

VEGETATION AND ECOLOGICAL CONDITIONS ON BLM-MANAGED LANDS
IN THE RAYMOND MOUNTAIN WILDERNESS STUDY AREA
AND ALONG LITTLE MUDDY CREEK, STONER CREEK, AND COAL CREEK,
KEMMERER RESOURCE AREA, ROCK SPRINGS DISTRICT.

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INTRODUCTION

This project to inventory vegetation types and ecological conditions in the Raymond Mountain Wilderness Study Area (Figure 1) and along three nearby streams was conducted by the Wyoming Natural Diversity Database (WYNDD) under the terms of Bureau of Land Management Cooperative Agreement K910-A4-0011, Task Order No. TO-017. The original parties to that agreement, signed in 1997, were Bureau of Land Management and The Nature Conservancy, a private, non-profit organization of which WYNDD was part. On July 1, 1998, WYNDD became a unit of the University of Wyoming, and the bulk of the work on the project was completed by WYNDD acting as a unit of the University.

The specific tasks to be completed in the project were:

- Map all plant community types within the study area on 7.5' topographic maps, using the standard vegetation classification developed by WYNDD and The Nature Conservancy. Rare vegetation types should be emphasized.
- Provide at least one photograph of each community type.
- List all identifiable plant species in each community type.
- Identify areas that represent each community type in unusually good condition.
- Note animal use of each community type.
- For streams, identify potential conditions.
- Map and identify populations of rare plant species (Special Status Plant Species). Deposit voucher specimens of such species in the Rocky Mountain Herbarium and the BLM Rock Spring District Office. Photograph previously undocumented populations of Special Status Plant Species.
- Map and identify populations of exotic weeds, both listed noxious and others.

METHODS

Before the start of field work, a search of WYNDD's computer databases was conducted for records of rare plants in the study area, and geologic maps and topographic maps of the study area were reviewed to identify potential habitat for rare plants known to occur in the southwestern corner of Wyoming and that might occur in the study area. Potential travel routes for field work were chosen to include the stretches of streams specified in the task order and, for the uplands in the Raymond Mountain WSA, to include general vegetation types identified on aerial photographs and the variety of the area's geologic substrates and topographic features.

Field work was carried out on three trips to the study area during spring and summer, 1998: a reconnaissance trip of June 15 and 16 (cut short because of impassable roads and a late growing season), and two longer trips of July 9 - 13 and July 21 - 25. As a result of the reconnaissance trip, which included conversations with BLM staff, the potential travel routes for later field work were modified to emphasize inventory of Raymond Creek, Mill Creek, and Chalk Creek within the WSA. The reconnaissance trip also resulted in refinement of the general vegetation types and adjustment of the potential travel routes through the uplands.

During the two later trips, information was collected on the nature of the vegetation types encountered, the location and abundance of weeds, and the conditions of streams. The uplands in the WSA were surveyed primarily on foot, with supplemental observations made from the IGO Speedway on the eastern side of the WSA and from Wyoming Highway 89 west of the WSA. In the uplands, information was collected from discrete stands of vegetation (areas in which the vegetation and environment appeared uniform) and consisted of an estimate of the canopy cover of each vascular plant species in each vegetation layer (recorded by cover class; see Appendix 2), estimates of the percentage of the ground surface covered by each of seven categories of ground cover (see Appendix 2), the slope and aspect of the stand (measured with a clinometer and compass, respectively), and notes on evidence of browsing, grazing, trampling, fire, burrowing, and other disturbances. In large stands of grassland, sagebrush shrublands, other shrublands, and some woodlands, this information was collected in temporary sampling plots covering ca. 0.1-0.2 acres (200 - 800 square meters). In other stands, the information was collected by walking through the stand, but no sampling plot was marked out. This detailed information was supplemented with notes made of the locations of stands of various vegetation types observed during foot survey but not visited.

Along streams, survey was done almost entirely on foot, with limited survey from a vehicle on Little Muddy Creek and Huff Creek. Sampling plots were not used in the riparian areas; rather, estimates of canopy cover of the dominant species (and of minor species thought to indicate potential vegetation) on each riparian surface were recorded for stretches of stream valley. Notes were also made of the location and condition of beaver dams and beaver-cut trees; size and degree of entrenchment of the stream channel; the size class of materials in the stream channel and on sediment bars; disturbances such as grazing, browsing, trampling, and burrowing; and the presence of willows.

In both the uplands and the riparian zones, the presence and distribution of plant species on Wyoming's noxious weed list and of other exotic plant species were noted. Estimates were made of the numbers of these plants present and the size of weed patches.

Specimens of most of the vascular species encountered were collected for later identification to species. Some plants were identified to species in the field, and specimens of many of these were collected for later confirmation. Specimens were not collected for easily-identified species, such as the trees.

RESULTS

Locations referred to in this section are shown on Figure 2. Photographs of most vegetation types are provided in Appendix 6.

I. PLANT COMMUNITIES

General community types encountered in the Raymond Mountain WSA and along the three nearby streams are described below. Plot data and stand descriptions for the upland communities and the mountain silver sagebrush riparian shrublands are shown in the tables in Appendix 2. Descriptions of the major herbaceous riparian types and the mountain silver

sagebrush types are given in Appendix 3. For each general vegetation type, the more specific vegetation types or habitat types that it contains that have been identified in published classifications from this region are listed in the text, in Appendix 1, and in the tables of Appendix 2.. This information on specific vegetation types was taken from USDA Forest Service classifications of riparian community types in western Wyoming and eastern Idaho (Youngblood et al. 1985) and in Utah and southeastern Idaho (Padgett et al. 1989), the Montana Riparian Association's classification of community types and habitat types of Montana (Hansen et al. 1995), the USDA Forest Service aspen community type classification for the Intermountain Region (Mueggler 1988), the USDA Forest Service forest habitat type classification for eastern Idaho and western Wyoming (Steele et al. 1983), and the new national vegetation classification of the United States (Anderson et al. 1998).

Scientific names of plants are from Dorn (1992), except when used in names of alliances or plant associations from the national vegetation classification (Anderson et al. 1998), where plant names from Kartesz (1994) are used.

Photographs of most of the plant community types are provided in Appendix 6.

A. Upland Communities

1. Douglas-fir Woodlands (Table 1-1)

Douglas-fir woodlands are far and away the most common of the conifer woodlands in the study area. They occur throughout the WSA, primarily on north- and east-facing slopes. The largest Douglas-fir stands grow on steep, north-facing slopes in draws draining the highest ridge on the western side of the WSA.

Stands of Douglas-fir often have patchy overstories containing trees of various sizes, with the largest trees in most stands 10"-12" (25-30 cm) dbh. Douglas-fir often is the only tree present. Shrub layers are sparse in most stands, and Utah snowberry (*Symphoricarpos oreophilus*) generally contributes most cover. The herbaceous undergrowth usually contains substantial amounts of heartleaf arnica (*Arnica cordifolia*) and Oregon grape (*Mahonia repens*). Following approach of Steele et al. (1983) for delineating Douglas-fir habitat types in the region, the stands in which Oregon grape dominates or co-dominates are placed into the *Pseudotsuga menziesii/Mahonia repens* Forest (Anderson et al. 1998), and stands in which heartleaf arnica dominates are placed into the *P. menziesii/Arnica cordifolia* Forest. A third type, the *P. menziesii/Calamagrostis rubescens* Forest, also occurs in the WSA. All of these are widespread types in western Wyoming and eastern Idaho.

2. Other Conifer Woodlands (Table 1-2)

The 1998 field work suggests that subalpine fir woodlands and lodgepole pine woodlands are minor vegetation types in the WSA. Two subalpine fir stands were described during field work, stand 442 on an east-facing slope high on the main ridge at the western side of the WSA and stand 91 on the south side of a draw on the eastern side of the WSA. Both stands appear to be low-elevation representatives of the *Abies lasiocarpa/Arnica cordifolia* Forest (Anderson et al. 1998) that grows on the widespread habitat type of that name in western Wyoming and eastern

Idaho (Steele et al. 1983). Subalpine fir was also noted along the bases of north-facing slopes at several other locations in the WSA, growing in Douglas-fir or aspen woodlands.

One lodgepole pine stand was described from the eastern base of the main ridge in the western part of the WSA. This stand represents the *Pinus contorta/Calamagrostis rubescens* Forest (Anderson et al. 1998) known from the habitat type of that name in western Wyoming and eastern Idaho (Steele et al. 1983).

Both the subalpine fir and the lodgepole pine stands appear to be stable vegetation types.

3. Aspen Woodlands (Table 1-3)

Aspen woodlands grow throughout the WSA, mostly on north- and east-facing slopes. Many stands merge with Douglas-fir woodlands.

Few aspens larger than 9" (23 cm) dbh were noted during fieldwork, and many stands in the WSA are composed primarily of saplings (stems \leq 5", or 12.6 cm, dbh). A few aspen stands contain substantial amounts of conifers and seem to be seral to conifer stands, but most aspen woodlands in the WSA have no conifers. The decadent aspen in several of the stands sampled or described during field work (plot 2.1 and stands 55 and 57) suggest that many of the aspen groves in the WSA eventually will be succeeded by shrub stands, unless something is done to periodically rejuvenate the aspens.

Nearly all aspen stands have a low shrub layer dominated or co-dominated by *Symphoricarpos oreophilus*. Taller shrubs, especially *Amelanchier* sp. and *Prunus virginiana*, are present in most stands, and in some stands the taller shrubs form a distinct layer. Using the classification of Mueggler (1988) for the USDA Forest Service's Intermountain Region, the aspen woodlands with tall shrub layers belong to the *Populus tremuloides/Amelanchier alnifolia/Symphoricarpos oreophilus*/Tall Forb type or the *P. tremuloides/A. alnifolia/S. oreophilus/Bromus carinatus* type, with the latter being a grazing-induced type.. Most stands without tall shrub layers belong to the *P. tremuloides/Symphoricarpos oreophilus/Poa pratensis* type or the *P. tremuloides/S. oreophilus/Thalictrum fendleri* type, both of which are thought to be created by grazing (Mueggler 1988). Stands of other aspen types appear to be less common. Two stands (#17 and #41) could not be placed in Mueggler's system.

4. Big-tooth Maple Woodlands (Table 1-4)

This deciduous woodland type occurs as patches up to ca. 1 acre (0.4 ha) on slopes (primarily east-facing) of the main ridge along the western side of the WSA. These patches occur mixed with stands of curl-leaf mountain mahogany shrub vegetation, mountain big sagebrush shrub vegetation, and bluebunch wheatgrass grass vegetation. Two *Acer grandidentatum* plant associations have been named from Utah, but these stands appear to fit neither of them, so they are simply considered as representatives of the *Acer grandidentatum* Alliance (Anderson et al. 1998). They grow at the eastern edge of the distribution of big-tooth maple in the Intermountain - Central Rockies region and may be the eastern-most stands of big-tooth maple woodland.

5. Curl-leaf Mountain Mahogany Shrub Stands (Table 1-5)

Stands of this tall shrub type are common on the slopes (mainly south- and west-facing) of the main ridge along western side of the WSA, growing on limestone talus and bedrock. They typically cover 10 acres (4 ha) or less and occur mixed with stands of bluebunch wheatgrass grassland, mountain big sagebrush shrublands, and big-tooth maple woodlands. Nearby north- and east-facing slopes often support Douglas-fir woodlands or aspen woodlands.

Cercocarpus ledifolius var. *intercedens* forms a shrub layer 10-13 ft. (3-4 m) tall. The shrub layer usually is open, and canopy cover ranges from ca. 10% up to over 50%. Lower shrubs often are present but contribute little cover. The herbaceous undergrowth often contains roughly equal amounts of graminoids and forbs, and common species are bluebunch wheatgrass (*Elymus spicatus*), King spikefescue (*Leucopoa kingii*), arrowleaf balsamroot (*Balsamorhiza sagittata*), and Oregon grape (*Mahonia repens*). This type is considered representative of the *Cercocarpus ledifolius/Pseudoroegneria spicata* Shrubland (Anderson et al. 1998). (The national classification does not yet recognize stands dominated by this tall subspecies of *C. ledifolius* as a separate type.)

Stands of tall curl-leaf mountain mahogany are known from Idaho south of the Snake River (S. Rust, Idaho Conservation Data Center, pers. comm.), and the shrub is widespread in Utah (Welsh et al. 1993); hence this vegetation type apparently is present throughout the Intermountain Region. Raymond Mountain apparently contains the eastern-most stands.

6. True Mountain Mahogany Shrub Stands (Table 1-6)

This is a minor type in the WSA, occurring in small patches (up to ca. 3 acres [1.2 ha]) on slopes of the main ridge on the western side of the area. In Chalk Creek Canyon, stands cover much of the western valley wall (plot 5.1). *Cercocarpus montanus* forms a shrub layer 3.2-5 ft. (1-1.5 m) tall, and other shrubs may be present in small amounts. The undergrowth often is sparse, and *Elymus spicatus* dominates or co-dominates. Stands of this type are considered to belong to the *Cercocarpus montanus/Pseudoroegneria spicata* Shrubland (Anderson et al. 1998), which is widespread in the region.

Shrubs in stands of this type typically show signs of moderate to heavy browsing in past years.

7. Mountain Big Sagebrush Shrub Stands (Table 1-7)

Shrub vegetation dominated or co-dominated by mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*) covers much of the uplands throughout the WSA. In the western part, on the main ridge, mountain big sagebrush stands frequently cover up to ca. 5 acres (2 ha) each and are mixed with Douglas-fir woodlands, aspen woodlands, curl-leaf mountain mahogany shrub stands, and bluebunch wheatgrass (*Elymus spicatus*) vegetation. In the eastern half of the WSA, they occur with stands of alkali sagebrush (*Artemisia arbuscula* var. *longiloba*), and these two types form the matrix for woodlands.

Composition of the vegetation varies with landscape position, aspect, and (probably) grazing history. Stands on rocky slopes and fans, especially those facing west and south, have shrub layers most strongly dominated by mountain big sagebrush and containing relatively little Utah snowberry (*Symphoricarpos oreophilus*). Rubber rabbitbrush (*Chrysothamnus*

viscidiflorus) often co-dominates in the shrub layer in these stands. Major species in the undergrowth are bluebunch wheatgrass, Ross's sedge (*Carex rossii*), and King spikefescue (*Leucopoa kingii*). Most of these stands are considered to represent the *Artemisia tridentata* ssp. *vaseyana*/*Pseudoroegneria spicata* Shrubland of the national vegetation classification (Anderson et al. 1998). In the central and eastern part of the WSA, stands on dry slopes often are co-dominated by antelope bitterbrush (*Purshia tridentata*) and are placed in the *A. tridentata* ssp. *vaseyana*-*Purshia tridentata*/*Pseudoroegneria spicata* Shrubland (Anderson et al. 1998). These drier mountain big sagebrush stands merge with alkali sagebrush stands (as illustrated by stand 51).

