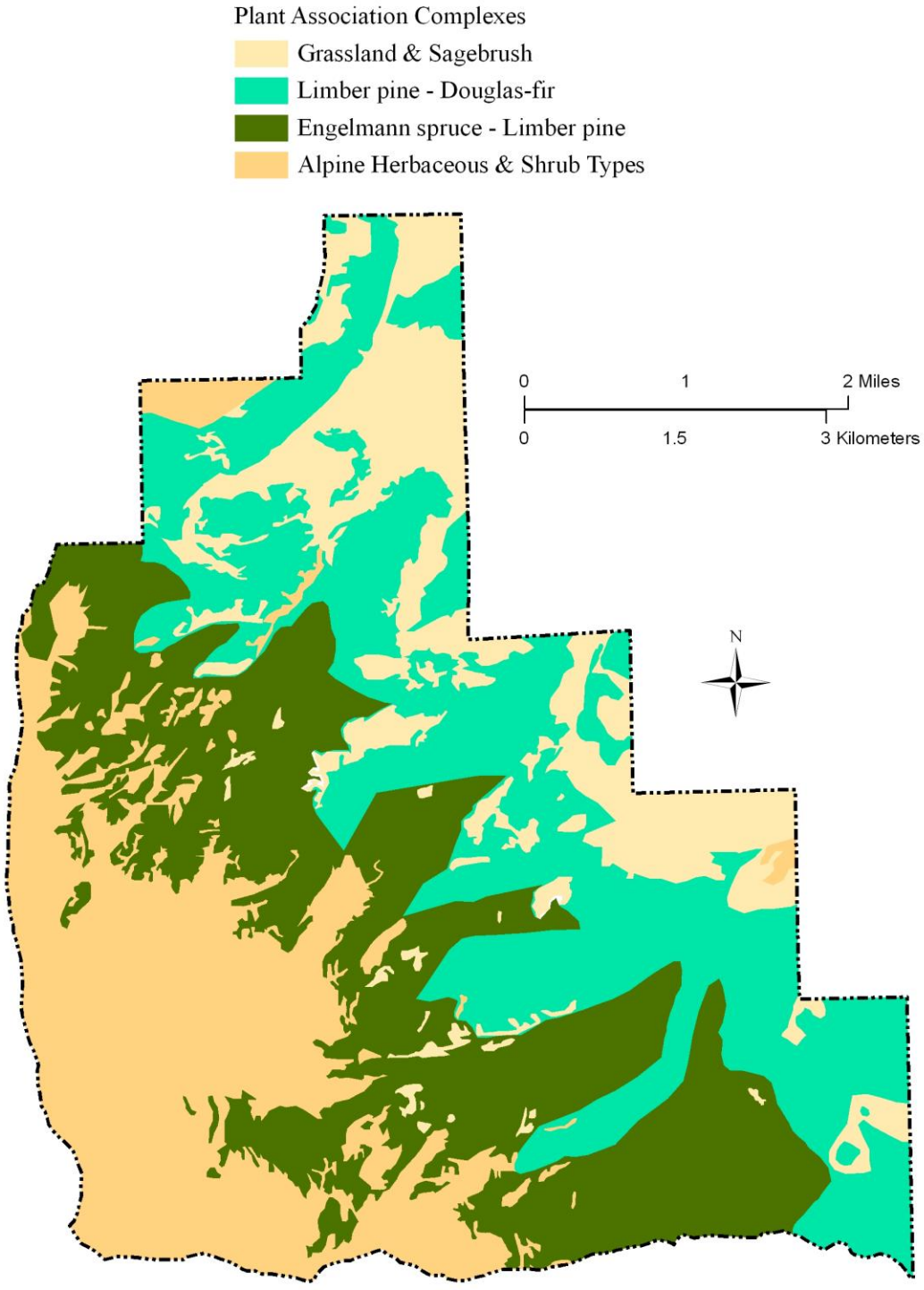

Figure 4. Complexes of Kuchler vegetation types (Kuchler 1964) in the potential Arrow Mountain Research Natural Area. Areas of these types are listed in Table 2.

