

DRAFT
ECOLOGICAL EVALUATION
for the
SMUGGLER MOUNTAIN POTENTIAL RESEARCH NATURAL AREA
WHITE RIVER NATIONAL FOREST
PITKIN COUNTY, COLORADO

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October, 1995

INTRODUCTION

The Smuggler Mountain potential Research Natural Area is located approximately two and one half miles southeast of Aspen, Colorado, in the Hunter Fryingpan Wilderness. It includes approximately 8,660 acres (3,505 ha.), consisting of forests dominated by Engelmann spruce and subalpine fir, and wetlands dominated by willows, sedges and mesic forbs. Use of the area is very limited, in spite of its proximity to Aspen.

LAND MANAGEMENT PLANNING

This document has been prepared by the Colorado Natural Heritage Program through a Challenge Cost-Share Agreement with the White River National Forest to produce Ecological Evaluations of potential Research Natural Areas. These evaluations are intended to aid the National Forest in environmental analysis during revision of their Forest Management Plan. The specific areas and boundaries for evaluation were chosen by the White River National Forest.

OBJECTIVES

One of the primary objectives of RNAs as listed in the Forest Service Manual (4063.02, USDA Forest Service 1990) is to "preserve a wide spectrum of pristine representative areas that typify important forest, shrubland, grassland, alpine, aquatic, geologic and similar natural situations..." The Smuggler Mountain potential RNA would meet this objective by representing a number of plant associations within the spruce/fir, wetland and subalpine grassland alliances. The area is of particular interest as an example of subalpine wetlands, including sedge dominated fens and willow carrs, and is home to one of Colorado's rare plants, *Eriophorum altaicum var. neogaeum*, or whitebristle cottongrass, ranked G4T? S2 by the Colorado Natural Heritage Program (1995a). A Smuggler Mountain RNA would meet further objectives of the RNA system by (1) protecting elements of biodiversity, (2) serving as a reference area for the study of succession and long-term ecological changes, particularly in wetlands, (3) providing a site for non-manipulative scientific research, and (4) serving as a control area for comparing results of manipulative research and resource management in other areas with similar ecosystem types. In order to accomplish these objectives, a Smuggler Mountain RNA should be managed to maintain, as much as possible, the natural composition, structure, and function of the area's ecosystems (Andrews 1993).

PRINCIPAL DISTINGUISHING FEATURES

The Smuggler Mountain potential RNA is located in the West Elk Mountains, in the drainage of the Roaring Fork River. Elevations in the area range from 9,000 ft., along Hunter Creek on the northern boundary, to 12,721 feet on the eastern boundary. Most of the area is between 11,000 and 12,000 ft. The central part of the RNA has extensive subalpine wetlands which drain to the north and west.

Ecoregion: The area occurs within the North Central Highlands and Rocky Mountain Section (M311H) of Bailey's (1994) map of the ecoregions of the United States.

Physiography and Geology: Smuggler Mountain is located in the Southern Rocky Mountain Province (Fenneman 1931), in the Sawatch Range, a massive faulted anticline produced by the uplift of Precambrian rock, with intrusions of igneous rocks. The Precambrian quartz monzonite has been weathered and covered by glacial moraines and colluvium (Bryant and Martin 1988).

Soils: Soils are light brown, granitic, mostly coarse sand or fine gravel. Newly weathered mineral soils were evident on upper slopes and in the bottoms of streams, whereas there were highly organic peat soils in the wet forest and fens.

Vegetation: The area is characterized by moist, boggy, forests of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*), with an understory of whortleberry (*Vaccinium myrtillus*). Other species commonly associated with the spruce and fir are sickletop lousewort (*Pedicularis racemosa*), elk sedge (*Carex geyeri*), and heartleaf arnica (*Arnica cordifolia*) in the drier sites; and heartleaf bittercress (*Cardamine cordifolia*), five-stamen miterwort (*Mitella pentandra*) and mosses in the wetter places. Some stands may qualify as old growth, with spruce up to 30 inches dbh. The forest is interrupted by many fens and willow carrs with sedges, spike rushes, tufted hairgrass (*Deschampsia cespitosa*), planeleaf willow (*Salix planifolia*) and mesic forbs. *Eriophorum altaicum* var. *neogaeum*, or "whitebristle cottongrass," a Colorado Natural Heritage Program species of special concern, was found in these wet meadows (Colorado Natural Heritage Program 1995a). The extreme western part of the area, which was not seen during this survey, is mapped as lodgepole pine and Douglas fir by the Forest Service, and was therefore mapped as such in this document, although it has not been field checked.

Natural Disturbances: Evidence of past fire was observed in small areas, which seem to indicate lightning strikes which failed to spread, perhaps because of the wetness of the area.

Human Use: There is very little human use of the area. There is an old road from Warren Lakes to the large meadow sampled in plots 2 and 3. The road is closed but has little revegetation. It becomes a single track trail along the edge of meadow, and then fades out. There was one campsite near the end of that road, and then no other signs of human impacts were observed beyond that point. An old pack trail by No Name Creek appears to be little used, and is not maintained by the forest service, but is visible. It is probably maintained by deer and elk. No evidence was seen of logging or grazing. However, the area was grazed historically by domestic sheep, and forest service personnel have seen some remains of old sheepherders' camps in the area.