In mesic sites, such as north-facing slopes and swales, Utah snowberry often co-dominates the shrub layer, and the herbaceous layer contains a different set of major species, primarily slender wheatgrass (*Elymus trachycaulus* var. *trachycaulus*), Nevada bluegrass (*Poa nevadensis*), Nelson's needlegrass (*Stipa nelsonii* var. *dorei* and *S. nelsonii* var. *nelsonii*), and Kentucky bluegrass (*Poa pratensis*). These stands are placed in the *A. tridentata* ssp. *vaseyana*-*Symphoricarpos oreophilus*/*Elymus trachycaulus* Shrubland of the national classification (Anderson et al. 1998).

A substantial number of mountain big sagebrush stands were sampled in valley bottoms and on slopes in which Kentucky bluegrass dominates the understory. In some of these stands, Nelson's needlegrass (*S. nelsonii* var. *nelsonii*) co-dominates, but native grasses are minor species in the other stands. None of the plant associations listed in the national vegetation classification system (Anderson et al. 1998) seem to apply to these stands, so they are simply placed into the *Artemisia tridentata* ssp. *vaseyana* Shrubland Alliance (Anderson et al. 1998).

Pocket gopher (Geomyidae) digging was noted often in these sagebrush stands. Antelope bitterbrush had been browsed in previous years in many stands.

The national vegetation classification system (Anderson et al. 1998) only lists names of alliance and plant associations; descriptions of the vegetation types are being developed. Hence placement of the Raymond Mountain stands into plant associations from the national classification is tentative.

8. Alkali Sagebrush Shrub Stands (Table 1-8)

This vegetation of low shrubs and graminoids is a major type in the eastern half and the southern end of the WSA, on dry slopes with fine-textured substrates, where it combines with other sagebrush types (especially mountain big sagebrush stands) to form the matrix for woodlands and taller shrub types. Smaller stands occur on slopes of the main ridge in the western part of the WSA, mixed with stands of mountain big sagebrush and bluebunch wheatgrass.

Alkali sagebrush (*Artemisia arbuscula* var. *longiloba*) dominates or co-dominates the shrub stratum, and herbaceous stratum includes Sandberg bluegrass (*Poa secunda* var. *elongata* and *P. secunda* var. *secunda*), western wheatgrass (*Elymus smithii*)¹, King spikefescue

¹Western wheatgrass also includes thickspike wheatgrass (*Elymus lanceolatus* var. *lanceolatus*, or *Agropyron dasystachyum*), because the two species are so similar morphologically and ecologically as to be difficult to distinguish in the field.

(*Leucopoa kingii*), onion grass (*Medica bulbosa*), and big bluegrass (*Poa juncifolia*) as the major species. These stands apparently represent the *A. arbuscula* ssp. *longiloba*/*Pascopyrum smithii* or the *A. arbuscula* ssp. *longiloba*/*Poa secunda* Dwarf-Shrub Herbaceous Vegetation types of the national vegetation classification (Anderson et al. 1998).

9. Minor Shrub Types (Table 1-10)

These are vegetation types that were encountered rarely during field work and apparently cover only a small area of the WSA. They are described here to illustrate the variation in the area's vegetation and the difficulty of classifying all stands into recognized types.

Chokecherry (*Prunus virginiana*) stands were found on easterly slopes on the high, main ridge along the western side of the WSA, one (plot 1.6) in Raymond Canyon and the other (stand 54) at the southern end of the area. In both, chokecherry forms a shrub layer ca. 1.5-2 ft. (0.5-0.6 m) tall that includes Utah snowberry (*Symphoricarpos oreophilus*), serviceberry (*Amelanchier* spp.), and other species. Snowbrush ceanothus (*Ceanothus velutinus*) is a major species in one stand. The undergrowths are quite different in the two stands, which represent the *Prunus virginiana* Shrubland Alliance in the national classification (Anderson et al. 1998).

One species-rich stand of shrubs and grasses in which boxleaf myrtle (*Paxistima myrsinites*) is a major species (plot 2.5c) was noted on the south side of Raymond Canyon, high on an east-facing slope. A second dense shrub stand in the area (plot 2.5), dominated by Utah snowberry (*Symphoricarpos oreophilus*), also does not seem to fit into existing classifications, although it may represent a variation of the *Artemisia tridentata* ssp. *vaseyana*-*Symphoricarpos oreophilus* Shrubland Alliance of the national vegetation classification (Anderson et al. 1998).

In the sagebrush vegetation on the main ridge at the southern end of the WSA, a stand of sparse vegetation dominated by black sagebrush (*Artemisia nova*) and bluebunch wheatgrass (*Elymus spicatus*) was noted on the ridge line and the upper part of the west-facing slope below. This stand represents the *Artemisia nova*/*Pseudoroegneria spicata* Dwarf-Shrubland Association of the national classification (Anderson et al. 1998), a widespread type in the western U.S.

10. Grass Stands (Table 1-11)

Grass vegetation containing bluebunch wheatgrass (*Elymus spicatus*), King spikefescue (*Leucopoa kingii*), and arrowleaf balsamroot (*Balsamorhiza sagittata*) is common on the slopes of the main ridge along the western side of the WSA, where it occurs in a mosaic with mountain big sagebrush shrub stands, curl-leaf mountain mahogany shrub stands, and woodlands. Plot 1.7 illustrates a dense stand of this vegetation, and stand 45 a sparse stand. This vegetation apparently represents the *Pseudoroegneria spicata* Herbaceous Alliance of the national vegetation classification (Anderson et al. 1998).

11. Forb Types (Table 1-12)

Four stands of vegetation that were sampled or described during field work are placed in the general forb vegetation type because cover of forbs equals or exceeds that of graminoids. All four stands are relatively small patches (up to ca. 0.5 acre [0.2 ha]) of sparse vegetation on shallow soil in a matrix of sagebrush or woodland. In three of the four, arrowleaf balsamroot (*Balsamorhiza sagittata*) contributes the most cover, and bluebunch wheatgrass (*Elymus*

spicatus), King spikefescue (*Leucopoa kingii*), and Sandberg bluegrass (*Poa secunda* var. *elongata*) are secondary species. Despite the higher cover of forbs, these stands may represent the *Pseudoroegneria spicata* - *Balsamorhiza sagittata* - *Poa secunda* Herbaceous Vegetation association described from Idaho, Oregon, and Washington, which belongs to the *Pseudoroegneria spicata* Herbaceous Alliance of the national classification (Anderson et al. 1998). The fourth stand in this general group is dominated by stemless goldenweed (*Haplopappus acaulis*) and contains only small amounts of a few other forbs and grasses. This stand may belong to the *Pseudoroegneria spicata*-Cushion Plant Herbaceous Vegetation association of the national classification.

These patches of sparse, forb-dominated vegetation are found in the WSA mainly on the limestones and sandstones of the main ridge along the western side.

B. Riparian Communities and Stream Conditions

The agreement establishing this project stipulated that portions of three streams outside the Raymond Mountain Wilderness Study Area -- Coal Creek northeast of the WSA, and Little Muddy Creek and Stoner Creek east of the WSA -- would be evaluated (Figure 2). In addition, BLM resource staff asked that several streams within the WSA receive particular attention in the project (Ed Feeley, BLM Kemmerer office, personal communication).

Evaluation of the streams concentrated on the following characteristics:

- physical features of the valley and the channel (valley gradient and width; channel width, depth, and entrenchment; channel and bar substrate; distribution, size, and condition of beaver dams);
- characteristics of the vegetation (distribution and condition of willows, composition and structure of the riparian vegetation, distribution of noxious plants); and
- disturbances to the riparian zone by grazing, browsing, trampling, and burrowing.

Observations on each of these features were noted during surveys of the stream valleys, made on foot and from a vehicle. Likely future conditions in the streams and the riparian vegetation that can be inferred from the observations of present conditions also are discussed.

Valley gradient was calculated as the quotient of the drop in elevation (shown on a 7.5' topographic quad) divided by the length of the stream valley. The length of the stream valley was obtained (also from 7.5' quads) by running a map wheel along the general course of the stream channel. The riparian vegetation in each valley was assigned to vegetation types, each of which is related in Appendix 1 to types identified in relevant, published classifications of riparian vegetation. The descriptions of the herbaceous riparian types from the individual streams below are collected in Appendix 3 to illustrate the variability in these types. Locations cited below are shown on the map in Figure 2. Photographs of the streams are provided in Appendix 6.

Streams outside the WSA

1. Little Muddy Creek

The entire length of the valley of Little Muddy Creek upstream from the mouth of the major tributary at location 90 was surveyed on foot, as was the valley of that tributary. In the valley of Little Muddy Creek from location 90 downstream to the confluence with Coal Creek, foot survey was limited to three locations (#s 94, 95, and 96). Observation of the valley from a vehicle on the two-track road up the western side of the valley bottom suggested that the vegetation and physical features were uniform enough that three survey points would give an adequate description.

a. Present conditions

(1) Physical features

Most of the valley, from the mouth of the major tributary at location 90 downstream to the confluence with Coal Creek, has a gentle gradient of 1%. The valley segment from the mouth of the tributary at location 90 upstream to location 86 has a gradient of 4.3%, and the uppermost ca. 0.5 mile (0.8 km) of the perennial portion of the stream (from location 85 to location 86) is steep, with a gradient of 10%. The tributary entering Little Muddy Creek at location 90 flows through a steep valley, with a gradient of 8.6%. Throughout its length, the stream flows through fine-textured sediments (clays and silts); even in the steep, upper portions, only a few gravels or cobbles were noted in the channel or on the floodplain or terraces.

Beaver dams are common in the stretch of the stream from the upper end at location 85 to the tributary at location 90. The following observations of dams and the stream channel were made in this stretch:

-- Location 85: two active dams and a large, abandoned dam, ca. 165 ft. (50 m) long and 8 ft. (2.5 m) high, are present (photo 98GJ2.2).

-- Location 86 (state land): a few small, very old, breached dams are present. The riparian zone is < 16 ft. (5 m) wide, and the channel is entrenched ca. 1.5 ft. (0.5 m) in places; in other places, it is not entrenched at all.

Location 87 (state land): many large dams, 66-100 ft. (20 m-30 m) wide and ca. 6.5 ft. (2 m) tall, and a few smaller dams, still hold water. At least one of the large dams is actively maintained. The riparian zone is 32-165 ft. (10-50 m) wide.

Location 88: fewer large dams and more small dams (the latter ca. 32 ft. [10 m] across and ca. 3.2 ft [1 m tall]) stand in the stream. The channel is not incised, and the riparian zone is ca. 1.6 ft. (0.5 m) wide.

-- Location 89: the meandering channel is < 3.2 ft. (1 m) wide and is confined between the valley walls. In places, it is incised to ca. 3 ft. (1 m), but in other places, it is not incised (photo 98GJ2.4). A few small dams are present. The vegetation in the riparian zone has been grazed throughout to a height of several inches, and barren stream banks are common.

Beaver dams are also common on the tributary entering at location 90. In fact, the stretch of this stream shown as a perennial channel on the Huff Creek 7.5' topographic quad is a series of beaver dams, many relatively small (ca.16 ft. [5 m] wide by 3.2-6.4 ft.[1-2 m] tall) and some

considerably larger (ca. 66 ft. [20 m] wide by 6.5-13 ft. [2-4 m] high; photo 98GJ2.6) connected by a narrow channel ca. 1.6 ft. [0.5 m] wide. The channel is incised in places to ca. 1.6 ft. [0.5 m], but for most of the stretch, the channel is not incised into the valley floor, perhaps because the beaver dams have not been breached. The dams are built of aspen branches and trunks. Dams in the lower part of the tributary are actively maintained, and beaver are dragging material from an aspen grove ca. 100 yards. (ca. 100 m) west of the stream, over a 40-foot (12-m) -tall rise.

No beaver dams were noted at the locations surveyed on Little Muddy Creek below the mouth of the tributary at location 90. The channel in this stretch is entrenched 3.2-6.4 ft. (1-2 m) into the valley floor, and in places (e.g., location 94) is meandering within the gully (photo 98GJ2.8).

(2) Vegetation

Little Muddy Creek supports primarily herbaceous and sparse-shrub riparian vegetation. The only common shrub is mountain silver sagebrush (*Artemisia tridentata* var. *viscidula*). Shrubby cinquefoil (*Pentaphylloides floribunda*) occurs at the downstream end of the valley. Willows were noted only in the steep, upper segment of the valley of Little Muddy Creek, upstream from location 86. Approximately ten plants were noted, most of them Geyer willow (*Salix geyeriana*) and Pacific or whiplash willow (*Salix lasiandra*), with a few Booth willow (*S. boothii*) and sandbar willow (*S. exigua*). All had been browsed. A few honeysuckle (*Lonicera involucrata*) were present as well. No evidence suggesting that willows were formerly more common (such as dead plants, stumps, or branches) was noted.

The following vegetation types were noted in the riparian zone of Little Muddy Creek and along its major tributary that enters at location 90.

(a) Tufted hairgrass - Sedge species (*Deschampsia cespitosa*-*Carex* spp.) Herbaceous Vegetation.

This is one of two major riparian types in the valley of Little Muddy Creek below the mouth of the tributary at location 90, where it grows on the drier riparian surfaces up to ca. 3.2 ft. (1 m) above the channel. The major species are Kentucky bluegrass (*Poa pratensis*), tufted hairgrass (*Deschampsia cespitosa*), and field-clustered sedge (*Carex praegracilis*). Mountain silver sagebrush (*Artemisia cana* var. *viscidula*) may be present, but its canopy cover is usually less than ca. 10%. The vegetation on drier riparian surfaces upstream from location 90, and on the tributary entering at location 90, can also be placed into this vegetation type, although the major species there are tufted hairgrass, Kentucky bluegrass (*Poa pratensis*), yarrow (*Achillea millefolium*), and *Hordeum brachyantherum*. with only small amounts of field-clustered sedge.

This vegetation apparently corresponds to the *Deschampsia cespitosa* Habitat Type described from Montana (Hansen et al. 1995), the *Deschampsia cespitosa* Community Type described from western Wyoming and eastern Idaho (Youngblood et al. 1985), and the *Deschampsia cespitosa* Community Type described from Utah and southeastern Idaho (Padgett et al 1989).

(b) Mountain Silver Sagebrush/Tufted Hairgrass (*Artemisia cana* var. *viscidula*/*Deschampsia cespitosa*) Sparse Shrub Vegetation.

This is the other major type on the valley floor, where it occupies the highest riparian surfaces and covers most of the valley floor downstream from location 90. Mountain silver sagebrush forms a patchy shrub layer with at least 10% canopy cover, and shrubby cinquefoil (*Pentaphylloides floribunda*) is present near the mouth of Stoner Creek. Kentucky bluegrass (*Poa pratensis*) and field-clustered sedge (*Carex praegracilis*) generally dominate, and tufted hairgrass and slender wheatgrass (*Elymus trachycaulus* var. *trachycaulus*) are present in smaller amounts. Similar vegetation in southeastern Idaho has been named the *Artemisia cana*/*Poa pratensis* type by Padgett et al. 1989, but they note that it is derived from the *Artemisia cana*/*Deschampsia cespitosa* type by grazing.

This type seems to represent the *Deschampsia cespitosa* Habitat Type described from Montana (Hansen et al. 1995), the *Deschampsia cespitosa* Community Type described from western Wyoming and eastern Idaho (Youngblood et al. 1985), and the *Artemisia cana*/*Deschampsia cespitosa* Community Type described from Utah and southeastern Idaho (Padgett et al 1989).