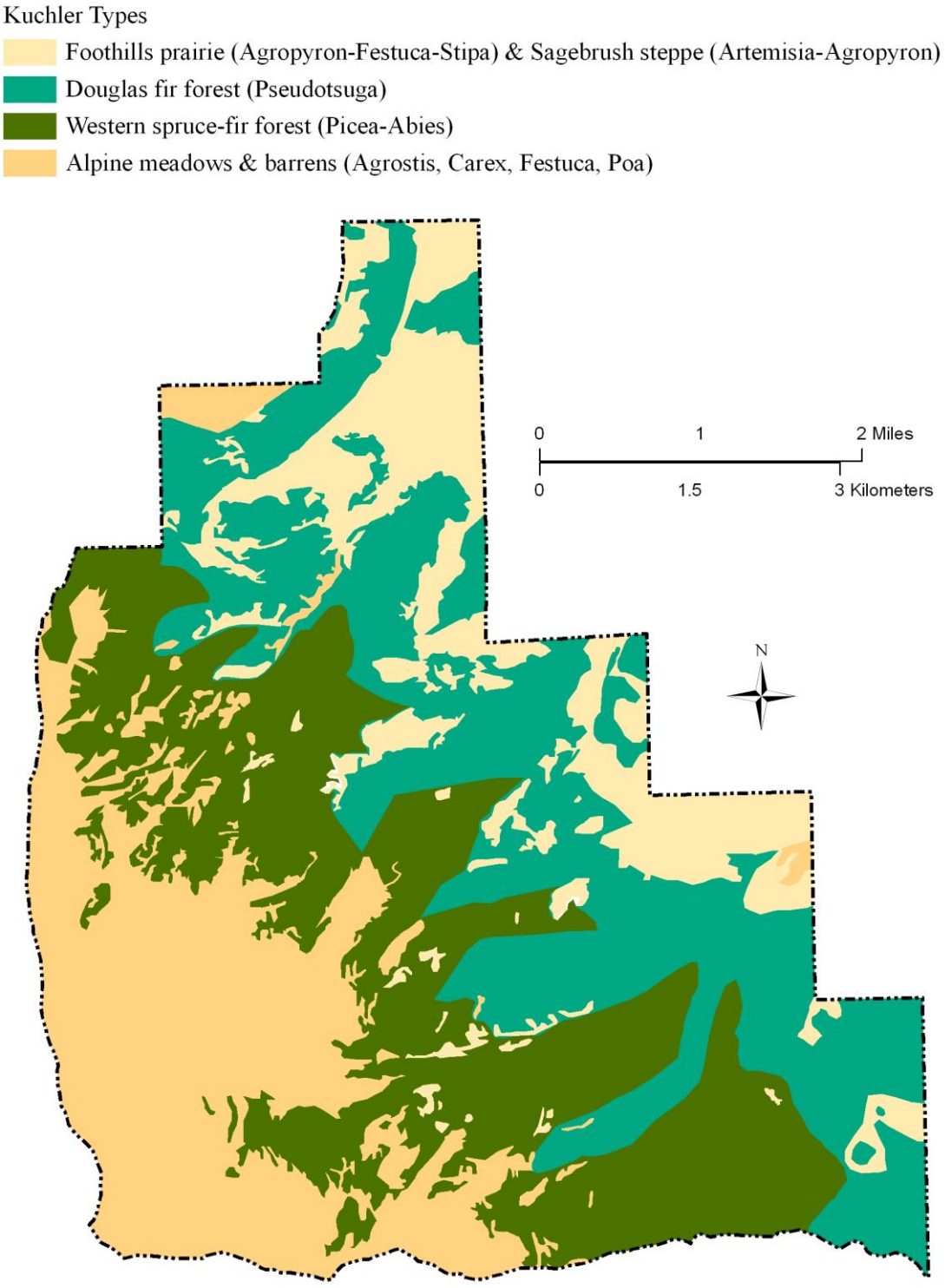

Figure 5. Complexes of habitat types (Steele *et al.* 1983, Tweit & Houston 1980) in the potential Arrow Mountain Research Natural Area. The habitat types present in each complex are listed in Table 3.