LOCATION

National Forest, County, and Legal Description. The potential RNA is located on the Aspen District of the White River National Forest, in Pitkin County. It occupies all or part of T10S, R84 W, Sections 1 - 3, 11 - 14, 22 - 27, 35 and 36; and T10S, R83W, Sections 17 - 20, and 28 - 33.

Maps.

USDA Forest Service 1:126,720 map of White River National forest, 1991.

U. S. Geological Survey 1: 24,000 topographic maps: Thimble Rock (3910626); and Aspen (3910627).

Total Acreage and Elevation. The area comprises approximately 8,660 acres (3,504 ha.), ranging in elevation from 9,000 ft. to 12,721 ft. (2,743 m. to 3,877 m.)

Boundary Description. The northeastern boundary is defined by Hunter Creek, from its intersection with the Hunter Fryingpan Wilderness boundary to the confluence of No Name Creek; thence southeast along the ridges connecting the summits of a series of unnamed peaks with elevations shown on the Aspen USGS map as 11,530 ft., 12,125 ft., 12,721 ft., (then southwest to) 12,478 ft., and 12,321 ft.; then south to the wilderness boundary. The southern and eastern margins are defined by the wilderness boundary, to its intersection with Hunter Creek.

Access and Travel Routes: The nearest road to the potential RNA is the Smuggler Mine Road from the town of Aspen. This road is heavily used by day hikers, bicyclists, 4-wheelers and motorcycles, and is suitable only for 4-wheel drive vehicles with good clearance. There is a gate at the private property boundary at Warren Lakes, with intimidating signs, and no trail into the RNA, which probably accounts for its being little used by recreationists. By bushwhacking around the hill to the south, one can intercept an old road at the south end of Warren Lake, at the wilderness boundary, which is signed. This road is closed, but only partially revegetated, and leads to a large meadow/wetland, where it becomes a single track, and then disappears. A pack trail, which is shown on the USGS topo, but not on the forest map, runs from the north end of Warren Lake northeast to No Name and Hunter Creeks, and southeast through the area to Midway Pass. The trail is still in existence, but not maintained, and appears to be little used. There are no roads or maintained trails within the potential RNA. However, there are numerous game trails in the area, and route finding is easily accomplished by referring to the shapes of non-forested areas.

AREA BY COVER TYPES

The cover type map of the site with acreages of each cover type is attached. Aerial photo interpretation and field observation indicate that the area is approximately 69% Engelmann spruce/subalpine fir forest with *Vaccinium myrtillus* understory, 7% lodgepole pine, 20% sedge wetlands and subalpine grass-forb meadows, and 4% barren rock.

Vegetation was mapped based on interpretation of aerial photographs (USDA Color infra-red, 1:58,000, and USGS Ortho photographs, 1:24,000); topographic maps; and field observation. Not all areas have been field checked. In cases where a mixture of cover types was impossible to separate, polygons were mapped as mixtures. Acreage for each major cover type was determined by using a planimeter to measure areas of polygons on the attached map. Mixed polygons were arbitrarily assumed to contain equal amounts of each cover type to arrive at the estimated acreages below.

Table 1.

Society of American Foresters Cover Types (Eyre 1980)

Type (SAF no.)	Acres	Hectares
Engelmann spruce-subalpine fir (206)	5,923	2,397
Lodgepole pine (218)	623	252
Interior Douglas fir	35	14
Non-forested	2,079	841
Total	8,660	3,504

Table 2.

Kuchler Cover Types (Kuchler 1985)

Type (No.)	Acres	Hectares
Western spruce-fir forest (14) (Includes lodgepole pine)	6,546	2,649
Pine-Douglas fir forest (17)	35	14
Alpine meadows and barren (45)	2,079	841
Total	8,660	3,504

Table 3.
Plant Series / Plant Associations

If the series or plant association is well represented in the area it is given an M for major representation. If the series or plant association covers only a small area, it is given an m for minor representation. Plant association names which are from Johnston (1987) are given using his nomenclature. For updated plant association names using SCS nomenclature see Appendix 1. For common names and plant name synonyms, see Appendix 2.