(c) Tufted Hairgrass - Nebraska Sedge (*Deschampsia cespitosa* - *Carex nebrascensis*) Herbaceous Vegetation.

This type occurs in wet areas on the floodplain and low terraces on Little Muddy Creek upstream from location 90 and along the tributary entering at location 90, on slightly higher surfaces than those supporting either the Beaked Sedge Herbaceous Vegetation or the Small-wing Sedge Herbaceous Vegetation. Major species are tufted hairgrass and Nebraska sedge, with patches of beaked sedge (*Carex rostrata*) in low spots near the channel. This vegetation also seems to correspond to the *Deschampsia cespitosa* Habitat Type described from Montana (Hansen et al. 1995), the *Deschampsia cespitosa* Community Type described from western Wyoming and eastern Idaho (Youngblood et al. 1985), and the *Deschampsia cespitosa* Community Type described from Utah and southeastern Idaho (Padgett et al 1989).

(d) Beaked Sedge (*Carex rostrata*) Herbaceous Vegetation.

Along Little Muddy Creek, this type occurs downstream from location 90, where it forms a fringe up to several meters wide along the edge of the channel. Along the tributary entering at location 90, it occurs as patches around the margins of the beaver ponds and in the narrow channel. This type is dominated by beaked sedge and contains fowl mannagrass (*Glyceria striata*), foxtail (*Hordeum brachyantherum*), woolly sedge (*Carex lanuginosa*), and redtop (*Agrostis stolonifera*), and (in some areas) tufted hairgrass (*Deschampsia cespitosa*) as a secondary species. This type apparently corresponds to the *Carex rostrata* habitat type, *Deschampsia cespitosa* phase from Montana (Hansen et al. 1995), and relatively dry stands of the *Carex rostrata* Community Type of western Wyoming and eastern Idaho (Youngblood et al. 1985) and the *Carex rostrata* Community Type of Utah and southeastern Idaho (Padgett et al. 1989).

(e) Small-wing Sedge (*Carex microptera*) Herbaceous Vegetation

In the stretch of Little Muddy Creek farthest upstream (location 85), where there is little standing water, the wet part of the riparian zone supports vegetation in which small-wing sedge (*Carex microptera*), rush (*Juncus longistylis*), and fowl mannagrass (*Glyceria striata*) are present, although field horsetail (*Equisetum arvense*), foxtail (*Hordeum brachyantherum*), Kentucky bluegrass (*Poa pratensis*), willowherb (*Epilobium ciliatum*), and monkeflower (*Mimulus guttatus*) may contribute more cover. This type also grows in the wet soils along the tributary that enters at location 90. It apparently represents the *Carex microptera* Community Type named from western Wyoming and eastern Idaho (Youngblood et al. 1985) and from Utah and southeastern Idaho (Padgett et al. 1989). The habitat type from Montana (Hansen et al. 1995) to which it corresponds is unclear.

(f) Nebraska sedge (*Carex nebrascensis*) Herbaceous Vegetation

This type occupies only a small area, growing in stands up to ca. 100 yards (91 m) wide along small tributaries entering Little Muddy Creek from the west, downstream from location 90. These tributaries often are wet meadows without a defined channel. It was not observed along Little Muddy Creek or its major tributary. Nebraska sedge dominates the vegetation strongly, and tufted hairgrass and fowl mannagrass (*Glyceria striata*) are secondary species. Water whorlgrass (*Catabrosia aquatica*) is present. This vegetation apparently represents the *Carex nebrascensis* Habitat Type described from Montana (Hansen et al. 1995), the *Carex nebrascensis* Community Type of western Wyoming and eastern Idaho (Youngblood et al. 1985), and the *Carex nebrascensis* Community Type of Utah and southeastern Idaho (Padgett et al. 1989).

Canada thistle (*Cirsium arvense*), a noxious weed, is common along Little Muddy Creek above location 90 and along the tributary entering at location 90. *Carduus* sp., another noxious weed, also is common in the valley of that major tributary.

The vegetation on the surrounding uplands in the lower part of the valley, north of location 90, is mainly mountain big sagebrush shrubland and alkali sagebrush (*Artemisia arbuscula* var. *longiloba*) shrubland. In the upper part of the valley, and in the valley of the tributary entering at location 90, the upland vegetation is mainly mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*) and snowberry (*Symphoricarpos oreophilus*) shrubland on south- and west-facing slopes, and woodlands of Douglas-fir and aspen on north- and east-facing slopes. Virtually no aspen trees grow within ca. 100 yards (ca. 100 m) of the stream and most are 150-200 yards (137-183 m) from the riparian zone. Stumps from aspen trees cut by beaver are common nearer to Little Muddy Creek, indicating that the beaver dams in this stretch of the valley were built with materials near to hand (photo 98GJ2.6). At location 85 on the upper part of Little Muddy Creek, an open aspen woodland used to grow on the adjacent upland slopes, but beaver have cut most of the trees, and the vegetation is now shrubland. The Douglas-fir woodland on the south side of the stream valley still contains some aspen. In the valley of the major tributary, fallen aspen trunks are common on the hills near the stream. Beaver there are bringing aspen from a stand ca. 150 yd. (137 m) to the west of the stream, and over a rise ca. 40 ft. (12 m) high, to maintain the dams in the lower part of the valley.

(3) Disturbance

For the most part, the stream banks are well-vegetated. Sparsely-vegetated and barren banks were largely limited to the cutbanks on the outsides of stream meanders.

Cattle were present in the upper part of the valley of Little Muddy Creek, upstream from location 90. At location 89, the vegetation in the riparian zone had been grazed throughout to a height of < 6 in. (15 cm), and barren stream banks were common. Trails ran through the riparian zone. The riparian vegetation in the valley of the tributary entering at location 90 had been grazed throughout the valley, and ungulate trails were present.

b. Potential conditions

Little Muddy Creek supports mainly herbaceous vegetation now, and no evidence was noted to suggest that willows were extensive in the valley in the past. Little Muddy Creek valley was sprayed with herbicide from the air in the 1960s as part of a treatment on the grazing allotment (Ed Feeley, BLM Kemmerer office, personal communication), but if this spraying some 30 years ago killed large stands of willows, the evidence has disappeared. It seems highly unlikely that large numbers of willows will become established soon on Little Muddy Creek with current conditions. Willow seedlings (especially of sandbar, whiplash, and yellow willow; Padgett et al. 1989) generally become established on open substrates provided by sediment bars and drained beaver ponds. The meandering channel of Little Muddy Creek, and the abandoned beaver ponds at the upstream end of the valley, provide a limited amount of habitat, but there is no nearby source of abundant seed. There is no apparent reason why willow stands could not thrive once established, provided that they were protected from browsing animals until the plants grew tall enough that most of the canopy was above the reach of browsers. The presence of small stands of willows in nearby Stoner Creek, and the presence of large stands of Booth willow and sandbar willow on streams several miles to the northwest (i.e., Coal Creek upstream from its confluence with Salt Creek, and Salt Creek in Salt Canyon) indicate that established willows thrive in the area. Moreover, the studies by Youngblood et al. (1985) in western Wyoming and eastern Idaho, and by Padgett et al. (1989) in Utah and southeastern Idaho, show that stands of Booth willow and Geyer willow (both species present in the upper part of Little Muddy Creek) occupy fine-textured soils such as those found along Little Muddy Creek. In most of the stream valley, the habitat apparently suitable for willow establishment is found in a narrow zone along the stream channel, so willow stands in the valley, if established, would probably be limited for some time to a narrow fringe along the channel.

The beaver ponds in the upper part of Little Muddy Creek and in the major tributary entering at location 90 may be preventing downcutting of the stream channel in these steep valleys. Many of the dams apparently are abandoned, though, and they may fail eventually, resulting in downcutting in these stream sections. The lack of aspen within ca. 100 yards (91 m) of the stream channel, where it used to grow, may be an important reason for the abandonment of the dams. (Note, though, that beaver are bringing aspen to the dams in the lower part of the tributary from ca. 150 yards [137 m] away.) If the dams become stabilized by rhizomatous sedges, though (as have abandoned beaver dams on the South Fork of Mill Creek, described below), they may remain for many years, and the wide valley bottom become a series of wet meadows and, possibly, patches of willow.

2. Stoner Creek

Four locations were sampled on foot on Stoner Creek, two on the main branch between its confluence with Little Muddy Creek, and two on the South Fork between its confluence with the North Fork and the upstream limit of the perennial channel shown on the Huff Lake 7.5' topographic quad. cursory survey from a vehicle on the two-track road up the valley bottom suggested that these four locations represented the conditions on the entire stream.

a. Present condition

(1) Physical features

The valley gradient of the main branch is 3.6%, and of the South Fork, 5%. In the main branch and most of the South Fork, the channel is entrenched 5-6.6 ft. (1.5 - 2 m) into the valley bottom (98GJ2.12). The gully ends at a head cut ca. 300 yards (275 m) downstream from the upper end of the perennial part of the South Fork; above that headcut the channel is entrenched < 1.6 ft. (0.5 m) (photo 98GJ2.13). The presence of large willows (described below) along the entrenched channel within several hundred yards downstream from the head cut suggests that the head cut is moving upstream only slowly.

Throughout, the channel is ca. 1-1.6 ft (ca. 0.25 - 0.5 m) wide, and the channel bottom is covered with gravel and small cobbles.

(2) Vegetation

The valley bottom along Stoner Creek is narrow (to ca. 50 yards [46 m]), and riparian vegetation consists of essentially the same types as occur along Little Muddy Creek. Mountain silver sagebrush (*Artemisia cana* var. *viscidula*) is the most common shrub, growing on the upper terraces in the riparian zone. Willows are uncommon and were noted at two locations. In the lower part, at location 99, eight plants were seen, most of which were Geyer willow (*Salix geyeriana*) ca. 8 ft. (2.5 m) tall growing in the tufted hairgrass-Nebraska sedge meadow near the channel. At location 98 in the upper part of the South Fork, ten willows (Geyer willow and Booth willow [*Salix boothii*] 6.5-10 ft. [2 - 3 m] tall) were noted growing in the entrenched part of the stream. No willow seedlings were noted elsewhere, although they may be present in the unsurveyed parts of the stream.

The riparian vegetation can be placed into these types:

(a) Mountain silver sagebrush (*Artemisia cana* var. *viscidula*) Shrubland

This type covers most of the valley bottom, and grows on the highest of the riparian surfaces. Along the main branch of the stream, this type consists of a sagebrush layer above a herbaceous undergrowth in which the major species are Nelson needlegrass (*Stipa nelsonii*), Kentucky bluegrass (*Poa pratensis*), and field-clustered sedge (*Carex praegracilis*). In the upper part of the South Fork, this type consists of a mix of mountain silver sagebrush and mountain big

sagebrush (*Artemisia tridentata* ssp. *vaseyana*) with Great Basin wildrye (*Elymus cinereus*), Kentucky bluegrass, and field-clustered sedge.

This shrub type may correspond to the *Deschampsia cespitosa* Habitat Type described from Montana (Hansen et al. 1995), the *Deschampsia cespitosa* Community Type described from western Wyoming and eastern Idaho (Youngblood et al. 1985), and the *Artemisia cana*/*Deschampsia cespitosa* Community Type described from Utah and southeastern Idaho (Padgett et al 1989).

(b) Tufted hairgrass - Sedge species (*Deschampsia cespitosa*-*Carex* spp.) Herbaceous Vegetation

This herbaceous meadow grows on mesic terraces above the wettest part of the riparian zone, and is a minor type because these terraces are narrow. This vegetation apparently corresponds to the *Deschampsia cespitosa* Habitat Type described from Montana (Hansen et al. 1995), the *Deschampsia cespitosa* Community Type described from western Wyoming and eastern Idaho (Youngblood et al. 1985), and the *Deschampsia cespitosa* Community Type described from Utah and southeastern Idaho (Padgett et al 1989).

(c) Tufted hairgrass - Nebraska Sedge (*Deschampsia cespitosa*-*Carex nebrascensis*) Herbaceous Vegetation

Narrow bands of saturated soil near the channel support this wet meadow, which occurs along the entire length of the stream. This vegetation also apparently represents the *Deschampsia cespitosa* Habitat Type described from Montana (Hansen et al. 1995), the *Deschampsia cespitosa* Community Type described from western Wyoming and eastern Idaho (Youngblood et al. 1985), and the *Deschampsia cespitosa* Community Type described from Utah and southeastern Idaho (Padgett et al 1989).

(d) Beaked sedge (*Carex rostrata*) Herbaceous Vegetation

Small patches (most < 120 square yards [100 square meters]) of this type grow along the lower part of the main branch of Stoner Creek, near its confluence with Little Muddy Creek. Apparently it is absent from the steeper valley along the South Fork. This type apparently corresponds to the *Carex rostrata* habitat type, *Deschampsia cespitosa* phase from Montana (Hansen et al. 1995), and relatively dry stands of the *Carex rostrata* Community Type of western Wyoming and eastern Idaho (Youngblood et al. 1985) and the *Carex rostrata* Community Type of Utah and southeastern Idaho (Padgett et al. 1989).

(3) Disturbance

In the upper portion surveyed on the South Fork, animal trails ran through the valley bottom and the riparian vegetation had been grazed. Only minor trampling was noted in the riparian zone. The stream banks are generally well-vegetated throughout.

b. Potential conditions

The head cut in the upper part of the South Fork probably will continue to migrate upstream, and the stream channel will become entrenched. The presence of the large willows within several hundred yards downstream of the head cut (location 98) suggests that headcutting

has been intermittent or slow, so the time and rate at which the entrenchment will occur is unclear.

No evidence was noted that willow stands were extensive on Stoner Creek in the past. The riparian zone apparently was sprayed with herbicide applied from aircraft in the 1960s as part of a treatment in the grazing allotment (Ed Feeley, BLM Kemmerer office, personal communication), but if this spraying some 30 years ago killed large stands of willows on Stoner Creek, the evidence has disappeared.

The reason for the absence of willows along most of the stream is unclear. Willows obviously thrive on Stoner Creek once established, and the point bars in the meandering channel appear to provide suitable habitat for seedling establishment. It seems plausible that a narrow fringe of willows could become established on Stoner Creek if seedlings were established in the narrow zone of suitable habitat along the channel, and the plants were protected from browsing until the canopies were out of reach of most browsing animals. The willow stand could expand out into the rest of the valley floor only if the water table were raised several feet (ca. 1-1.5 m).

3. Coal Creek

Essentially the entire stretch of Coal Creek upstream from the mouth of the East Fork was surveyed on foot.

a. Present conditions

(1) Physical features

The surveyed stream stretch drops from 7,600 ft. to 6,600 ft. elevation and has an average valley gradient of 3.6%. The steepest portion of the valley is near the lower end (locations 102 and 111), where the valley gradient is 6%. The valley bottom is generally at least 100 yards (91 m) wide, but it is constricted in several places by sandstone outcrops (locations 111, 102, 106) or landslides (location 109). Throughout most of the valley, the stream channel is entrenched 3.2-6.4 ft. (1-2 m), and is 3.2-6.4 ft. (1-2 m) wide. The channel bottom and the point and lateral bars contain substantial amounts of sand, gravel, and cobbles (to ca. 24 in. [61 cm] long dimension).