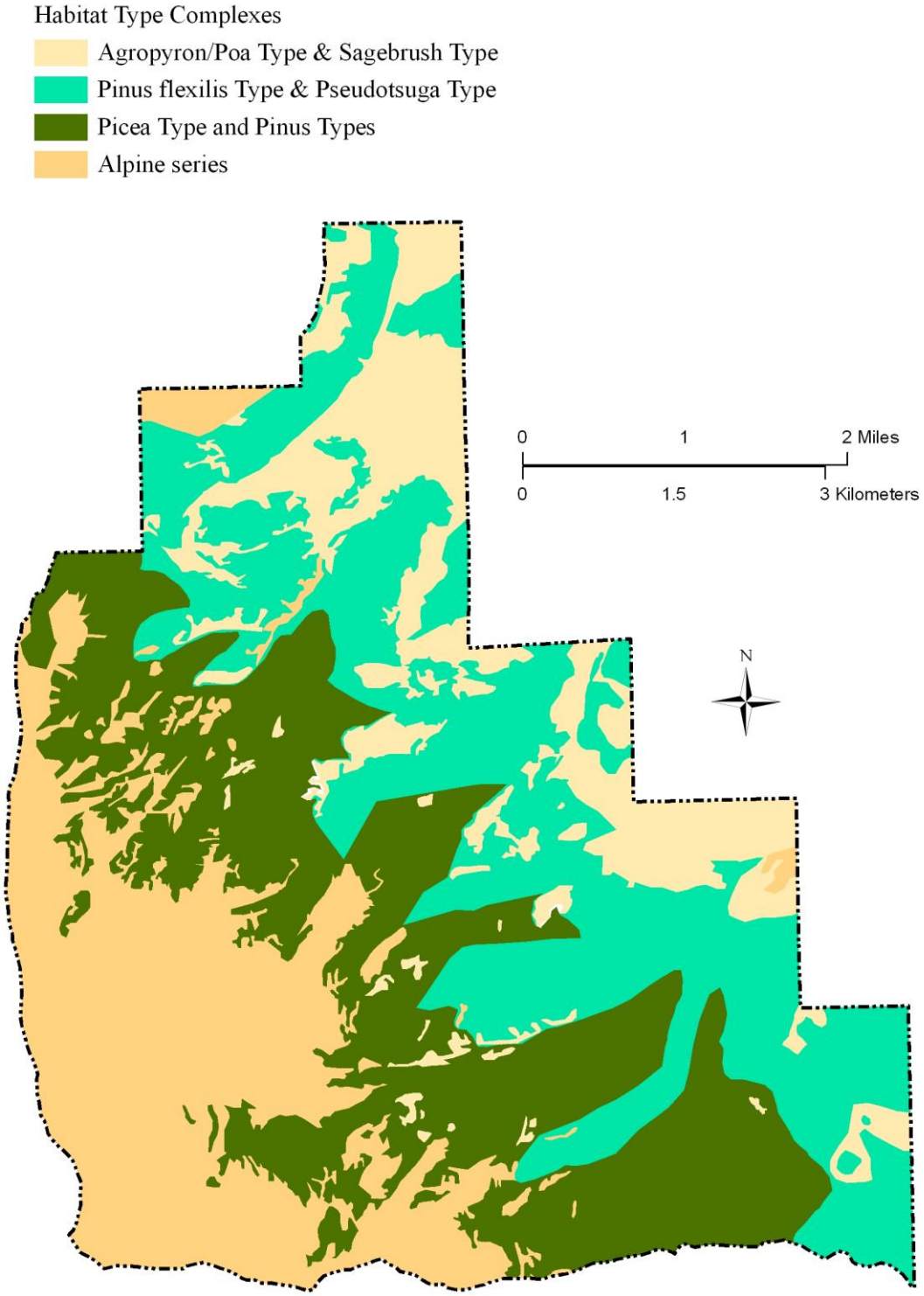

Figure 6. Society of American Foresters Cover Types (Eyre 1980) in the potential Arrow Mountain Research Natural Area. Areas of these types are shown in Table 4.