Series / Plant Association (see plot data for cross references with CNHP names)	Representation	Acres	Hectares
<u>Abies lasiocarpa-Picea engelmannii</u>	M	5,923	2,397
Abies lasiocarpa-Picea engelmannii / Vaccinium myrtillus	M		
<u>Pinus contorta</u> (no plots)	M	623	252
<u>Pseudotsuga menziesii</u> (no plots)	m	35	14
<u>Salix spp.</u>	M	663	268
Salix phylicifolia ssp. planifolia / Deschampsia cespitosa	M		
Salix phylicifolia ssp. planifolia / Carex aquatilis	M		
Salix phylicifolia ssp. planifolia / Carex scopulorum	M		
<u>Grass and forb series and plant associations</u>	M	1,055	427
<u>Mesophytic Sod-Forming Subalpine - Alpine Grasslands</u> (Kittel et al. 1994)	M		
Eleocharis quinqueflora (Kittel et al. 1994)	M		
<u>Tufted Hairgrass, Reedgrass, Sedge and Forb Series</u>	M		
Cardamine cordifolia / Caltha leptosepala	M		
Deschampsia cespitosa / Carex spp.	M		
Vaccinium myrtillus / Sibbaldia procumbens / Moss	m		
Barren		361	146
Total acreage		8,660	3,504

Description of Values

Flora:

Threatened and Endangered species. One Colorado Natural Heritage Program species of special concern was found: *Eriophorum altaicum* var. *neogaeum*, or “whitebristle cottongrass” occurred in subalpine fens with *Deschampsia cespitosa*, *Pedicularis groenlandica* and sedges. This species is listed as sensitive by the forest service. It is ranked G4T? S2 by the Colorado Natural Heritage Program (1995a).

Exotic species: No exotic species were observed, not even *Poa pratensis*, although *Taraxacum officinale* has been reported by district personnel.

Vegetation: This area contains an ecosystem unique among the Potential RNAs seen so far: extensive subalpine fens and meadows dominated by sedges and forbs. Other wetlands occur in Difficult Creek, but most there are dominated by willows. This area also has the wettest spruce-fir forests observed.

Fauna: Wildlife or their sign observed in the area included deer, elk, marmot, squirrels. Other species known from the area are ptarmigan and pica. The wetlands may provide habitat for the boreal toad, and other amphibians. Undoubtedly, the area serves as suitable habitat for a wide variety of vertebrates and invertebrates which were not documented during this brief survey.

Threatened and endangered species: None were observed.

Exotic species: None were observed.

Lands: The potential RNA is entirely within the Hunter-Fryingpan Wilderness on the White River National Forest, and under National Forest management. There is private land adjoining the area on the west at Warren Lakes. This has been purchased by the Vail Association, and may be available for trade.

Impacts and Possible Conflicts:

Mineral resources: Peat has been mined in the past at Warren Lakes. The area is protected from future mineral exploration by its wilderness status. However, any claims in existence before 1964 could still be activated.

Grazing: The area was grazed historically, but not within recent time.

Timber: The area is not known to have been logged.

Watershed:

Forest Service personnel advise that there is a water diversion to a tunnel at No Name Creek.

Evaluation

Criteria of quality, condition, viability and defensibility were developed by the Rocky Mountain Region to assess how well a potential RNA meets RNA qualification (Andrews 1993). These criteria are based on those developed by the Colorado Natural Heritage Program to evaluate occurrences of individual elements and communities.

Quality is based on how well a site represents the targeted ecosystem type or protected biodiversity elements.

Condition refers to the naturalness of the site and the degree to which it has been degraded or altered from presettlement conditions.

Viability is the prospect for long-term survival of the ecosystem and its protected elements.

Defensibility is the extent to which the site can be protected from extrinsic anthropogenic factors.

The Smuggler Mountain potential RNA has been evaluated according to these criteria as follows:

Quality: The area contains the best representation of wet subalpine forests and fens seen during this survey.

Condition: There were no exotic species or significant human impacts observed.

Viability: Under present management, the ecosystem is not apt to sustain significant changes.

Defensibility: The area is entirely within the White River National Forest, and under its management.

Literature Cited

- Andrews, T. 1993. Research Natural Area Guide for the Rocky Mountain Region, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
- Bailey, R. G., P. E. Avers, T. King and W. H. McNab. 1994. Ecoregions and Subregions of the United States. Prepared for the USDA Forest Service by the U. S. Geological Survey.
- Bourgeron, P. S. and L. D. Engelking, eds. 1994. A Preliminary Vegetation Classification of the Western United States. Unpublished report prepared by the Western Heritage Task Force for the Nature Conservancy, Boulder, CO.
- Bryant, Bruce and Peter L. Martin. 1988. The Geologic Story of the Aspen Region. U. S. Geological Survey Bulletin 1603. U. S. Government Printing Office, Washington DC.
- Colorado Natural Heritage Program. 1995a. Colorado's Natural Heritage: Rare and Imperiled Animals, Plants, and Natural Communities. CNHP, Fort Collins, CO.
- Colorado Natural Heritage Program. 1995b. Significant Natural Communities found in Colorado. CNHP, Fort Collins, CO
- Eyre, F. S., ed. 1980. Forest Cover Types of the United States and Canada. Society of American Foresters, Washington.
- Fenneman, N. M. 1931. Physiography of Western United States. McGraw Hill Book Co., New York.
- Hess, Karl and Clinton H. Wasser. 1982. Grassland, Shrubland, and Forestland Habitat Types of the White River-Arapaho National Forest.
- Johnston, Barry. 1987. Plant Associations of Region Two, Edition 4. USDA Forest Service, Lakewood, CO.
- Kittel, Gwen, Renee Rondeau, Nan Lederer and Dan Randolph. 1994. A Classification of the Riparian Vegetation of the White and Colorado River Basins, Colorado. Colorado Natural Heritage Program, Boulder, CO.
- Kuchler, A. W. 1985. Map of the potential natural vegetation of the coterminous United States. American Geographical Society, New York.
- Padgett, W. G., A. P. Youngblood, and A. H. Winward. 1989. Riparian Community Type Classification of Utah and Southeastern Idaho. USDA Forest Service Intermountain Region. R4-ECOL-89-01.
- USDA Forest Service. 1990. Forest Service Manual 4063.
- USDA Soil Conservation Service. 1994. PLANTS. Plants of Colorado--Alphabetical Listing.
- Weber, William A. 1987. Colorado Flora: Western Slope. Colorado Associated University Press, Boulder, CO.