Beaver dams were noted at a number of locations in the valley, as follows (starting from the downstream end):

- Location 109: remains of one old beaver dam of aspen. (Aspen trees are now ca. 100 yards [ca. 100 m] up the valley wall.)
- Location 101: dam <3.2 ft. (1 m) high and ca. 16 ft. (5 m) wide, containing fresh aspen and sagebrush.
- Location 104: old beaver dams, ca 32 ft (10m) across and 3.2 ft. (1m) high, of sticks to ca. 2" (5 cm) diameter. Very old; no sign of pond or meadow. Aspen now at least 200 yards (183 m) from stream here.
- Location 105: old dams of branches and trunks (aspen?) to ca. 6 in. (15 cm) dia. Typically ca. 5ft. (1.5 m) tall and 16 ft. (5 m) long, with Booth willow growing on them, ca. five shrubs to 6.5 ft. (2 m) tall (photo 98GJ2.16). Also one Geyer willow. Upper part of this stretch

of stream is a series of old dams, now with dry meadows. Channel entrenched to 3.2-6.5 ft. (1-2 m) -- 10 ft (3 m) in places -- in the meadows (photo 98GJ2.17).

-- Location 106: narrow, rocky valley bottom with steep gradient. Four active beaver dams built of aspen and willow.

-- Location 107: old, breached dams with shallow ponds and wetlands behind them.

(2) Vegetation

The riparian vegetation is primarily herbaceous meadow with a substantial amount of mountain silver sagebrush shrubland. Willows are present throughout the valley and are more common on Coal Creek than on Little Muddy Creek or Stoner Creek. Booth willow (*Salix boothii*) appears to be the most common species, followed by Pacific or whiplash willow (*Salix lasiandra*), Geyer willow (*S. geyeriana*), and yellow willow (*S. lutea*). Sandbar or coyote willow (*S. exigua*) is present as well. Most of the willows were observed growing on sparsely-vegetated bars or in wet vegetation types (the Beaked Sedge Herbaceous Type described below) no higher than 3.2 ft. (1 m) above the channel (locations 108, 109, 110, 104, 105). The plants usually were less than 1 foot tall, had stems at least 0.5 in. (1.3 cm) in diameter, and had been browsed, indicating that they were older plants, not seedlings. Booth, Geyer, and yellow willows were also noted at location 101 growing on a higher surface in the mountain silver sagebrush vegetation.

Willows are tallest and densest in the few short rocky stretches of stream valley, between sandstone outcrops. At locations 111 and 102, these are primarily Pacific willow (*S. lasiandra*), sandbar willow (*S. exigua*), and yellow willow (*S. lutea*); Booth willow (*S. boothii*) is present as well, but Geyer willow (*S. geyeriana*) was not noted in these two rocky sites. At location 106, farther up the valley, Booth willow and Geyer willow were only two species in the rocky habitat. In these short stream stretches, the willows often grow to 6.5 ft. (2 m) tall, although some plants at location 111 have been browsed to a height of less than 1.6 ft. (0.5 m).

The willows in the constricted, rocky valley segments were accompanied by a few honeysuckle (*Lonicera involucrata*) and 1 bog birch (*Betula glandulosa*) (location 102). Scattered pole-size narrowleaf cottonwoods (*Populus angustifolia*) are present in the rocky valley bottom at location 111, and a stand of narrowleaf cottonwood saplings grows on the eastern valley wall ca. 32 ft. (10 m) above the valley bottom there.

At location 105, some 20 clumps of dead shrub stems about 4 in. (10 cm) in diameter were noted in a dry meadow of approximately 1 acre (0.4 ha), ca. 6.5 ft. (2 m) above the stream channel behind an old beaver dam. These clumps of dead stumps, each ca. 3.2 ft. (1 m) in diameter, resembled the bases of willows more than any other shrub noted in the valley.

The vegetation in the riparian zone and around seeps on the lower valley walls can be placed into these types:

(a) Kentucky bluegrass - Slender wheatgrass (*Poa pratensis* - *Elymus trachycaulus*) Herbaceous Vegetation (photos 98GJ2.14 and 2.18)

This vegetation type grows on the intermediate terraces in the riparian zone, and covers much of the valley floor. The major species are Kentucky bluegrass, field-clustered sedge (*Carex praegracilis*), and slender wheatgrass (*Elymus trachycaulus* var. *trachycaulus*); secondary

species in some areas are redtop (*Agrostis stolonifera*), yarrow (*Achillea millefolium*), Nelson's needlegrass (*Stipa nelsonii*), strawberry (*Fragaria virginiana*), rosy pussytoes (*Antennaria rosea*), and dandelion (*Taraxacum* sp.). Tufted hairgrass (*Deschampsia cespitosa*) is present in places, but contributes only a little canopy cover. Mountain silver sagebrush (*Artemisia cana* var. *viscidula*) contributes up to ca. 10% canopy cover in some areas.

This type appears to occupy the same position in the riparian zone as does the Tufted Hairgrass - Sedge species (*Deschampsia cespitosa* - *Carex* spp.) Herbaceous Vegetation in the valley of Little Muddy Creek, and this Kentucky bluegrass type may be derived from that Tufted Hairgrass - Sedge spp. type by grazing, as suggested by Youngblood et al. (1985) and Padgett et al. (1989). (The near-absence of tufted hairgrass along Coal Creek, though, is puzzling.) If so, then it apparently represents the *Deschampsia cespitosa* Habitat Type described from Montana (Hansen et al. 1995), the *Deschampsia cespitosa* Community Type described from western Wyoming and eastern Idaho (Youngblood et al. 1985), and the *Deschampsia cespitosa* Community Type described from Utah and southeastern Idaho (Padgett et al 1989).

(b) Mountain Silver Sagebrush/Tufted Hairgrass (*Artemisia cana* var. *viscidula*/*Deschampsia cespitosa*) Shrub Vegetation (photos 98GJ2.14 and 2.18)

This vegetation type with a sparse shrub layer grows on the highest of the terraces in the riparian zone and covers much of the valley bottom. Mountain silver sagebrush forms a shrub canopy (usually with < 25% cover) that may contain small amounts of mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*). The major species of the herbaceous undergrowth are California brome (*Bromus carinatus*), Kentucky bluegrass (*Poa pratensis*), and slender wheatgrass (*Elymus trachycaulus* var. *trachycaulus*). Tufted hairgrass is present in places but usually contributes only a small amount of canopy cover. Western coneflower (*Rudbeckia occidentalis*) and Canada thistle (*Cirsium arvense*), a noxious weed, form patches in some locations. This type may be a grazing-induced variant of the Mountain Silver Sagebrush/Tufted Hairgrass Sparse Shrubland that appears to grow on equivalent terraces in the valley of Little Muddy Creek.

This type apparently corresponds to the *Deschampsia cespitosa* Habitat Type described from Montana (Hansen et al. 1995), the *Deschampsia cespitosa* Community Type described from western Wyoming and eastern Idaho (Youngblood et al. 1985), and the *Artemisia cana*/*Deschampsia cespitosa* Community Type described from Utah and southeastern Idaho (Padgett et al 1989).

(c) Beaked sedge (*Carex rostrata*) Herbaceous Vegetation

This type occurs as narrow bands (to ca. 6.5 ft. [2 m] wide) and patches in wet soils along the stream channel and around old beaver ponds (location 107). Common associates are spikerush (*Eleocharis quinqueflora*), fowl mannagrass (*Glyceria striata*), woolly sedge (*Carex lanuginosa*), and Nebraska sedge (*Carex nebrascensis*). Although it covers little of the riparian zone, this sedge type occurs throughout the length of Coal Creek (98GJ2.18).

This type apparently corresponds to the *Carex rostrata* habitat type, *Deschampsia cespitosa* phase from Montana (Hansen et al. 1995), and relatively dry stands of the *Carex*

rostrata Community Type of western Wyoming and eastern Idaho (Youngblood et al. 1985) and the *Carex rostrata* Community Type of Utah and southeastern Idaho (Padgett et al. 1989).

(d) Woolly sedge (*Carex lanuginosa*) Herbaceous Vegetation

This is a type that covers little area in the riparian zone and appears to occupy slightly drier sites than does the beaked sedge type: wet soils farther from the channel and slightly higher, cut-off channels, and abandoned meanders. These two types merge into one another. Woolly sedge, fowl mannagrass (*Glyceria striata*), and redtop (*Agrostis stolonifera*) are the major species; beaked sedge (*Carex rostrata*), Nebraska sedge (*Carex nebrascensis*), and Baltic rush (*Juncus balticus*) usually occur in the vegetation. This type apparently corresponds to the *Carex lasiocarpa* Habitat Type of Montana (Hansen et al. 1995), and represents the Miscellaneous *Carex* Community Types of western Wyoming and eastern Idaho (Youngblood et al. 1985) and the *Carex lanuginosa* Community Type of Utah and southeastern Idaho (Padgett et al. 1989).

(e) Nebraska sedge (*Carex nebrascensis*) Herbaceous Vegetation

Patches of this type were noted around seeps on the lower parts of valley walls and higher terraces; it was not noted near the stream channel. Nebraska sedge, woolly sedge (*Carex lanuginosa*), tufted hairgrass (*Deschampsia cespitosa*), and fowl mannagrass (*Glyceria striata*) are the most common species, and Baltic rush (*Juncus balticus*) is present. It seems to represent the *Carex lasiocarpa* Habitat Type or the *Carex nebrascensis* Habitat Type described from Montana (Hansen et al. 1995), the *Carex nebrascensis* Community Type or the Miscellaneous *Carex* Community Types of western Wyoming and eastern Idaho (Youngblood et al. 1985), and the *Carex nebrascensis* Community Type of Utah and southeastern Idaho (Padgett et al. 1989).

(3) Disturbance

In the central part of this segment of stream valley (locations 103, 104, 105), the vegetation in the riparian zone had been grazed to 1-2 in. (2.5-5 cm) high and much of it had been trampled. Barren, trampled streambanks were also noted in this part (photos 98GJ2.16 and 2.17). Cattle were present in the valley from location 101 (where the fence around a large enclosure apparently was down in places,) downstream, but the vegetation and streambanks showed much less sign of grazing and trampling.

Pocket gopher (Geomysidae) diggings were noted as being abundant at one location (105) in the central part of the valley.

On nearly all of the willows, stems up to 0.5 in. (1.2 cm) diameter had been browsed to a height of 6-24 in. (6-60 cm), except in the three narrow, rocky valley segments (locations 111, 102, 106), where many of the shrubs were unbrowsed and grew over 6.5 ft (2 m) tall.

b. Potential conditions

Willows are scattered along the stream valley in the segment of Coal Creek surveyed, but no evidence was noted to suggest that willows were extensive in the valley in the past. Coal Creek valley was sprayed with aerially-applied herbicide in the 1960s as part of a treatment of the grazing allotment (Ed Feeley, BLM Kemmerer office, personal communication), but if the spraying some 30 years ago killed large stands of willows in Coal Creek, the evidence has

disappeared. The presence of the clumps of dead shrubs in the dry meadow behind the old beaver pond at location 105 suggests that Coal Creek may have supported scattered patches of willows at one time. (Note, though, that no signs of willow patches were noted at any other locations outside of the narrow, rocky valley segments.)

Coal Creek seems to have the potential to support a fringe of willows, or scattered clumps of willows, along the channel. Small groups of willows already occur on bars in the valley, and if these plants were protected from browsing until they grew several yards (several meters) tall, they might provide a seed source for new plants to become established on the other stream bars formed by the meandering channel. Any willow stands likely to become established in the near future will be limited to the area along the channel, and expansion into the rest of the valley bottom would require that open sites for seedling establishment be created and the water table be raised.

The abandoned beaver dams and the dry meadows behind them in the upper part of the valley indicate that beaver at one time exerted a larger influence on the riparian and aquatic ecosystems than they do now and are likely to in the near future. Although signs of recent beaver activity were noted in the lower, middle, and upper parts of this valley segment (locations 109, 101, 106), few aspen now grow closer than ca. 100 yards (ca. 100 m) to the stream, and willows seem to be too sparse to support beaver. Hence the valley seems to lack food and dam materials for beaver.

In the relatively dry riparian vegetation types that cover most of the valley bottom, the high proportion of Kentucky bluegrass and the scarcity of tufted hairgrass might be attributed to prolonged grazing (Youngblood et al. 1985, Padgett et al. 1989). If so, a change in grazing management might produce a more diverse herbaceous layer. Padgett et al. (1989) note, though, that grazing should not always be assumed to produce sites with substantial Kentucky bluegrass and little tufted hairgrass. Note that pocket gophers are common in the drier riparian zone at one location (at least) in the valley, and that the vegetation contains substantial amounts of graminoids palatable to livestock: California brome (USDA 1937), slender wheatgrass (USDA 1937), and field-clustered sedge (Hermann 1970).

Streams within the WSA

1. Raymond Creek

Raymond Creek was surveyed on foot from the mouth of the canyon at the western edge of the WSA, upstream on the North Fork to NW1/4 NE1/4 Sec 33, T27N, R119W, and upstream on the South Fork to ca. 200 yards (183 m) above Raymond Basin (location 22).

a. Present conditions

(1) Physical features

The stretch of Raymond Creek from the confluence of the South and North Forks at Raymond Basin downstream to the mouth of the canyon flows through a valley with a gradient of 2.4%. On the North Fork, from Raymond Basin upstream ca. 1 mile (1.6 km) to location 28, the

valley gradient is somewhat steeper (3.9%), but up the South Fork ca. 0.25 mile (0.4 km), the valley has a gentle gradient of only 1.4%.

For most of the stretch of Raymond Creek surveyed upstream from the mouth of the canyon, the stream channel is 3.2-6.4 ft. (1-2 m) wide and is entrenched ca. 5-8 ft. (1.5-2.5 m) into the valley floor (photos 98GJ6.15 and 6.16). The meandering channel has cut terraces and a new floodplain in the gully, and the steep walls of the gully are well vegetated. Much of the alluvium in the valley is fine textured, but gravels and cobbles are common in the channel and on bars. Conditions differ from these in two stretches of stream. The uppermost section of the North Fork surveyed, from the confluence of the two branches in NW1/4 SE1/4 Sec 33 upstream ca. 0.25 mile (0.4 km) to location 28, is a smaller stream (carrying only ca. 25% of the water found below Raymond Basin) that is not entrenched and flows across a bed of limestone gravel. The South Fork in Raymond Basin flows through a gully 6.4-10 ft. (2-3 m) deep and only ca. 16 ft. (5 m) wide cut into fine-textured alluvium (photo 98GJ6.19). The straight channel there has not formed a new floodplain, and the sides of the gully are sparsely vegetated, largely with weeds (Canada thistle, black henbane, mullein). Above Raymond Basin, the short stretch of the South Fork surveyed (only ca. 200 yards [183 m]) has essentially the same characteristics as it does below Raymond Basin.