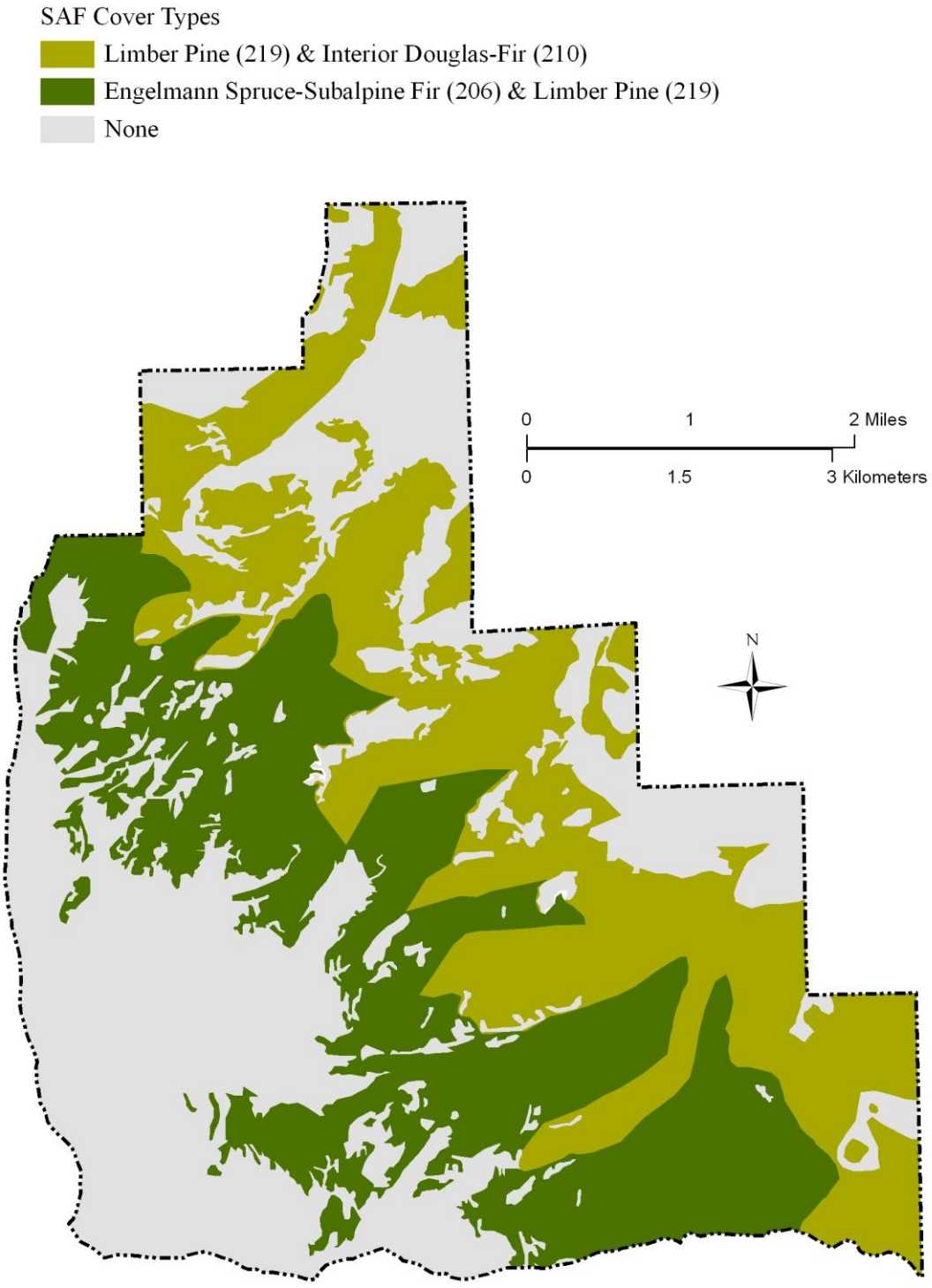

Figure 7. Ecological systems in the potential Arrow Mountain Research Natural Area. See following page for legend. Areas of these types are listed in Table 5