APPENDIX 1

PLOT DATA FOR PLANT ASSOCIATIONS SAMPLED

Plant Association names are from Johnston (1987) or Hess and Wasser (1982) whenever a reasonably good fit can be found in those publications. Plant association names, edited to include the more recent plant species names from USDA Soil Conservation Service (1994), are given in parentheses where there are differences. Plant Association names are cross referenced with the names used by the Colorado Natural Heritage Program wherever possible. CNHP names are listed in bold type, followed by their global and state ranks.

Plant species coverage within plots was estimated into cover classes, and species are listed alphabetically within each class. Because of time limitations, not all species within the plots were always identified or collected. Plant species names are from USDA Soil Conservation Service (1994). Where these species names differ from Weber (1987), the Weber names are shown in parentheses. For instances in which the Weber and SCS names differ from Johnston (1987), the plant species names used by Johnston are given in parentheses and followed by *. See Appendix 2 for common names.

Abies lasiocarpa-Picea engelmannii / Vaccinium myrtillus p.a. (Johnston 1987)
(This seems to be a little higher and wetter than the association described.)

Abies lasiocarpa / Vaccinium myrtillus p. a. G5S5 (Colorado Natural Heritage Program 1995 b)

Plot 1 (100 X 100 ft.)

Located just inside the wilderness boundary south of Warren Lake.

UTM's: 348,500 E / 4,336,750 N

USGS Quadrangle: Aspen 3910627

Elevation: 10,840 ft.

Slope: 5 degrees

Aspect: 360 degrees

Bare ground		5 - 25
Rock		< 1
Picea engelmannii	Engelmann's spruce	50 - 75
Vaccinium myrtillus var. oreophilus	whortleberry	25 - 50
Moss and lichen		25 - 50
Arnica cordifolia	heartleaf arnica	5 - 25
Vaccinium cespitosum	dwarf blueberry	1 - 5
Polemonium pulcherrimum	ssp. delicatum skunkweed polemonium	< 1
Pedicularis racemosa	sickle-top lousewort	< 1

Spike-rush (*Eleocharis quinqueflora*) p.a. (Kittel et al., 1994)

Kittel et al. (1994) note that this community is sensitive to trampling and heavy equipment.

***Eleocharis quinqueflora* alpine wetland p. a. G4S? (Colorado Natural Heritage Program 1995 b)**

Plot 2 (A and B)

UTM's: 349,200 E / 4,335,950 N

USGS Quadrangle: Thimble Rock 3910626

Elevation: 11,120 ft.

Slope: level

Aspect: NA

Plot 2 A (20 X 20 ft) In center of fen, wettest area

Bare ground		< 1
Rock		< 1
Open water		1 - 5
<i>Eleocharis quinqueflora</i>	fewflower spikerush	50 - 75
<i>Deschampsia cespitosa</i>	tufted hairgrass	5 - 25
<i>Carex utriculata</i>	Northwest Territory sedge	5 - 25
<i>Pedicularis groenlandica</i>	elephanthead lousewort	< 1

Plot 2 B(20 X 20 ft.) Toward edge of fen, a little less wet than 2A, but with some standing water.
(more open water than A, because the vegetation is tufted, and water more shallow)

Bare ground		< 1
Rock		< 1
Open water		5 - 25
<i>Eleocharis quinqueflora</i>	fewflower spikerush	25 - 50
<i>Caltha leptosepala</i>	white marshmarigold	25 - 50
Moss sp.		5 - 25
<i>Deschampsia cespitosa</i>	tufted hairgrass	1 - 5
<i>Carex ebenea</i>	ebony sedge	1 - 5
<i>Carex aquatilis</i> var. <i>stans</i>	water sedge	1 - 5
<i>Senecio dimorphophyllus</i>	splitleaf groundsel	< 1
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	whitebristle cottongrass	< 1
<i>Saxifraga oregana</i> (<i>Micranthes</i>)	Oregon saxifrage	< 1
<i>Pedicularis groenlandica</i>	elephanthead lousewort	< 1

Salix phylicifolia ssp. planifolia / Carex aquatilis p.a. (Johnston 1987)

This is a good fit, except that there is no *Betula glandulosa* in this area. Also similar to Salix phylicifolia ssp. planifolia / Caltha leptosepala p.a., but there is no *Ligusticum porteri*, *Delphinium barbeyi*, *Pseudocymopterus montanus* or *Achillea lanulosa* here, perhaps because this is higher than the usual range of those species.