Beaver dams were noted only on the North Fork above Raymond Basin (locations 23 and 26), and all of the dams (5 or 6 of them) were old and not being maintained. Several had been breached or by-passed by the stream. The dams appear to have been constructed of aspen. Stumps of beaver-cut aspen were noted at location 24 on the North Fork (where several of the dams were located), in the dry meadow on the South Fork in Raymond Basin, and in the valley bottom downstream from Raymond Basin to the mouth of the canyon. (Stumps in the latter stretch might have been from narrowleaf cottonwood.) Beaver cut logs and branches old enough that they had lost their bark were noted in the gully on the South Fork in Raymond Basin and in the riparian zone from Raymond Basin downstream to the mouth of the canyon, but no dams were noted in these locations.

(2) Vegetation

Shrubby riparian vegetation grows along most of the part of Raymond Creek surveyed. From the mouth of the canyon upstream to the confluence of the North Fork with the South Fork, the shrubs grow throughout the valley bottom, on the old valley floor (which now forms the highest of the riparian surfaces) and on the terraces and the new floodplain in the gully (photos 98GJ6.15 and 6.16). On the two forks above Raymond Basin, the shrubs grow in patches mixed with patches of herbaceous vegetation. Riparian vegetation largely disappears up the North Fork above the confluence of the two branches in NW1/4 SE1/4 Sec 33. Narrowleaf cottonwood (*Populus angustifolia*) is present, but is limited to a grove of trees at the mouth of the canyon, scattered trees in the stretch from the canyon mouth upstream to Raymond Basin, and two or three small clumps of trees on the North Fork upstream from the confluence of the two branches (location 28). Aspen is similarly rare in the riparian zone.

The riparian vegetation along Raymond Creek can be placed into the following types.

(a) Mixed-Shrub Vegetation

This is the most widespread of the riparian types on Raymond Creek, occurring from the mouths of the tributaries in NW1/4 NW1/4 Sec 5 upstream to the branches of the North Fork in NW1/4 SE1/4 Sec 35, and ca. 200 yards (183 m) above Raymond Basin on the South Fork. Downstream from Raymond Basin the shrubs largely fill the valley bottom, but above Raymond Basin the vegetation becomes a mix of shrub patches and patches of herbaceous vegetation. Throughout, red-osier dogwood (*Cornus sericea*), sandbar willow (*Salix exigua*), and chokecherry (*Prunus virginiana*) contribute the most cover (about equal to one another) and Wood's rose (*Rosa woodsii*) is secondary; yellow willow (*S. lutea*) and whiplash willow (*S. lasiandra*) are present sporadically. Chokecherry is restricted to the higher, drier parts of the valley bottom, while the dogwood and the willows are found on all surfaces. On the lowest surface (i.e., bars along the channel), small-wing sedge (*Carex microptera*), Kentucky bluegrass (*Poa pratensis*), fowl mannagrass (*Glyceria striata*), and seedlings of sandbar willow and red-osier dogwood form open patches.

The abundance of chokecherry, which probably results from the entrenchment of the stream channel and the consequent drying of the old valley floor, makes placement of this vegetation into types from other classifications difficult. It is tentatively assigned to the *Salix exigua/Poa pratensis* Community Type that Youngblood et al. (1985) described from western Wyoming and eastern Idaho, but it also resembles vegetation from canyons on the western side of the Bighorn Mountains, where red-osier dogwood and chokecherry grow together along high-gradient streams (G. Jones, WYNDD, unpublished notes).

(b) Western Birch/Red-osier Dogwood (*Betula occidentalis/Cornus sericea*) Shrub Vegetation

This dense shrub type is found on the lower part of Raymond Creek, from the mouth of the canyon upstream ca. 0.5 mile (0.8 km) to the tributaries in NW1/4 NW1/4 Sec 5. It merges upstream into the Mixed Shrub Vegetation Type as western birch drops out. Western birch forms a tall shrub layer above a lower layer of red-osier dogwood, sandbar willow (*Salix exigua*), and Wood's rose (*Rosa woodsii*). Yellow willow (*S. lutea*) and whiplash willow (*S. lasiandra*) are present in smaller amounts. Chokecherry (*Prunus virginiana*) grows on the higher surfaces in the valley bottom and contributes substantial cover.

This type seems to fit the *B. occidentalis/C. sericea* community type of Padgett et al. (1989) from Utah and southeastern Idaho.

Weeds are common as scattered patches and individuals throughout the riparian zone from the canyon mouth upstream into Raymond Basin. The list of weeds in this stretch includes the noxious species hoary cress (*Cardaria chalapensis*), Canada thistle (*Cirsium arvense*), Dalmatian toadflax (*Linnaria dalmatica*), Dyer's woad (*Isatis tinctoria*), and burdock (*Arctium minus*). See page 33 for details.

(3) Disturbance

A bladed road, now closed at the canyon mouth, runs up the valley from the canyon mouth. Ungulate trails run throughout the shrub vegetation from the mouth of the canyon upstream to Raymond Basin, and cattle tracks and droppings were noted along the trail and the road in this stretch of canyon. The shrubs showed no obvious sign of heavy browsing, and the riparian zone was not noticeably trampled or heavily grazed. While bare cutbanks are present in the entrenched stream channel, the sides of that gully are at least moderately vegetated.

b. Potential conditions

The deep gully in the bottom of the valley indicates that Raymond Creek went through a period of downcutting, the cause of which is unclear. Judging from the point and lateral bars along the edge of the channel, which are vegetated with willow seedlings and various graminoids and forbs, the stream is now cutting a new floodplain in the bottom of the gully. If this lateral cutting continues, the vegetation in the riparian zone probably will come to have a higher proportion of willows and a lower proportion of chokecherry.

Beaver have inhabited the canyon, as indicated by the presence of abandoned dams and of beaver-cut branches and stumps. No evidence was noted to suggest that beaver are active now. The riparian zone appears to offer little in the way of food or dam materials for beaver: few of the willow branches are larger than 3 or 4 in. (7.6-10 cm) in diameter, narrowleaf cottonwoods are rare, and few aspen grow within several hundred yards (several hundred meters) of the valley bottom (excepting that stand at the mouth of the tributary that enters from the south at Raymond Basin; location 13).

2. South Fork of Mill Creek

The South Fork of Mill Creek was surveyed on foot from its confluence with the North Fork upstream ca. 1.8 mile (2.9 km) to the point in SW1/4 Sec 27, T26N, R119W where the pack trail diverges from the stream.

a. Present conditions

(1) Physical features

The gradient of the valley from the confluence with the North Fork upstream ca. 1.6 mile (2.6 km) to the point in Sec 27 where the trail leaves the stream is 5.2%. The upper part of the valley is steeper: above the mouth of the tributary in SE1/4 Sec 27, the gradient is 6%, while the gradient below that tributary is 4.8%.

In the 0.67-mile-long (1-km-long) stream reach upstream from the confluence with the North Fork, the stream channel is entrenched ca. 6.5 ft. (2 m) into the valley floor, and the gully it occupies is 10-13 ft. (3-4 m) wide. Three (or possibly four) old beaver dams, some breached, were noted in this reach. At the point where the stream is shown crossing the section line between Sec 26 and Sec 35, the valley is constricted by a steeply-dipping sandstone outcrop. Upstream from that constriction to the mouth of the tributary in SE1/4 Sec 27, the channel is entrenched only ca. 3.2 ft. (1 m) in a gully ca. 6.4 ft. (2 m) wide and is well vegetated (photos 98GJ1.17 and 1.18). This stretch of the valley contains numerous beaver dams so old that many

are just outlines in the dense herbaceous vegetation. The dams appear to have been built of aspen trunks and branches 6-8 in. (15-20 cm) in diameter.

Above the mouth of the tributary, the South Fork is more narrowly confined by the valley walls. The channel is entrenched ca. 6.5-10 ft. (2-3 m) in the valley floor. Small beaver dams 6.5-10 ft. (2-3 m) across and 3.2 ft. (1 m) or less high are present in this stretch of the valley.

(2) Vegetation

The riparian vegetation in the South Fork valley is predominantly sagebrush shrub in the lower part, herbaceous meadow in the middle part, and conifer and aspen woodland in the upper part. Willows are present in the stretch from the sandstone constriction (Sec 26/Sec 35 line) upstream to the mouth of the tributary (SE1/4 Sec 27), but only as scattered individuals and clumps of decadent Geyer willow (*Salix geyeriana*).

Aspen were present in the valley. In the stretch from the sandstone constriction upstream to the mouth of the tributary, the trees within several hundred yards (several hundred m) of the riparian zone are less than 3 in. (7.5 cm) in diameter; larger trees are farther from the stream. In the upper part of the valley, upstream from the tributary in Sec 27, aspen poles and small trees are common within 50 yards (46 m) of the valley bottom.

Canada thistle (*Cirsium arvense*) is common in the valley bottom. Patches containing several hundred to ca. 1000 stems were noted in the riparian zone near the confluence with the North Fork and near the mouth of the tributary in SE1/4 Sec 27, and individuals plants were scattered in the mountain big sagebrush vegetation at the foot of the north valley wall. Bull thistle (*Cirsium vulgare*) also was present as scattered plants at the mouth of the tributary. *Carduus* sp. and mullein (*Verbascum thapsus*) were growing with the Canada thistle at the foot of the north valley wall.

The following types of vegetation grow in the riparian zone of the South Fork

(a) Nebraska sedge (*Carex nebrascensis*) Herbaceous Vegetation

This wet meadow type fills the valley from the sandstone outcrop on the Sec 26/Sec 35 line upstream to the mouth of the tributary in Sec 27, where the channel is little entrenched and old beaver dams have maintained a high water table (photos 98GJ1.17 and 1.18). Nebraska sedge, fowl mannagrass (*Glyceria striata*), spikerush (*Eleocharis* sp. [probably *E. quinqueflora*]), and rush (*Juncus* sp.) are the major species, and meadow timothy (*Phleum pratense*), an exotic species, grows in the drier parts of this vegetation. Below the sandstone constriction, Nebraska sedge also grows in small patches along the deeply-entrenched channel. This type apparently corresponds to the *Carex nebrascensis* Community Type named from western Wyoming and eastern Idaho by Youngblood et al (1985), from Utah and southeastern Idaho by Padgett et al. (1989), and from Montana (Hansen et al. 1995).

(b) Mountain Silver Sagebrush (*Artemisia cana* var. *viscidula*) Shrub Vegetation

This type covers most of the valley section downstream from the sandstone constriction (Sec 26/35 line), where the channel is deeply entrenched, leaving the old valley bottom (where this type grows) dry. Major species in the herbaceous undergrowth are the exotic Kentucky

bluegrass (*Poa pratensis*), Nelson's needlegrass (*Stipa nelsonii*), and slender wheatgrass (*Elymus trachycaulus*). All of the major grasses grow in upland sites, which indicates that much of the valley bottom in this reach may no longer qualify as a riparian site. This vegetation type does not seem to correspond to any riparian types described in published classifications.

(c) Aspen/Chokecherry (*Populus tremuloides/Prunus virginiana*) Woodland

Upstream from the mouth of the tributary in Sec 27, the riparian vegetation along the entrenched stream consists of chokecherry and Utah snowberry (*Symphoricarpos oreophilus*) with a patchy tree overstory of aspen and Douglas-fir (*Pseudotsuga menziesii*). Much of this stream reach is bordered on the south by a Douglas-fir woodland growing on a north-facing slope, and that tree is not a riparian species in this area. This woodland does not correspond to any type from the classification of riparian communities applicable to this area (Youngblood et al. 1985, Padgett et al. 1989). It may represent the *Populus tremuloides/Cornus stolonifera* Habitat Type described from Montana.

(3) Disturbance

Throughout much of the valley bottom in the South Fork, the herbaceous vegetation had been grazed to a height of less than 6 in. (15 cm), and ungulate trails were present. Cattle were grazing in the riparian zone in the lower part of the valley (near the confluence with the North Fork), the middle part (from the sandstone constriction upstream to the mouth of the tributary in Sec 27), and the upper part (upstream from the tributary). In the latter part of the valley, cattle may stay in the valley bottom because the valley sides are steep and offer little forage.

b. Potential conditions

The high water table in the middle stretch of the stream valley, from the sandstone constriction in Sec 26/35 upstream to the tributary in Sec 27, is due to the presence of beaver dams. None of the dams are maintained, and willows or aspens suitable for dams are lacking. The dams are partly vegetated with rhizomatous Nebraska sedge, though, and they may prevent downcutting by the stream channel. If the dams are breached, that section of the stream probably will become entrenched, lowering the water table and causing the vegetation to shift from the wet Nebraska sedge meadow to a drier type. (It is unclear whether the sandstone outcrop that constricts the valley is close enough to the ground surface beneath the valley bottom to prevent the stream from entrenching.) The willows are unlikely to spread in this part of the valley because the open sediment bars needed for seedling establishment are lacking.

In the lower part of the valley, the riparian zone will continue to be restricted to a narrow fringe along the entrenched channel until the stream meanders enough to cut a new floodplain. The time required for this is unclear. The old valley bottom, which was drained by entrenchment of the channel, will remain dry unless the water table is raised again. Given the absence of willows or aspen suitable for beaver, there is no obvious mechanism to accomplish this.

In the upper part of the valley, upstream from the mouth of the tributary in Sec 27, sufficient aspen poles and small trees may be growing near the valley bottom to support a beaver population. If so, the riparian zone might be widened, and habitat provided for hydrophytic

grasses and sedges and for willows. However, there is no apparent source of willow seeds nearby.

3. Chalk Creek

A stretch of the valley ca. 2 miles (3.2 km) long, from the head of the valley downstream to the NW1/4 SW1/4 Sec 3, T25N, R119W, was surveyed on foot.

a. Present conditions

(1) Physical features

Chalk Creek flows in a steep valley. From the point at which water was noted in the stream channel (at an elevation of ca. 7,400' [2255 m] in SE1/4 NE1/4 Sec 33) downstream ca. 2 miles (3.2 km) to the boundary with private property on the southern section line of Sec 3, the valley has a gradient of 8.6%. The valley containing the length of stream shown as perennial on the Marse 7.5' topographic quad, from the SE1/4 SE1/4 Sec 33 downstream ca. 1.5 miles (2.4 km) to the boundary with private land, has a gradient of 6.7%.

The valley bottom is ca. 150-300 ft. (ca. 50-100 m) wide and appears to be filled with fine-textured alluvium. The channel is entrenched into the valley bottom some 8-10 ft. (2.5-3 m), in a gully 15-25 ft. (4.5-7.6 m) wide (photo 98GJ1.22). The channel is narrow (up to ca. 5 feet, or 1.5 m, wide) and flows through fine-textured alluvium. Gravel and cobbles are present in the channel bottom and on bars.

No beaver dams or other signs of beaver were noted in the valley.