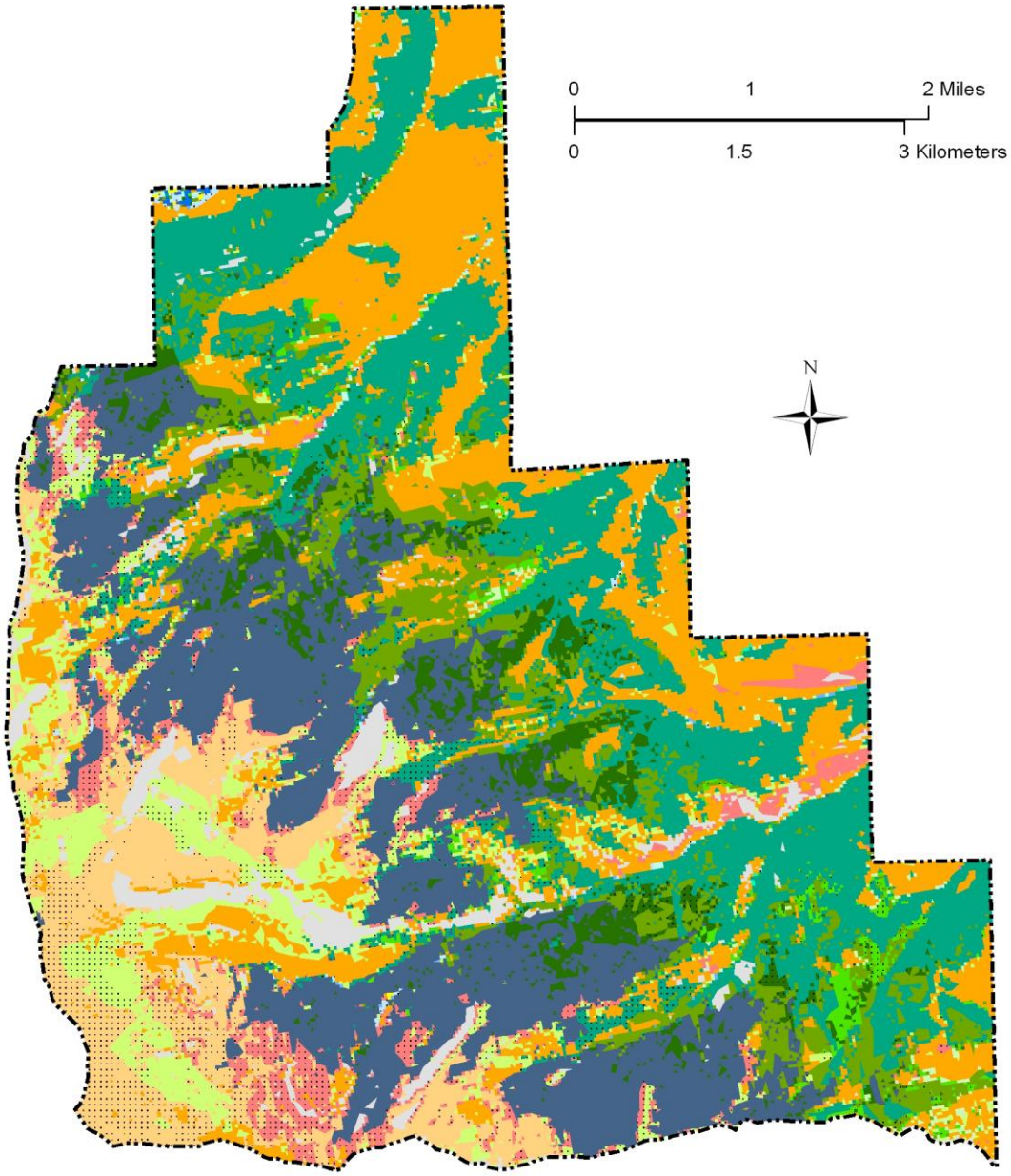

Figure 7 (continued). Legend for map of ecological systems in the potential Arrow Mountain Research Natural Area. System names are listed alphabetically in two groups. Systems in the first group ("Barren" through "Rocky Mountain Subalpine-Montane Mesic Meadow") each cover ≥ 1% of the area; systems in the second group each cover <1% of the area.