See also Bourgeron and Engelking (1994) III.B.3.c. *Salix planifolia*/*Carex aquatilis*, ref. 162, 1027,1037,1040,1052,1134,270,1197 1027,1037,1040,1052,1134,270,1197

Salix planifolia / Carex aquatilis p. a. GU S? (Colorado Natural Heritage Program 1995 b)

Plot 3 (50 X 50 ft.)

Sampled in wet meadow northwest of Warren Peak (headwaters of unnamed tributary of Roaring Fork.)

Meadow is surrounded by boggy spruce-fir forest

(Largest spruce 36 in. dbh)

UTM's: 349,650 E / 4,335,050 N

USGS Quadrangle: Thimble Rock 3910626

Elevation: 11,040 ft.

Slope: 5 degrees

Aspect: 360 degrees

Bare ground		< 1	
Rock		< 1	
<i>Salix planifolia</i> (<i>S. phylicifolia</i> ssp. <i>planifolia</i>)	diamondleaf willow		50 - 75
Moss		75 - 95	
<i>Carex aquatilis</i> var. <i>stans</i>	water sedge	25 - 50	
<i>Caltha leptosepala</i>	white marshmarigold	25 - 50	
<i>Pedicularis groenlandica</i>	elephanthead lousewort	5 - 25	
<i>Senecio triangularis</i>	arrowleaf groundsel	1 - 5	
<i>Saxifraga oregana</i> (<i>Micranthes</i>)	Oregon saxifrage	1 - 5	
<i>Sedum rhodanthum</i> (<i>Clementsia</i>)	redpod stonecrop	< 1	
<i>Ranunculus alismaefolius</i>	waterplantain buttercup	< 1	

Cardamine cordifolia / Caltha leptosepala p.a. (Johnston 1987)

Cardamine cordifolia / Caltha leptosepala p. a. GU S? (Colorado Natural Heritage Program 1995 b)

Plot 4 (10 X 30 ft.)

Sampled along small (1 foot wide) stream, in area with saturated soil and large boulders, 2-4 ft. diameter.

UTM's: 350,000 E / 4,334,450 N

USGS Quadrangle: Thimble Rock 3910626

Elevation: 11,320 ft.

Slope: 10 degrees

Aspect: 270 degrees

Bare ground		1 - 5
Rock		25 - 50
Water		5 - 25
Cardamine cordifolia	heartleaf bittercress	25 - 50
Moss sp.		25 - 50
Caltha leptosepala	white marshmarigold	5 - 25
Carex aquatilis var. stans	water sedge	5 - 25
Saxifraga odontoloma (Micranthes)	brook saxifrage	5 - 25
Senecio triangularis	arrowleaf groundsel	5 - 25
Oxypolis fendleri	Fendler's cowbane	1 - 5
Picea engelmannii	Engelmann's spruce	1 - 5
Pedicularis groenlandica	elephanthead lousewort	< 1
Primula parryi	Parry's primrose	< 1

Deschampsia cespitosa / Carex spp. p.a. (Johnston 1987)

Also similar to Deschampsia cespitosa / Juncus drummondii p.a. (Johnston 1987)

Kittel et al. note that “presence of this community type without abundance of *Poa pratensis*, *Juncus balticus* and *Taraxacum officinale* may indicate non-disturbance conditions according to Padgett et al. (1989).”

Deschampsia cespitosa / Carex spp. p. a. GU SU (Colorado Natural Heritage Program 1995 b)

Plot 5 (50 X 50 ft.) photo 1.

Sampled in boulder field on north facing hillside, west side of Warren Peak, near top (base of saddle).
Probably a late snow-melt area, although it is well-drained.

UTM's: 350,050 E / 4,334,150 N

USGS Quadrangle: Thimble Rock 3910626

Elevation: 11,680 ft.

Slope: 30 degrees

Aspect: 360 degrees

Bare ground		< 1
Rock		25 - 50
Carex illota	sheep sedge	25 - 50
Deschampsia cespitosa	tufted hairgrass	5 - 25
Juncus drummondii	Drummond's rush	5 - 25
Poa fendleriana (P. cusickii ssp. epilis)	muttongrass	5 - 25
Arnica cordifolia	heartleaf arnica	1 - 5
Carex norvegica ssp. norvegica	Norway sedge	1 - 5
Danthonia intermedia	timber oatgrass	1 - 5
Erigeron melanocephalus	blackhead fleabane	1 - 5
Erigeron peregrinus ssp. callianthemus	subalpine fleabane	1 - 5
Potentilla diversifolia	varileaf cinquefoil	1 - 5
Sibbaldia procumbens	creeping sibbaldia	1 - 5
Thlaspi montanum (Noccaea)	alpine pennycress	1 - 5
Artemisia scopulorum	alpine sagebrush	< 1
Castilleja occidentalis	western Indian paintbrush	< 1
Mertensia ciliata	mountain bluebells	< 1
Penstemon whippleanus	Whipple's penstemon	< 1
Phleum alpinum (P. commutatum)	alpine timothy	< 1
Primula parryi	Parry's primrose	< 1
Saxifraga rhomboidea (Micranthes)	diamondleaf saxifrage	< 1
Senecio amplexans var. amplexans (Ligularia)	showy alpine groundsel	< 1

Vaccinium myrtilus / Sibbaldia procumbens - Moss sp. potential p.a. (unclassified)

Similar to Sibbaldia procumbens / Carex ebenea p.a. (Johnston 1987) except for the abundance of *Vaccinium*.