(2) Vegetation

The vegetation over most of the valley floor has more the character of upland vegetation than of riparian vegetation. This vegetation may be placed in the following types:

(a) Mountain Big Sagebrush (*Artemisia tridentata* var. *vaseyana*) Shrub Vegetation

The vegetation on most of the valley floor is an open shrub layer of Douglas rabbitbrush (*Chrysothamnus nauseosus*) and mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*) with Utah snowberry (*Symphoricarpos oreophilus*) and a herbaceous undergrowth in which the major species are Kentucky bluegrass (*Poa pratensis*), dandelion (*Taraxacum* sp.), yarrow (*Achillea millefolium*), Nelson's needlegrass (*Stipa nelsonii*), California brome (*Bromus carinatus*), and slender wheatgrass (*Elymus trachycaulus* var. *trachycaulus*) (photos 98GJ1.21 and 1.22). The tall grasses -- needlegrass, brome, and slender wheatgrass -- grow mostly beneath the shrubs, and the Kentucky bluegrass between the shrubs. A few scattered Rocky Mountain juniper (*Juniperus scopulorum*) grow in this vegetation. These species are characteristic of mesic upland sites, and the vegetation should not be considered riparian. Youngblood et al. (1985), writing about their *Poa pratensis* Community Type in western Wyoming and eastern Idaho, note that vegetation with a high proportion of Kentucky bluegrass and yarrow (and other species) is derived from grazing of other types, and that mountain big sagebrush invades the vegetation if the water level drops.

(b) Kentucky bluegrass (*Poa pratensis*) Herbaceous Vegetation

Several small tributary streams, ca. 1 ft. (30 cm) wide and 3 in. (7.6 cm) deep, flow across the valley bottom in poorly defined channels from the western valley wall (photo 98GJ1.23). The wet soils along these streams support narrow bands of Kentucky bluegrass, foxtail barley (*Hordeum brachyantherum*), and fowl mannagrass (*Glyceria striata*). This type covers a very small part of the valley floor. Youngblood et al. (1985) described a *Poa pratensis* Community Type from western Wyoming and eastern Idaho that seems to encompass this Chalk Creek vegetation. They note that it is a persistent, grazing-induced type derived from other riparian communities.

(c) Narrowleaf Cottonwood/Wood's Rose (*Populus angustifolia/Rosa woodsii*) Woodland

One small grove of cottonwood trees, ca. 33 feet (10 m) wide and 165 feet (50 m) long, was noted at location 72, growing in the gully cut by the stream channel. The trees are 6 in. (15 cm) or less in diameter and ca. 50 feet (15 m) tall. Beneath the cottonwood overstory is an open lower tree layer of Douglas-fir (*Pseudotsuga menziesii*) saplings to ca. 16 ft. (5 m) tall, and an open shrub layer of Rocky Mountain maple (*Acer glabrum*), chokecherry (*Prunus virginiana*), and Wood's rose. The herbaceous undergrowth is very sparse and includes mainly Kentucky bluegrass (*Poa pratensis*). This vegetation type apparently represents the *Populus angustifolia/Rosa woodsii* Community Type from Utah (Padgett et al. 1989). Hansen et al. (1995) have described a *P. angustifolia/Symphoricarpos occidentalis* Community Type from Montana (Hansen et al. 1995), which this type also resembles, and they consider it a grazing-induced phase of the *P. angustifolia/Cornus stolonifera* (synonym of *Cornus sericea*) Community Type. (This Chalk Creek stand may be growing on finer-textured soils than does the Montana type, and the interpretation of Hansen et al. may not apply here.)

Patches of Canada thistle (*Cirsium arvense*) are common along the stream channel. Houndstongue (*Cynoglossum officinale*) and mullein (*Verbascum thapsus*) are common in the valley bottom, growing as scattered individual plants in the mountain big sagebrush vegetation.

(3) Disturbance

Pocket gopher (Geomyidae) diggings were common in the mountain big sagebrush vegetation. The herbaceous vegetation throughout the valley floor was grazed to a height of several inches (several cm), and cattle tracks and droppings were common. The Rocky Mountain juniper shrubs had a distinct lower canopy line ca. 3.2 feet (1 m) above the ground (photo 98GJ1.21).

b. Potential conditions

Several observations suggest that the vegetation in the valley bottom will undergo only minor changes. First, the mountain big sagebrush type on the old valley floor is located above the water table, and changes in that vegetation are likely to consist simply of changes in the relative amounts of the species adapted to the mesic environment. Total grass cover might be increased and shrub cover decreased as well, but the vegetation is unlikely to change to anything other than a mesic grassland or shrub type.

Second, the presence of cottonwood trees on the side of the gully suggests that, in at least part of the valley, the channel became entrenched some time ago. The failure of the channel to begin cutting a new floodplain within the gully may indicate that the stream is stable.

The aspen woodland at the head of the valley and the cottonwood grove farther down the valley may provide food and dam material sufficient to support a beaver population. If so, the water table might be raised, and more significant changes might be expected in the vegetation of the valley bottom.

4. Huff Creek

The riparian vegetation along Huff Creek was sampled at three points. cursory survey of the valley bottom by vehicle and on foot from its mouth upstream ca. 3.5 miles (5.6 km) to the SE1/4 Sec 9, T27N, R119W suggests that those three points represent the major vegetation types.

No survey was made of the valley above the SE1/4 Sec 9, but observations through binoculars revealed no obvious differences between that upper, un-surveyed part of the valley and the lower part.

a. Present conditions

(1) Physical features

Most of the valley, from an elevation of 6,800 ft. (2,073 m) in SE1/4 Sec 16 downstream to the mouth, has a very gentle gradient of 1.5% - 1.6%. The upper mile of the valley, from Huff Lake downstream to the SE1/4 Sec 16, has a gradient of 3.8%. The features physical features and the vegetation described here may differ from those in that steep, upper stretch.

The meandering channel of Huff Creek is 3.2-5 ft. (1-1.5 m) wide and entrenched < 3.2 ft. (1 m) into the valley floor. Gravel and cobbles are present in the channel and on bars. Alluvial fans from tributaries confine the stream in places (photo 98GJ6.29). Dense herbaceous vegetation covers much of the streambank. Within the large enclosure in the downstream half of the valley, log drop structures have been built in the channel and many of the meanders have been armored with boulders.

(2) Vegetation

The Huff Creek valley bottom is covered with herbaceous meadows and mountain silver sagebrush shrub vegetation. Willows were noted at one location (#50, in the large grazing enclosure), where three small plants of yellow willow (*Salix lutea*) were found growing together in the dense herbaceous vegetation. More small willows may be present elsewhere but hidden from view by the dense vegetation. Tall willows are absent.

The riparian vegetation in the valley can be placed into three major types:

(a) Tufted Hairgrass - Nebraska Sedge (*Deschampsia cespitosa* - *Carex nebrascensis*) Herbaceous Vegetation.

This is one of three major vegetation types in the valley bottom, growing on the lowest terraces near the channel. Tufted hairgrass, Nebraska sedge, woolly sedge (*Carex lanuginosa*),

strawberry (*Fragaria virginiana*), and potentilla (*Potentilla anserina*) are the major species, and other common species are field-clustered sedge (*Carex praegracilis*) and, near the channel, beaked sedge (*Carex rostrata*). Sweetgrass (*Hierochloa odorata*), buttercup (*Ranunculus macounii*), avens (*Geum macrophyllum*), several *Potentilla* spp., Baltic rush (*Juncus balticus*), and yarrow (*Achillea millefolium*), and shooting star (*Dodecatheon pulchellum*) may be present. Canada thistle (*Cirsium arvense*) is scattered throughout some stands.

This vegetation seems to correspond to the *Deschampsia cespitosa* Habitat Type described from Montana (Hansen et al. 1995), and the *Deschampsia cespitosa* Community Type described from western Wyoming and eastern Idaho (Youngblood et al. 1985) and from Utah and southeastern Idaho (Padgett et al 1989).

(b) Tufted hairgrass - Sedge species (*Deschampsia cespitosa*-*Carex* spp.) Herbaceous Vegetation.

This is one of the three major types in the valley bottom, growing on the intermediate terraces. Tufted hairgrass, field-clustered sedge (*Carex praegracilis*), and Kentucky bluegrass (*Poa pratensis*) co-dominate, and strawberry (*Fragaria virginiana*) and aster (*Aster ascendens*) are common. Baltic rush (*Juncus balticus*) and yarrow (*Achillea millefolium*) are present. Scattered mountain silver sagebrush (*Artemisia cana* var. *viscidula*) and shrubby cinquefoil (*Pentaphylloides floribunda*) usually grow in the vegetation but do not form a distinct shrub layer. This vegetation apparently also represents the *Deschampsia cespitosa* Habitat Type described from Montana (Hansen et al. 1995), and the *Deschampsia cespitosa* Community Type described from western Wyoming and eastern Idaho (Youngblood et al. 1985), and from Utah and southeastern Idaho (Padgett et al 1989).

(c) Mountain Silver Sagebrush/Tufted Hairgrass (*Artemisia cana* var. *viscidula*/*Deschampsia cespitosa*) Sparse Shrub Vegetation (Table 1-9)

This is the third major type in the valley bottom, where it grows on the highest terraces. Mountain silver sagebrush forms the shrub layer, which often contains smaller amounts of shrubby cinquefoil (*Pentaphylloides floribunda*). The understory in the two plots sampled (3.8 and 3.9) consisted of Kentucky bluegrass (*Poa pratensis*) and field-clustered sedge (*Carex praegracilis*) with yarrow (*Achillea millefolium*), strawberry (*Fragaria virginiana*), and various other species. Tufted hairgrass was absent from the two plots but present elsewhere in the vegetation. Shrub cover ranges from a closed canopy (plot 3.9) to an open canopy (plot 3.8), and this type merges into the *Deschampsia cespitosa*-*Carex* spp. Herbaceous Type on slightly lower surfaces.

Similar vegetation in southeastern Idaho has been named the *Artemisia cana*/*Poa pratensis* type by Padgett et al. 1989, but they note that it is derived from the *Artemisia cana*/*Deschampsia cespitosa* type by grazing. Hence this vegetation is interpreted as being a grazing-induced form of the *Artemisia cana*/*Deschampsia cespitosa* Community Type described by the same authors from Utah and southeastern Idaho. This type seems to represent the *Deschampsia cespitosa* Habitat Type described from Montana (Hansen et al. 1995), and it may correspond to the *Deschampsia cespitosa* Community Type described from western Wyoming and eastern Idaho (Youngblood et al. 1985).

A fourth, minor vegetation type may be recognized in the riparian zone:

(d) Baltic Rush (*Juncus balticus*) Herbaceous Vegetation

Patches of vegetation covering several hundred square yards (or meters) with a high proportion of Baltic rush were noted in the lower 1-1.5 mile (1.6-2.4 km) of the Huff Creek valley, where it covers ca. 20% of the valley bottom. This type was noted from the vehicle on the two-track road and was not sampled. Depending on the amounts of tufted hairgrass and field-clustered sedge present, it may be part of the *Deschampsia cespitosa*-*Carex praeegracilis* Herbaceous Vegetation type.

Stems of Canada thistle (*Cirsium arvense*) and *Carduus* sp. are scattered throughout the riparian vegetation

(3) Disturbance

Much of the downstream half of the valley bottom is contained within an enclosure, and the vegetation therein had not been grazed. In sample plot 3.8 upstream from the enclosure, the herbaceous vegetation had been grazed lightly.

b. Potential conditions

No evidence was noted that the riparian zone of Huff Creek will change from a combination of dense herbaceous vegetation and mountain silver sagebrush shrubland. Willows are present, at least in the lower half, but they apparently are not numerous, and establishment of willow seedlings will be inhibited by the dense herbaceous cover. Open sediment bars, which would provide suitable habitat for seedlings, seem to be limited in area, and the armoring of stream meanders with boulders will slow the formation of bars. The large stands on the lower part of Coal Creek and on Salt Creek several miles to the northwest suggest that, once established, willows would thrive on Huff Creek.

C. Rare Plant Communities and Exemplary Locations

All of the vegetation types noted in the Raymond Mountain WSA and along the three nearby streams apparently are common throughout the Intermountain Region. Two vegetation types, the *Cercocarpus ledifolius* var. *intercedens* shrub stands and the *Acer grandidentatum* woodlands, are uncommon on BLM-managed lands in Wyoming because both types reach the eastern limits to their geographic ranges along the western edge of the state.

For the most part, the stands of the common vegetation types in the study area probably are good representatives of the community types to which they belong, in terms of the composition and structure of the vegetation and the effects of human disturbance. Exotic plants are widespread throughout the area -- especially Kentucky bluegrass (*Poa pratensis*) and Canada thistle (*Cirsium arvense*) in the riparian zones and the mesic uplands, and cheatgrass (*Bromus tectorum* and *B. commutatus*) in the drier upland types -- but these species are just as common (if not more common) in similar habitats throughout the West. The aspen woodlands and Douglas-

fir woodlands in the WSA show little sign of human disturbance, and in this regard may be unusually good representatives of those types.

Spraying of herbicide may have affected the composition of the mountain big sagebrush and alkali sagebrush stands in the eastern part of the WSA and in the uplands around Little Muddy Creek, Stoner Creek, and Coal Creek outside the WSA. The grazing allotments in that area were sprayed with herbicide from the air in the 1960s to kill sagebrush (Ed Feeley, personal communication), but the exact area sprayed may be unknown. No evidence of this spraying, such as dead sagebrush or differences in the amounts of broad-leaved plants present there compared to other parts of the WSA, were noted during this fieldwork. Sagebrush and snowberry are dense in many parts of the area that apparently were sprayed. The effects of this herbicide on the upland vegetation, and the degree to which it made this area unrepresentative of the mountain big sagebrush and alkali sagebrush types in the region, probably can be determined only by detailed comparison of the composition of the vegetation in the study area with similar vegetation from other locations.

The vegetation of the valley bottoms along Chalk Creek, the South Fork of Mill Creek, and part of Raymond Creek (in the Raymond Basin) in the WSA, and on the upper part of Coal Creek northeast of the WSA, appear to be poor examples of riparian vegetation. Very little riparian vegetation remains along Chalk Creek, the lowest stretch of the South Fork of Mill Creek, and the South Fork of Raymond Creek in the Raymond Basin, due to the entrenchment of the stream channels and the consequent drying of the valley floors. Along the middle stretch of the South Fork of Mill Creek and along the upper part of Coal Creek, the valley bottoms still supports riparian vegetation, but Kentucky bluegrass is a strong dominant.

II. RARE PLANT SPECIES

A search of WYNDD's element occurrence record database conducted before the 1998 field work indicated no occurrences within the WSA or nearby stream valleys of plant species tracked by WYNDD -- that is, of federally-listed threatened or endangered species, plants on the BLM Rock Springs District list of special status plant species, or other species rare in the state. Furthermore, a review of geologic and topographic maps of the study area suggested that those plant species known to occur in far southwestern Wyoming are unlikely to occur in the study area.

The 1998 field work documented a population of Douglas's campion (*Silene douglasii* var. *douglasii*), a species that was previously unknown from Wyoming, in big-tooth maple sample plot 1.4 in Raymond Canyon within the WSA. A specimen had been collected from this population by a botanist from the Rocky Mountain Herbarium in 1995, but the specimen (Cramer 7661) had been identified as *Silene parryi*. As a result of the 1995 and 1998 collections, the species has been added to the list of plants tracked by WYNDD and an element occurrence record for the Raymond Canyon population is included in Appendix 5. Information on Douglas's campion is summarized here.