APPENDICES

APPENDIX 1. VASCULAR PLANT SPECIES DOCUMENTED IN THE POTENTIAL ARROW 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 Authorities	PLANTS Common Name
Trees	
Abies lasiocarpa (Hook.) Nutt.	subalpine fir
Picea engelmannii Parry ex Engelm.	Engelmann spruce
Pinus albicaulis Engelm.	whitebark pine
Pinus contorta Douglas ex Louden	lodgepole pine
Pinus flexilis James	limber pine
Pseudotsuga menziesii (Mirb.) Franco var. glauca (Beissn.) Franco	Rocky Mountain Douglas-fir
Shrubs	
Artemisia tridentata Nutt. ssp. vaseyana (Rydb.) Beetle	mountain big sagebrush
Betula glandulosa Michx.	resin birch
Dasiphora fruticosa (L.) Rydb. ssp. floribunda (Pursh) Kartesz	shrubby cinquefoil
Ribes inerme Rydb.	whitestem gooseberry
Ribes montigenum McClatchie	gooseberry currant
Salix brachycarpa Nutt.	shortfruit willow
Salix drummondiana Barratt ex Hook.	Drummond's willow
Salix glauca L.	grayleaf willow
Salix nivalis Hook.	snow willow
Salix petrophila Rydb.	alpine willow
Forbs	
Agoseris glauca (Pursh) Raf.	pale agoseris
Allium cernuum Roth	nodding onion
Androsace chamaejasme Wulfen ssp. carinata (Torr.) Hultén	sweetflower rockjasmine
Androsace septentrionalis L.	pygmyflower rockjasmine
Antennaria aromatica Evert	scented pussytoes
Antennaria media Greene	Rocky Mountain pussytoes
Antennaria microphylla Rydb.	littleleaf pussytoes
Aquilegia jonesii Parry	Jones' columbine
Arabis lyallii S. Watson	Lyall's rockcress
Arenaria congesta Nutt. var. congesta	ballhead sandwort
Arenaria congesta Nutt. var. lithophila (Rydb.) Maguire	rock-loving sandwort
Arnica angustifolia Vahl ssp. tomentosa (Macoun) G.W. Douglas & G. Ruyle-Douglas	narrowleaf arnica
Arnica gracilis Rydb.	smallhead arnica
Artemisia michauxiana Besser	Michaux's wormwood
Artemisia scopulorum A. Gray	alpine sagebrush
Astragalus kentrophyta A. Gray var. tegetarius (S. Watson) Dorn	mat milkvetch
Astragalus miser Douglas ex Hook. var. decumbens (Nutt. ex Torr. & A. Gray) Cronquist	prostrate milkvetch
Besseya wyomingensis (A. Nelson) Rydb.	Wyoming besseya
Bupleurum americanum J.M. Coult. & Rose	American thorow wax
Campanula uniflora L.	arctic bellflower
Castilleja flava S. Watson	yellow Indian paintbrush
Castilleja pulchella Rydb.	beautiful Indian paintbrush

Appendix I (continued).