See also Bourgeron and Engelking (1994) V.C.6.b. *Sibbaldia procumbens*-*Polygonum bistortoides*, ref. 12, 746.

Sibbaldia procumbens p. a. G4G5 S4S5 (Colorado Natural Heritage Program 1995 b)

Plot 6 (50 X 50 ft.) photo 8-1

Sampled in saddle west of Warren Peak, just above plot 5. Drier, windswept and more level, with deeper soil but less protection from rocks, which are about half buried.

UTM's: 350,100 E / 4,333,900 N

USGS Quadrangle: Thimble Rock 3910626

Elevation: 11,760 ft.

Slope: 10 degrees

Aspect: 332 degrees

Bare ground		1 - 5
Rock		5 - 25
Moss-lichen		50 - 75
Sibbaldia procumbens	creeping sibbaldia	25 - 50
<i>Vaccinium myrtilus</i> var. <i>oreophilum</i>	whortleberry	25 - 50
<i>Erigeron melanocephalus</i>	blackhead fleabane	1 - 5
<i>Erigeron simplex</i>	onestem fleabane	1 - 5
<i>Artemisia scopulorum</i>	alpine sagebrush	1 - 5
<i>Poa fendleriana</i> (<i>Poa cusickii</i> ssp. <i>epilis</i>)	muttongrass	1 - 5
<i>Viola labradorica</i>	alpine violet	1 - 5
<i>Deschampsia cespitosa</i>	tufted hairgrass	1 - 5
<i>Potentilla diversifolia</i>	varileaf cinquefoil	< 1
<i>Carex ebenea</i>	ebony sedge	< 1

Abies lasiocarpa-Picea engelmannii / Vaccinium myrtillus p.a. (Johnston 1987)
Similar to Picea engelmannii / Vaccinium myrtillus p.a. (Johnston 1987)

Abies lasiocarpa / Vaccinium myrtillus p.a. G5 S5 (Colorado Natural Heritage Program 1995 b)

Plot 7 (100 X 100 ft.) No photo

Sampled on south side of Warren Peak. No trees were very large, but all age classes were represented. One lodgepole pine was seen in the area, not in the plot.

UTM's: 350,400 E / 4,333,700 N

USGS Quadrangle: Thimble Rock 3910626

Elevation: 11,840 ft.

Slope: 45 degrees

Aspect: 267 degrees

Bare ground		25 - 50
Picea engelmannii	Engelmann's spruce	25 - 50
Vaccinium myrtillus var. oreophilum	whortleberry	25 - 50
Carex geeyeri	elk sedge	5 - 25
Arnica cordifolia	heartleaf arnica	5 - 25

Similar to Salix phylicifolia ssp. planifolia / Carex scopulorum p.a. (Johnston 1987)
and Salix phylicifolia ssp. planifolia / Deschampsia cespitosa p.a. (Johnston 1987)

Carex illota alpine wetland p. a. GU S? (Colorado Natural Heritage Program 1995 b)

Plot 8 (5 X 20 ft.) Photos 3 and 4, roll 8

Sampled in the narrow band containing *Eriophorum altaicum* (Colorado species of Special Concern), in the ecotone between a dryer hillside with more *Deschampsia* and a wetter fen with more *Salix planifolia*.

UTM's: 351,300 E / 4,334,450 N

USGS Quadrangle: Thimble Rock 3910626

Elevation: 11,200 ft.

Slope: 5 degrees

Aspect: 135 degrees

Carex illota	sheep sedge	50 - 75	
Carex scopulorum	mountain sedge	5 - 25	
Carex praeceptorum	early sedge	5 - 25	
Salix planifolia (S. phylicifolia ssp. planifolia)	diamondleaf willow		1 - 5
Deschampsia cespitosa	tufted hairgrass	1 - 5	
Eriophorum altaicum var. neogaeum	whitebristle cottongrass	1 - 5	
Pedicularis groenlandica	elephanthead lousewort	1 - 5	

Similar to *Salix phylicifolia* ssp. *planifolia* / *Deschampsia cespitosa* p.a. (Johnston 1987) except for the abundance of *Vaccinium myrtilus* var. *oreophilum* in this area.

Salix planifolia / Deschampsia cespitosa p. a. G2G3 (Bourgeron and Engelking, 1994)

Plot 9 (50 X 50 ft.) photo 8-5 from hillside above.