Silene douglasii* var. *douglasii (Douglas's campion)

Heritage Rank: G4/S1.

Federal Status: None.

Geographic Range: Southern British Columbia south to eastern California, northern Nevada, northern Utah, and western Montana. In Wyoming, this taxon is known only from the Overthrust Belt mountains in western Lincoln County.

Habitat: Sagebrush plains and slopes.

Comments: Douglas' campion was first collected in Wyoming by Tom Cramer in 1995, and later by George Jones in 1998, both from Raymond Canyon on the western side of Raymond Mountain. Neither collection was positively identified until 1999. This sole known population in the state is protected within the Raymond Mountain ACEC and the Raymond Mountain Wilderness Study Area.

III. WEEDS

Designated and Prohibited Noxious Weeds

These plant species are on the list of designated and prohibited noxious weeds established under the Wyoming Weed and Pest Control Act.

Canada thistle (*Cirsium arvense*)

This perennial thistle apparently is common in riparian zones throughout the WSA. In the northern part of the area, Canada thistle was observed along Coal Creek (several hundred scattered stems at location 1) and along Huff Creek (location 50 and plot 3.1). In the west-central part of the WSA, along Raymond Creek, the species was observed at location 10 upstream from the WSA boundary (< 100 stems in a patch ca. 33 ft. x 33 ft. [10 m x 10 m], growing on a shale and gravel slope above a stream terrace); at location 103 immediately downstream from the Raymond Basin; at locations 21 and 22 in the Raymond Basin (scattered plants on sparsely vegetated cutbanks of the incised stream); and at location 62 on the North Fork of Raymond Creek (scattered plants in the riparian zone). In the south-central part of the WSA, Canada thistle was observed along the South Fork of Mill Creek at location 62 (patches of <100 stems to ca. 1000 stems each in meadows behind old beaver dams, and as scattered plants along the lower south-facing slopes of the north valley wall) and along Chalk Creek at location 71 (scattered clumps of stems).

Canada thistle also is common in the riparian zones of the streams examined outside the WSA. Along Coal Creek northeast of the WSA, from the mouth of the East Fork (T28N, R119W, Sec 25, SW 1/4) upstream at least as far as the SW1/4 NW1/4 Sec 8, T28N, R118W, the species was observed as follows: at location 108, scattered individual stems and patches of ca. 100 stems are common on cutbanks around stream meanders; at location 112 (a wetland on the west valley wall), the species is abundant in meadows in old beaver ponds; at location 101 (a large enclosure), Canada thistle grows on the higher stream terraces in patches so dense that walking through them is difficult; at location 104, the species is common on cutbanks and in mountain silver sagebrush vegetation; and at location 105, it is common in dry meadows of old beaver ponds.

On Little Muddy Creek east of the WSA, the species was observed as follows: at location 85, patches of 100 to 200 stems each are common throughout the riparian zone; at locations 86, 87, 88, and 89, scattered stems and patches are common in the riparian zone; at location 90, patches of 100 to 200 stems each are common; and at location 94, patches of thistle are common on the edges of the incised stream channel. Along Stoner Creek east of the WSA, Canada thistle is common on well-vegetated cutbanks.

Quackgrass (*Elymus repens*, *Agropyron repens*)

One patch of quackgrass was noted in a stand of aspen saplings (sample plot 4.8) at the southern end of the WSA. The rhizomatous grass was a minor species in a herbaceous undergrowth dominated by Kentucky bluegrass (*Poa pratensis*) beneath a species-rich sapling and shrub layer.

Hoary cress (Whitetop) (*Cardaria chalapensis*)

One patch of *Cardaria chalapensis* was noted on Raymond Creek on the western side of the area, upstream from the trail barricade (location 4). The 16 ft. x 16 ft. (5 m x 5 m) patch of plants occurred on a gravel slope above a stream terrace and contained several hundred stems, mixed with Canada thistle.

Dalmatian toadflax (*Linnaria dalmatica*)

This rhizomatous, perennial forb was observed in Raymond Canyon within the WSA. A patch of ca. 100 stems covering ca. 16 ft. x 32 ft. (5 m x 10 m) was found growing in gravels and cobbles in the bed of an ephemeral tributary on the northern side of Raymond Creek (location 9). Several thousand stems were observed in a patch in open shrub vegetation of *Amelanchier utahensis*, *Symphoricarpos oreophilus*, and *Artemisia tridentata* ssp. *vaseyana* on a talus slope north of Raymond Creek between the end of the road and the barrier on the Raymond Creek trail (location 29).

Common burdock (*Arctium minus*)

This perennial forb was observed along Raymond Creek within the WSA. It grows as scattered plants along the trail up Raymond Creek (location 4), and is common in places in the understory of the riparian shrub vegetation (location 5).

Musk thistle (*Carduus nutans*) or Plumeless thistle (*Carduus acanthoides*)

A tall, biennial thistle was observed throughout the WSA, but only a handful of specimens were found in flower. They keyed to *Carduus acanthoides* in Dorn (1992), but that species is not known from Lincoln County (Lincoln Co. Weed and Pest District, personal communication), and the plants may be *C. nutans*, which is known from that part of the state.

Along Raymond Creek in the west-central part of the WSA, this thistle was observed as follows: scattered plants growing on stream cutbanks (Location 4) and throughout the riparian zone (location 12) downstream from Raymond Basin; scattered plants and patches of plants in the shrub vegetation on the valley walls (locations 7 and 21); and throughout the riparian zone in places on the North Fork of Raymond Creek (location 26). In the north-central part of the WSA,

in the Huff Creek drainage, this thistle species was noted as scattered plants in the large riparian enclosure (location 50) and scattered plants in the mountain big sagebrush vegetation on a bench on the valley wall (plot 3.2). In the south-central part of the WSA, the thistle was noted in the valley of the South Fork of Mill Creek, growing as scattered plants along the lower part of the south-facing slopes on the north valley wall (location 62).

Outside the WSA, *Carduus* sp. was common in the riparian zone in the upper part of Little Muddy Creek (locations 87, 88, 89). On Coal Creek northeast of the WSA, the species was common in the riparian zone. In the large enclosure (location 101), this thistle grew with Canada thistle (*Cirsium arvense*) on a higher terrace in a patch so dense that walking through it was difficult. It also was common on cutbanks and in silver sagebrush vegetation upstream from the enclosure (locations 103 and 104) and downstream (location 108).

Dyer's woad (*Isatis tinctoria*)

This species was observed at several locations within the western part of the WSA. In Raymond Canyon, scattered plants grow on gravelly terraces and on cutbanks along the stream (locations 4 and 21) and in the undergrowths of mountain mahogany stands on the north valley wall and on chokecherry stands at the foot of the north valley wall (plots 1.2, 1.3, 1.5, and 1.6). In Chalk Creek valley, scattered plants were observed in the undergrowth of an open true mountain mahogany woodland growing on a west-facing slope of the eastern valley wall (location 77). This species is common in agricultural fields west of the WSA.

Houndstongue (*Cynoglossum officinale*)

This biennial forb was observed in the central and south-central part of the WSA and along Little Muddy Creek east of the WSA. Along Raymond Creek, scattered plants were growing in the undergrowth of the riparian zone upstream from the end of the road (the mouth of the canyon) for ca. 0.5 mile (locations 4 and 5). In the South Fork of Mill Creek (location 62), houndstongue was common in a meadow above an old beaver pond and as scattered plants on the foot of the north valley wall. In Chalk Creek (location 71), scattered plants were noted in the riparian zone. In the middle portion of Little Muddy Creek east of the WSA (location 90), many patches of the plant were noted in the drier part of the riparian zone.

Field bindweed (*Convolvulus arvensis*)

This rhizomatous perennial was noted at only one location, along the North Fork of Raymond Creek (location 28). Two plants were observed growing in the trail along the creek, but the area was not searched for more.

Other Exotic Plant Species

These are exotic species that contribute substantial cover to the vegetation in parts of the WSA or the nearby streams surveyed as part of this project, or that have the potential to become major species in the vegetation. Other exotic plant species occur in the WSA, as indicated on the list of vascular plants from the study area; only the major species or especially obvious species are mentioned below.

Mullein (*Verbascum thapsus*)

This biennial is present throughout the WSA. In the northern part of the area, the plant was observed in the riparian zone of Coal Creek (T28N, R119W, Sec 16), and it grows as scattered plants on the shoulder of the IGO Speedway along the northeastern border (Sec 25, 26, 35). It also is common along BLM Road 4216 north of the WSA (Section 21). In the west-central part of WSA, the plant was observed in Raymond Canyon: scattered plants (flowering stems and rosettes) grow along cutbanks formed by stream meanders from the mouth of the canyon upstream to the Raymond Basin and up the North Fork of Raymond Creek. Mullein is common in the south-central part of area as well: it was observed in the valley of the South Fork of Mill Creek from the confluence with the North Fork upstream for ca. 1 mile, scattered along the lower parts of south-facing slopes on the north valley wall; and in the Chalk Creek valley on the western side of the area, scattered plants grow in the riparian zone.

Kentucky bluegrass (*Poa pratensis*)

This perennial rhizomatous grass is ubiquitous in mesic sites throughout the WSA and the adjacent stream valleys. In the northern part of the WSA, on Coal Creek (location 1) and on Huff Creek (location 50), Kentucky bluegrass co-dominates the vegetation in mesic riparian meadows. Along Raymond Creek in the west-central part of the WSA, the species is common from the WSA boundary upstream through the Raymond Basin and up the North Fork. It dominates or co-dominates meadows and undergrowths in shrub stands on stream terraces and adjacent fans (locations 4, 13, 21, 22) and wet gravel bars (locations 23 and 26). In the south-central part of the WSA, the species is common along the South Fork of Mill Creek (location 62), the North Fork of Mill Creek (location 84, where it co-dominates the sparse riparian vegetation), and Chalk Creek (location 71).

Kentucky bluegrass is common along the streams surveyed outside the WSA as well, where it dominates or co-dominates in drier meadows and the undergrowths of mountain silver sagebrush stands. Observations were made on Little Muddy Creek (dominant or co-dominant at locations 87, 88, 89, 94, and 96, common at locations 85 and 97), Stoner Creek (locations 97 and 98), and Coal Creek (dominant or co-dominant at locations 103, 105, 108, and common at location 101).

Bull thistle (*Cirsium vulgare*)

Scattered individuals of this tall, biennial thistle were noted in the riparian zone of the South Fork of Mill Creek in the south-central part of the WSA (location 62).

Black henbane (*Hyoscamus niger*)

This annual or biennial forb was observed along Raymond Creek in the west-central part of the WSA. In the lower part of the canyon (location 4), two small patches (each ca. 13 ft. x 13 ft. [4 m x 4 m]) containing <50 plants were noted in the undergrowth of the riparian shrub stand. In the Raymond Basin (locations 21 and 22), scattered plants were seen growing on sparsely-vegetated cutbanks of the deeply incised stream.

Cheatgrass (*Bromus tectorum*)

This cosmopolitan, winter annual grass is widespread in the WSA, and probably grows in nearly all of the drier upland grasslands and shrublands. It dominates patches of vegetation on south- and west-facing slopes in Raymond Canyon (location 4, plot 1.5) and at the southern end of the area (locations 52 and 53). It also is present in smaller amounts in many other locations, e.g.: maple woodlands in Raymond Canyon (plot 1.6), stands of mountain big sagebrush (plots 4.2, 4.4, 4.6) and black sagebrush (plot 4.7) at the southern end of the area, and mountain mahogany stands in Chalk Creek Canyon (location 77).

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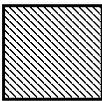
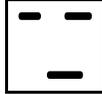
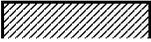
Figure 1. Location of the study area in Wyoming. Taken from BLM's Final Rock Springs Wilderness EIS, August 1990.

Figure 2. Map of vegetation in the Raymond Mountain WSA, and locations of sample plots, sample stands, and other features in the WSA and along the three streams outside the WSA.

Vegetation types are mapped as complexes because individual vegetation types occur in such a fine-grained pattern that they could not be mapped individually. The areas mapped along Little Muddy Creek, Stoner Creek, Coal Creek, Huff Creek, and S. Fk. Mill Creek as riparian complexes are, in many places, wider than the riparian zones, and should be interpreted as simply indicating the stretches of streams along which the herbaceous riparian types and the mountain silver sagebrush shrubland grow.

Figure 2 consists of seven 1:24,000-scale topographic maps in the folder following this page.

Legend for Figure 2.

<u>Map Unit</u>	<u>Map Symbol</u>
Complex of Douglas-fir woodland and aspen woodland, with inclusions of big-tooth maple woodland, lodgepole pine forest, subalpine fir forest, mountain big sagebrush shrubland, mountain mahogany shrubland, bluebunch wheatgrass vegetation, and forb vegetation	
Complex of mountain big sagebrush shrubland, curl-leaf mountain mahogany shrubland, and bluebunch wheatgrass vegetation, with inclusions of true mountain mahogany shrubland, Douglas-fir woodland, aspen woodland, minor shrub types, forb vegetation, and alkali sagebrush dwarf-shrub vegetation	
Complex of mountain big sagebrush shrubland and alkali sagebrush dwarf-shrub vegetation, with inclusions of Douglas-fir woodland, aspen woodland, bluebunch wheatgrass vegetation, minor shrub types, and forb vegetation	
Riparian complex of tufted hairgrass herbaceous vegetation, mountain silver sagebrush shrubland, and Kentucky bluegrass herbaceous vegetation, with inclusions of sedge herbaceous vegetation types and patches of upland mountain big sagebrush shrubland	
Location of sample plot	
Location of sample stand or other feature	

APPENDIXES

APPENDIX 1. CORRESPONDENCE OF VEGETATION TYPES NAMED IN THIS STUDY TO TYPES NAMED IN PUBLISHED CLASSIFICATIONS.

Vegetation types from six published classifications that correspond to each of the vegetation types from Raymond Mountain are shown below. In addition, the data tables in Appendix 2 show the alliance or plant association to which each Raymond Mountain stand corresponds. Some stands from the study area did not seem to fit any of the vegetation types from these classifications.

The six classifications are:

- 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, Virginia, USA. xlvii + 502 pp.
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The national vegetation classification uses plant names from Kartesz (1994), so names of its vegetation types differ from the names used in other classifications and from names used in this report, which are from Dorn (1992).