PLANTS Accepted Scientific Name with Authorites	PLANTS Common Name
Cerastium beeringianum Cham. & Schltdl.	Bering chickweed
Chaenactis douglasii (Hook.) Hook. & Arn. var. alpina A. Gray	alpine dustymaiden
Cirsium pulcherrimum (Rydb.) K. Schum.	Wyoming thistle
Claytonia megarhiza (A. Gray) Parry ex S. Watson	alpine springbeauty
Cymopterus nivalis S. Watson	snowline springparsley
Draba oligosperma Hook.	beavertip draba
Draba oligosperma Hook.	fewseed draba
Draba paysonii J.F. Macbr. var. treleasii (O.E. Schulz) C.L. Hitchcock	Trelease's draba
Draba porsildii G. Mulligan	Porsild's draba
Dryas octopetala L. ssp. hookeriana (Juz.) Hultén	Hooker's mountain-avens
Epilobium L.	willowherb
Erigeron compositus Pursh	cutleaf daisy
Erigeron radicatus Hook.	taproot fleabane
Erigeron simplex Greene	onestem fleabane
Eriogonum flavum Nutt. var. flavum	alpine golden buckwheat
Eriogonum ovalifolium Nutt. var. purpureum (Nutt.) Durand	cushion buckwheat
Eriogonum umbellatum Torr. var. majus Hook.	sulphur-flower buckwheat
Eritrichium nanum (Vill.) Schrad. ex Gaudin var. elongatum (Rydb.) Cronquist	arctic alpine forget-me-not
Geum rossii (R. Br.) Ser. var. turbinatum (Rydb.) C.L. Hitchc.	Ross' avens
Ipomopsis spicata (Nutt.) V.E. Grant ssp. orchidaceae (Brand) Wilken & R.L. Hartm.	orchid ipomopsis
Lesquerella fremontii Rollins & Shaw	Fremont's bladderpod
Lewisia pygmaea (A. Gray) B.L. Rob.	alpine lewisia
Lloydia serotina (L.) Salisb. ex Rchb.	common alplily
Lomatium cous (S. Watson) J.M. Coult. & Rose	cous biscuitroot
Lupinus depressus Rydb.	depressed lupine
Mertensia alpina (Torr.) G. Don	alpine bluebells
Mertensia oblongifolia (Nutt.) G. Don	oblongleaf bluebells
Myosotis asiatica (Vesterg.) Schischkin & Sergievskaja	Asian forget-me-not
Neotorularia humilis (C.A. Mey.) Hedge & J. Léonard	low northern-rockcress
Oreostemma alpigenum (Torr. & A. Gray) Greene var. haydenii (Porter) G.L. Nesom	tundra aster
Oxytropis campestris (L.) DC. var. cusickii (Greenm.) Barneby	Cusick's locoweed
Oxytropis campestris (L.) DC. var. spicata Hook.	field locoweed
Oxytropis sericea Nutt.	white locoweed
Packera cana (Hook.) W.A. Weber & A. Löve	woolly groundsel
Packera streptanthifolia (Greene) W.A. Weber & A. Löve	Rocky Mountain groundsel
Parrya nudicaulis (L.) Regel	nakedstem wallflower
Pedicularis pulchella Pennell	mountain lousewort
Pedicularis parryi A. Gray ssp. parryi	Parry's lousewort
Phlox hoodii Richardson	spiny phlox
Phlox pulvinata (Wherry) Cronquist	cushion phlox
Polemonium viscosum Nutt.	sticky polemonium
Polygonum bistortoides Pursh	American bistort
Potentilla diversifolia Lehm. var. diversifolia	varileaf cinquefoil
Potentilla diversifolia Lehm. var. perdissecta (Rydb.) C.L. Hitchc.	mountainmeadow cinquefoil
Potentilla glandulosa Lindl. ssp. pseudorupestris (Rydb.) D.D. Keck	sticky cinquefoil
Potentilla ovina Macoun ex J.M. Macoun var. decurrens (S. Watson) S.L. Welsh & B.C. Johnst.	sheep cinquefoil
Potentilla ovina Macoun ex J.M. Macoun var. ovina	sheep cinquefoil

Appendix I (continued).