Sampled at the confluence of unnamed creek with No Name Creek, by pack trail, above beaver ponds . (Ponds were dry.)

UTM's: 351,300 E / 4,335,200 N

USGS Quadrangle: Thimble Rock 3910626

Elevation: 10,840 ft.

Slope: 5 degrees

Aspect: 42 degrees

Bare ground		< 1	
Rock		< 1	
Salix planifolia (<i>S. phylicifolia</i> ssp. <i>planifolia</i>)	diamondleaf willow		50 - 75
Vaccinium myrtilus var. <i>oreophilum</i>	whortleberry		50 - 75
Deschampsia cespitosa	tufted hairgrass	25 - 50	
Carex nova	black sedge	1 - 5	
Phleum alpinum (<i>P. commutatum</i>)	alpine timothy	1 - 5	
Senecio triangularis	arrowleaf groundsel	1 - 5	
Arnica sp.		< 1	
Castilleja rhexifolia	rosy Indian paintbrush*	< 1	
Erigeron peregrinus ssp. <i>callianthemus</i>	subalpine fleabane	< 1	
Oxypolis fendleri	Fendler's cowbane	< 1	
Polygonum viviparum (<i>Bistorta</i>)	alpine bistort	< 1	
Veronica wormskjoldii (<i>V. nutans</i>)	American alpine speedwell		< 1

Cardamine cordifolia / Caltha leptosepala p.a. (Johnston 1987)

Cardamine cordifolia / Caltha leptosepala p. a. GU S? (Colorado Natural Heritage Program 1995 b)

Plot 10 (50 X 20 ft.)

Sampled by a stream between two large meadows, in a narrow opening in the spruce-fir forest.

UTM's: 349,350 E / 4,335,300 N

USGS Quadrangle: Thimble Rock 3910626

Elevation: 11,000 ft.

Slope: 5 degrees

Aspect: 170 degrees

Bare ground		< 1
Rock		1 - 5
Caltha leptosepala	white marshmarigold	50 - 75
Cardamine cordifolia	heartleaf bittercress	25 - 50
Deschampsia cespitosa	tufted hairgrass	5 - 25
Senecio triangularis	arrowleaf groundsel	5 - 25
Mertensia ciliata	mountain bluebells	1 - 5
Carex sp.		< 1
Mitella pentandra	fivestamen miterwort	< 1
Pedicularis groenlandica	elephanthead lousewort	< 1
Phleum alpinum (P. commutatum)	alpine timothy	< 1
Polygonum bistortoides (Bistorta)	American bistort	< 1
Ranunculus alismaefolius	waterplantain buttercup	< 1
Senecio dimorphophyllus	splitleaf groundsel	< 1

APPENDIX 2

PLANT SPECIES OBSERVED AT SMUGGLER MOUNTAIN POTENTIAL RNA SITE

Scientific names follow the USDA Soil Conservation Service (1994). Synonyms used by Weber (1987) are included in parentheses (small differences such as slight changes by Weber in spelling or the difference between ssp. and var. are not noted). If either of these names differs from those used in Johnston (1987), the name in Johnston is also included in parentheses with an *. Common names follow the U. S. D. A. Soil Conservation Service PLANTS list. Species listed by the Colorado Natural Heritage Program as Colorado Species of Special Concern are followed by CSSC. Adventive species are followed by ADV.

SCIENTIFIC NAME

COMMON NAME

Trees

<i>Abies lasiocarpa</i>	subalpine fir
<i>Picea engelmannii</i>	Engelmann's spruce
<i>Pinus contorta</i>	lodgepole pine

Shrubs

<i>Juniperus communis</i> var. <i>montana</i> (ssp. <i>alpina</i>)	common juniper
<i>Salix brachycarpa</i>	barrenground willow
<i>Salix planifolia</i> (<i>S. phyllifolia</i> ssp. <i>planifolia</i>)	diamondleaf willow
<i>Vaccinium cespitosum</i>	dwarf blueberry
<i>Vaccinium myrtillus</i> var. <i>oreophilum</i>	whortleberry

Graminoids

<i>Agrostis humilus</i>	alpine bentgrass	
<i>Agrostis scabra</i>	rough bentgrass	
<i>Carex aquatilis</i> var. <i>stans</i>	water sedge	
<i>Carex canescens</i>	silvery sedge	
<i>Carex ebenea</i>	ebony sedge	
<i>Carex elynoides</i>	blackroot sedge	
<i>Carex geyeri</i>	elk sedge	
<i>Carex illota</i>	sheep sedge	
<i>Carex microptera</i>	smallwing sedge	
<i>Carex norvegica</i> ssp. <i>norvegica</i>	Norway sedge	
<i>Carex nova</i>	black sedge	
<i>Carex praeceptorum</i>	early sedge	
<i>Carex magellanica</i> ssp. <i>irrigua</i>	boreal bog sedge	
<i>Carex rossii</i> (<i>geophila</i> ?)	Ross's sedge	
<i>Carex scopulorum</i>	mountain sedge	
<i>Carex utriculata</i>	Northwest Territory sedge	
<i>Danthonia intermedia</i>	timber oatgrass	
<i>Deschampsia cespitosa</i>	tufted hairgrass	
<i>Eleocharis quinqueflora</i>	fewflower spikerush	
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	whitebristle cottongrass	CSSC
<i>Festuca brachyphylla</i> ssp. <i>coloradense</i>	Colorado fescue	