PLANTS Accepted Scientific Name with Authorites	PLANTS Common Name
Pteryxia hendersonii (J.M. Coult. & Rose) Mathias & Constance	Henderson's wavewing
Ranunculus eschscholtzii Schltdl. var. trisectus (Eastw.) L.D. Benson	threesection buttercup
Rhodiola integrifolia Raf. ssp. integrifolia	ledge stonecrop
Rumex paucifolius Nutt.	alpine sheep sorrel
Saussurea weberi Hultén	Weber's saw-wort
Saxifraga rhomboidea Greene	diamondleaf saxifrage
Senecio integerrimus Nutt. var. exaltatus (Nutt.) Cronquist	Columbia ragwort
Senecio lugens Richardson	small blacktip ragwort
Senecio sphaerocephalus Greene	ballhead ragwort
Silene acaulis (L.) Jacq. var. subacaulescens (F.N. Williams) Fernald & H. St. John	moss campion
Silene kingii (S. Watson) Bocquet	King's campion
Silene parryi (S. Watson) C.L. Hitchc. & Maguire	Parry's silene
Smelowskia calycina (Stephan ex Willd.) C.A. Mey. var. americana (Regel & Herder) Drury & Rollins	American false candytuft
Solidago multiradiata Aiton var. scopulorum A. Gray	manyray goldenrod
Stellaria longipes Goldie ssp. longipes	chickweed, starwort
Taraxacum officinale F.H. Wigg. ssp. ceratophorum (Ledeb.) Schinz ex Thell.	common dandelion
Tetraneuris acaulis (Pursh) Greene var. acaulis	stemless four-nerve daisy
Tetraneuris grandiflora (Torr. & A. Gray ex A. Gray) K.F. Parker	graylocks four-nerve daisy
Thalictrum alpinum L.	alpine meadow-rue
Townsendia parryi D.C. Eaton	Parry's Townsend daisy
Trifolium dasyphyllum Torr. & A. Gray	alpine clover
Trifolium haydenii Porter	Hayden's clover
Veronica wormskjoldii Roem. & Schult.	American alpine speedwell
Graminoids	
Bromus inermis Leyss. ssp. pumpellianus (Scribn.) Wagnon var. pumpellianus (Scribn.) C.L. Hitchc.	Pumpelly's brome
Calamagrostis purpurascens R. Br.	purple reedgrass
Carex duriuscula C.A. Mey.	needleleaf sedge
Carex elynoides T. Holm	blackroot sedge
Carex filifolia Nutt.	threadleaf sedge
Carex haydeniana Olney	cloud sedge
Carex heteroneura W. Boott var. epapillosa (Mack.) F.J. Herm.	different-nerve sedge
Carex incurviformis Mack. var. danaensis (Stacey) F.J. Herm.	coastal sand sedge
Carex microglochin Wahlenb.	fewseeded bog sedge
Carex misandra R. Br.	shortleaved sedge
Carex nardina Fr.	spike sedge
Carex nelsonii Mack.	Nelson's sedge
Carex norvegica Retz. ssp. stevenii (T. Holm) E. Murray	Steven's sedge
Carex praegracilis W. Boott	clustered field sedge
Carex rupestris All.	curly sedge
Carex scirpoidea Michx. ssp. pseudoscirpoidea (Rydb.) Dunlop	western singlespike sedge
Carex scopulorum T. Holm	mountain sedge
Deschampsia cespitosa (L.) P. Beauv.	tufted hairgrass
Eleocharis R. Br.	spikerush
Elymus scribneri (Vasey) M.E. Jones	spreading wheatgrass
Elymus trachycaulus (Link) Gould ex Shinners	slender wheatgrass
Festuca idahoensis Elmer	Idaho fescue

Appendix I (continued).

PLANTS Accepted Scientific Name with Authorites	PLANTS Common Name
Festuca saximontana Rydb.	Rocky Mountain fescue
Helictotrichon mortonianum (Scribn.) Henr.	Morton's alpine oatgrass
Juncus albescens (Lange) Fernald	northern white rush
Juncus drummondii E. Mey.	Drummond's rush
Juncus tweedyi Rydb.	Tweedy's rush
Koeleria macrantha (Ledeb.) Schult.	prairie Junegrass
Luzula spicata (L.) DC.	spiked woodrush
Poa abbreviata R. Br. ssp. pattersonii (Vasey) A. Löve & D. Löve & Kapoor	Patterson's bluegrass
Poa alpina L.	alpine bluegrass
Poa cusickii Vasey ssp. epilis (Scribn.) W.A. Weber	Cusick's bluegrass
Poa fendleriana (Steud.) Vasey	muttongrass
Poa glauca Vahl ssp. rupicola (Nash ex Rydb.) W.A. Weber	timberline bluegrass
!Poa pratensis L.	Kentucky bluegrass
Poa secunda J. Presl	Sandberg bluegrass
Trisetum spicatum (L.) K. Richt.	spike trisetum

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.