Juncus drummondii	Drummond's rush
Juncus mertensianus	Merten's rush
Juncus parryi	Parry's rush
Juncus saximontanus	Rocky Mountain rush
Luzula parviflora	smallflowered woodrush
Phleum alpinum (P. commutatum)	alpine timothy
Poa fendleriana (P. cusickii ssp. epilis)	muttongrass
Poa nervosa	Wheeler bluegrass
Poa reflexa	nodding bluegrass

Forbs

Agoseris aurantiaca	orange agoseris
Agoseris glauca	pale agoseris
Antennaria corymbosa	flattop pussytoes
Antennaria rosea	rosy pussytoes
Aquilegia elegantula	western red columbine
Arenaria congesta	sandwort
Arabis (Boechea) drummondii	Drummond's rockcress
Arenaria congesta (Eremogene)	* sandwort
Arnica cordifolia	heartleaf arnica
Arnica mollis	hairy arnica
Artemisia scopulorum	alpine sagebrush
Caltha leptosepala (Psychrophila)	white marshmarigold
Cardamine cordifolia	heartleaf bittercress
Castilleja sulphurea	sulphur Indian paintbrush
Castilleja occidentalis	western Indian paintbrush
Castilleja rhexifolia	rosy Indian paintbrush*
Draba crassifolia	snowbed whitlowgrass
Erigeron melanocephalus	blackhead fleabane
Erigeron peregrinus ssp. callianthemus	subalpine fleabane
Erigeron simplex	onestem fleabane
Hieracium gracile var. gracile (Chlorocrepis tristis)	slender hawkweed
Mertensia ciliata	mountain bluebells
Mitella pentandra	fivestamen miterwort
Orthilia secunda	sidebells wintergreen
Oxypolis fendleri	Fendler's cowbane
Pedicularis groenlandica	elephanthead lousewort
Pedicularis procera	giant lousewort
Pedicularis racemosa	sickletop lousewort
Penstemon whippleanus	Whipple's penstemon
Polemonium pulcherrimum ssp. delicatum	skunkweed polemonium
Polygonum viviparum (Bistorta)	alpine bistort
Polygonum bistortoides (Bistorta)	American bistort
Potentilla diversifolia	varileaf cinquefoil
Primula parryi	Parry's primrose
Pseudocymopterus montanus	alpine false springparsley
Pyrola minor	snowline wintergreen
Ranunculus alismaefolius	waterplantain buttercup
Saxifraga rivularis (S. hyperborea ssp. debilis)	weak saxifrage
Saxifraga oregana (Micranthes)	Oregon saxifrage
Saxifraga odontoloma (Micranthes)	brook saxifrage

Saxifraga rhomboidea (Micranthes)	diamondleaf saxifrage
Sedum integrifolium (Rhodiola)	entireleaf stonecrop
Sedum rhodanthum (Clementsia)	redpod stonecrop
Senecio amplexans var. amplexans (Ligularia)	showy alpine groundsel
Senecio crassulus	thickleaf groundsel
Senecio dimorphophyllus (Packera)	splitleaf groundsel
Senecio triangularis	arrowleaf groundsel
Sibbaldia procumbens	creeping sibbaldia
Solidago parryi (Oreochrysum)	Parry's goldenrod
Stellaria umbellata	umbrella starwort
Thlaspi montanum (Noccaea)	alpine pennycress
Trifolium gymnocarpum (not in PLANTS)	hollyleaf clover
Trollius laxus ssp. albiflorus (T. albiflorus)	American globeflower
Veronica wormskjoldii (V. nutans)	American alpine speedwell
Viola biflora (V. canadensis, V. scopulorum)	field pansy
Viola labradorica	alpine violet

**COVER TYPES OF THE
SMUGGLER MOUNTAIN POTENTIAL RESEARCH NATURAL AREA**

Legend

- sf** Engelmann spruce - subalpine fir (SAF 206)
Western spruce - fir forests (Kuchler 14)
includes plant associations:
Abies lasiocarpa-Picea engelmannii / Vaccinium myrtillus
- w** Willow
includes plant associations:
Salix phylicifolia ssp. planifolia / Carex aquatilis
Salix phylicifolia ssp. planifolia / Carex scopulorum
Salix phylicifolia ssp. planifolia / Deschampsia cespitosa
- g** Graminoid
includes plant associations:
Deschampsia cespitosa / Carex spp.
Eleocharis quinqueflora
- f** Forb
includes plant associations:
Cardamine cordifolia / Caltha leptosepala
Vaccinium myrtillus / Sibbaldia procumbens-Moss
- r** Rock outcrops with little or no vegetation.
- ____ Potential RNA boundary