HERBACEOUS TYPES

Beaked Sedge

- National Vegetation Classification (Anderson et al. 1998): *Carex rostrata* Herbaceous Vegetation
- W. Wyo - E. Idaho Riparian (Youngblood et al. 1985): *Carex rostrata* Community Type
- Utah - SE. Idaho Riparian (Padgett et al. 1989): *Carex rostrata* Community Type
- Montana Riparian (Hansen et al. 1995): *Carex rostrata* habitat type, *Deschampsia cespitosa* phase

Small-wing Sedge

- National Vegetation Classification (Anderson et al. 1998): *Carex microptera* Herbaceous Vegetation
- W. Wyo - E. Idaho Riparian (Youngblood et al. 1985): *Carex microptera* Community Type
- Utah - SE. Idaho Riparian (Padgett et al. 1989): *Carex microptera* Community Type
- Montana Riparian (Hansen et al. 1995): Unknown

Nebraska Sedge

- National Vegetation Classification (Anderson et al. 1998): *Carex nebrascensis* Herbaceous Vegetation
- W. Wyo - E. Idaho Riparian (Youngblood et al. 1985): *Carex nebrascensis* Community Type
- Utah - SE. Idaho Riparian (Padgett et al. 1989): *Carex nebrascensis* Community Type
- Montana Riparian (Hansen et al. 1995): *Carex nebrascensis* Habitat Type

Woolly Sedge

- National Vegetation Classification (Anderson et al. 1998): *Carex lanuginosa* Herbaceous Vegetation
- W. Wyo - E. Idaho Riparian (Youngblood et al. 1985): Miscellaneous *Carex* Community Types
- Utah - SE. Idaho Riparian (Padgett et al. 1989): *Carex lanuginosa* Community Type
- Montana Riparian (Hansen et al. 1995): *Carex lasiocarpa* Habitat Type

Tufted Hairgrass-Nebraska Sedge

- National Vegetation Classification (Anderson et al. 1998): *Deschampsia cespitosa* - *Carex nebrascensis* Herbaceous Vegetation
- W. Wyo - E. Idaho Riparian (Youngblood et al. 1985): *Deschampsia cespitosa* Community Type
- Utah - SE. Idaho Riparian (Padgett et al. 1989): *Deschampsia cespitosa* Community Type
- Montana Riparian (Hansen et al. 1995): *Deschampsia cespitosa* Habitat Type

Tufted Hairgrass - Sedge Species

- National Vegetation Classification (Anderson et al. 1998): *Deschampsia cespitosa*-*Carex* spp. Herbaceous Vegetation
- W. Wyo - E. Idaho Riparian (Youngblood et al. 1985): *Deschampsia cespitosa* Community Type
- Utah - SE. Idaho Riparian (Padgett et al. 1989): *Deschampsia cespitosa* Community Type
- Montana Riparian (Hansen et al. 1995): *Deschampsia cespitosa* Habitat Type

Kentucky Bluegrass - Slender Wheatgrass

- National Vegetation Classification (Anderson et al. 1998): *Deschampsia cespitosa*-*Carex* spp. Herbaceous Vegetation?
- W. Wyo - E. Idaho Riparian (Youngblood et al. 1985): *Deschampsia cespitosa* Community Type?
- Utah - SE. Idaho Riparian (Padgett et al. 1989): *Deschampsia cespitosa* Community?
- Montana Riparian (Hansen et al. 1995): *Deschampsia cespitosa* Habitat Type?

Bluebunch Wheatgrass

- National Vegetation Classification (Anderson et al. 1998): *Pseudoroegneria spicata* Herbaceous Alliance

FORB TYPES

Stemless Goldenweed

- National Vegetation Classification (Anderson et al. 1998): *Pseudoroegneria spicata*- Cushion Plant Herbaceous Vegetation?

Arrowleaf Balsamroot

- National Vegetation Classification (Anderson et al. 1998): *Pseudoroegneria spicata* - *Balsamorhiza sagittata* - *Poa secunda* Herbaceous Vegetation?

SHRUB TYPES

Mountain Big Sagebrush

- National Vegetation Classification (Anderson et al. 1998):
 - Artemisia tridentata* ssp. *vaseyana* Shrubland Alliance
 - Artemisia tridentata* ssp. *vaseyana*/*Pseudoroegneria spicata* Shrubland
 - Artemisia tridentata* ssp. *vaseyana*/*Bromus carinatus* Shrubland
 - Artemisia tridentata* ssp. *vaseyana*-*Purshia tridentata*/*Pseudoroegneria spicata* Shrubland
 - Artemisia tridentata* ssp. *vaseyana*-*Symphoricarpos oreophilus*/*Elymus trachycaulus* ssp. *trachycaulus* Shrubland

Mountain Silver Sagebrush

-- National Vegetation Classification (Anderson et al. 1998): *Artemisia cana* var. *viscidula* Shrubland Alliance

Mountain Silver Sagebrush/Tufted Hairgrass

-- National Vegetation Classification (Anderson et al. 1998): *Artemisia cana* ssp. *viscidula* (*Deschampsia cespitosa*) Shrubland

-- W. Wyo - E. Idaho Riparian (Youngblood et al. 1985): *Deschampsia cespitosa* Community Type?

-- Utah - SE. Idaho Riparian (Padgett et al. 1989): *Artemisia cana*/*Deschampsia cespitosa* Community Type

-- Montana Riparian (Hansen et al. 1995): *Deschampsia cespitosa* Habitat Type?

Alkali Sagebrush

-- National Vegetation Classification (Anderson et al. 1998): *Artemisia arbuscula* ssp. *longiloba* Dwarf-Shrub Herbaceous Alliance; probably either the *Artemisia arbuscula* ssp. *longiloba*/*Pascopyrum smithii* Dwarf-Shrub Herbaceous Vegetation or *Artemisia arbuscula* ssp. *longiloba*/*Poa secunda* Dwarf-Shrub Herbaceous Vegetation

Black Sagebrush

-- National Vegetation Classification (Anderson et al. 1998): *Artemisia nova*/*Pseudoroegneria spicata* Dwarf-Shrubland

Curl-leaf Mountain Mahogany

-- National Vegetation Classification (Anderson et al. 1998): *Cercocarpus ledifolius*/*Pseudoroegneria spicata* Shrubland (var. *intercedens* is not yet recognized in the national classification)

True Mountain Mahogany

-- National Vegetation Classification (Anderson et al. 1998): *Cercocarpus montanus*/*Pseudoroegneria spicata* Shrubland

Western Birch/Red-osier Dogwood

-- National Vegetation Classification (Anderson et al. 1998): *Betula occidentalis*/*Cornus sericea* Shrubland

-- W. Wyo - E. Idaho Riparian (Youngblood et al. 1985): *Cornus stolonifera*/*Galium triflorum* Community Type?

-- Utah - SE. Idaho Riparian (Padgett et al. 1989): *Betula occidentalis*/*Cornus sericea* Community Type

-- Montana Riparian (Hansen et al. 1995): *Betula occidentalis* Community Type

Riparian Mixed Shrub

- National Vegetation Classification (Anderson et al. 1998): *Cornus sericea*/*Galium triflorum* Shrubland? *Cornus sericea* Shrubland Alliance (Provisional)?
- W. Wyo - E. Idaho Riparian (Youngblood et al. 1985): *Salix exigua*/*Poa pratensis* Community Type
- Utah - SE. Idaho Riparian (Padgett et al. 1989): *Cornus sericea*/*Heracleum lanatum* Community Type?
- Montana Riparian (Hansen et al. 1995): *Salix exigua* Community Type? *Prunus virginiana* Community Type?

Chokecherry (upland)

- National Vegetation Classification (Anderson et al. 1998): *Prunus virginiana* Shrubland Alliance

DECIDUOUS WOODLANDS

Big-tooth maple

- National Vegetation Classification (Anderson et al. 1998): *Acer grandidentatum* Alliance

Aspen

- Populus tremuloides*/*Amelanchier alnifolia*/*Symphoricarpos oreophilus*/Tall Forb Plant Association (Mueggler 1988); *P. tremuloides*/*A. alnifolia*-*S. oreophilus*/Tall Forb Forest (Anderson et al. 1998)
- Populus tremuloides*/*Amelanchier alnifolia*/*Symphoricarpos oreophilus*/*Bromus carinatus* Plant Association (Mueggler 1988); *P. tremuloides*/*A. alnifolia*-*S. oreophilus*/*B. carinatus* Forest (Anderson et al. 1998)
- Populus tremuloides*/*Symphoricarpos oreophilus*/*Calamagrostis rubescens* Plant Association (Mueggler et al. 1988); *P. tremuloides*/*S. oreophilus*/*C. rubescens* Forest (Anderson et al. 1998)
- Populus tremuloides*/*Symphoricarpos oreophilus*/*Poa pratensis* Plant Association (Mueggler 1988); *P. tremuloides*/*S. oreophilus* Forest? (Anderson et al. 1998)
- Populus tremuloides*/*Symphoricarpos oreophilus*/*Thalictrum fendleri* Plant Association (Mueggler 1988); *P. tremuloides*/*S. oreophilus*/*T. fendleri* Forest (Anderson et al. 1998)
- Populus tremuloides*/*Shepherdia canadensis* Plant Association (Mueggler 1988); *P. tremuloides*/*S. canadensis* Forest (Anderson et al. 1998)
- Populus tremuloides*/*Calamagrostis rubescens* Plant Association (Mueggler 1988); *P. tremuloides*/*C. rubescens* Forest (Anderson et al. 1998)
- Populus tremuloides*-*Pseudotsuga menziesii*/*Amelanchier alnifolia* Plant Association (Mueggler 1988); *P. tremuloides*-*P. menziesii*/*A. alnifolia* Forest (Anderson et al. 1998)
- Populus tremuloides*-*Abies lasiocarpa*/*Symphoricarpos oreophilus*/*Thalictrum fendleri* Plant Association (Mueggler 1988); *P. tremuloides*-*A. lasiocarpa*/*S. oreophilus*/*T. fendleri* Forest (Anderson et al. 1998)

CONIFEROUS WOODLANDS

Douglas-fir

-- National Vegetation Classification (Anderson et al. 1998): *Pseudotsuga menziesii*/*Arnica cordifolia* Forest, *Pseudotsuga menziesii*/*Calamagrostis rubescens* Forest, and *Pseudotsuga menziesii*/*Mahonia repens* Forest

Subalpine Fir

-- National Vegetation Classification (Anderson et al. 1998): *Abies lasiocarpa*/*Arnica cordifolia* Forest

Lodgepole Pine

-- National Vegetation Classification (Anderson et al. 1998): *Pinus contorta*/*Calamagrostis rubescens* Forest

APPENDIX 2. VEGETATION SAMPLE PLOTS AND DESCRIPTIONS OF STANDS IN THE RAYMOND MOUNTAIN WSA.

The correspondence of each plot or stand to an alliance or plant association from the national vegetation classification (Anderson et al. 1998) is indicated by the acronyms at the top of the plot's or stand's column. See Appendix 1 for the correspondence with types from other classifications. An asterisk, *, indicates an exotic species. Locations of plots and stands are shown on Figure 2.

Meanings of acronyms are shown below.

<u>Acronym</u>	<u>Name</u>
Abilas	<i>Abies lasiocarpa</i> (subalpine fir)
Amealn	<i>Amelanchier alnifolia</i> (serviceberry)
Ancor	<i>Arnica cordifolia</i> (heartleaf arnica)
Artnov	<i>Artemisia nova</i> (black sagebrush)
Atv	<i>Artemisia tridentata</i> ssp. <i>vaseyana</i> (mountain big sagebrush)
Balsag	<i>Balsamorhiza sagittata</i> (arrowleaf balsamroot)
Brocar	<i>Bromus carinatus</i>
Calrub	<i>Calamagrostis rubescens</i> (pinegrass)
Elytra	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>
Paxmyr	<i>Paxistima myrsinites</i> (boxleaf myrtle)
Pincon	<i>Pinus contorta</i> (lodgepole pine)
Poapra	<i>Poa pratensis</i> (Kentucky bluegrass)
Poasec	<i>Poa secunda</i> (Sandberg bluegrass)
Poptre	<i>Populus tremuloides</i> (quaking aspen)
Pruvir	<i>Prunus virginiana</i> (chokecherry)
Psemen	<i>Pseudotsuga menziesii</i> (Douglas-fir)
Psespi	<i>Pseudoroegneria spicata</i> Association
Purtri	<i>Purshia tridentata</i> (antelope bitterbrush)
Shecan	<i>Shepherdia canadensis</i> (russet buffaloberry)
Symore	<i>Symphoricarpos oreophilus</i> (Utah snowberry)
Thafen	<i>Thalictrum fendleri</i> (Fendleri's meadow rue)
Unkn.	Unknown vegetation type

Table 1-1. Plant canopy cover, ground cover, and landscape position of Douglas-fir samples.

Species	Psemen/Mahrep					Psemen/Arncor					Psemen/ Calrub
	Stand	Stand	Stand	Stand	Plot	Stand	Stand	Stand	Stand	Stand	Stand
	79	42	82	78	2.3	80	20	39	46	37	47
TREES					40						
<i>Juniperus scopulorum</i>					3						
<i>Pinus flexilis</i>		1			3				3		
<i>Pseudotsuga menziesii</i>	60	40	50	50	40	50	30	40	40	30	40
SHRUBS			20		10						
<i>Acer glabrum</i>			1		1		1				
<i>Acer grandidentatum</i>			1								
<i>Amelanchier</i> sp.				1	1	1	1				
<i>Ceanothus velutinus</i>		1									
<i>Juniperus communis</i>					1						
<i>Paxistima myrsinites</i>	1		1	1	1	1				1	
<i>Physocarpus malvaceus</i>						1					
<i>Prunus virginiana</i>					3	1					
<i>Rosa woodsii</i>			3	1	1					1	
<i>Shepherdia canadensis</i>			3								
<i>Symphoricarpos oreophilus</i>	10	3	10	1	1	1	20	10	10	10	1
GRAMINOIDS					3						
<i>Bromus anomalus</i>						1					
<i>Calamagrostis rubescens</i>						1				10	20
<i>Elymus glaucus</i>					1						

Table 1-1 (continued).	Psemen/Mahrep					Psemen/Arncor					Psemen/ Calrub
	Stand	Stand	Stand	Stand	Plot	Stand	Stand	Stand	Stand	Stand	Stand
Species	79	42	82	78	2.3	80	20	39	46	37	47
<i>Elymus trachycaulus</i> var. <i>trachycaulus</i>					1						
<i>Leucopoa kingii</i>							3	1		1	
<i>Poa nervosa</i> var. <i>wheeleri</i>	1	10	1	1	1		30	3		3	10
<i>Trisetum spicatum</i>						1					
FORBS					80						
<i>Arnica cordifolia</i>	1		10	3	60	10	30	40	40	60	10
<i>Aster ascendens</i>		10			10						
<i>Aster perelegans</i>					1		+				
<i>Aster engelmannii</i>					1						
<i>Balsamorhiza sagittata</i>					1						
<i>Fragaria vesca</i>			10					3	1	30	1
<i>Carex vallicola</i>					1		30				
<i>Geranium viscosissimum</i>			3								
<i>Heuchera parviflora</i>							+				
<i>Mahonia repens</i>	10	10	10	3	40	1	+		10		10
<i>Maianthemum racemosum</i>	1						+				
<i>Mitella</i> sp.	1					1	+			10	1
<i>Osmorhiza depauperata</i>	1				1		+			3	
<i>Penstemon humilis</i>	1										
<i>Sedum debile</i>							+				
<i>Sedum lanceolatum</i>							+				
<i>Thalictrum fendleri</i>								3		3	
<i>Veronica biloba</i>	1										

Table 1-1 (continued).	Psemen/Mahrep					Psemen/Arncor					Psemen/ Calrub
	Stand	Stand	Stand	Stand	Plot	Stand	Stand	Stand	Stand	Stand	Stand
Species	79	42	82	78	2.3	80	20	39	46	37	47
Viola adunca					1						
TOTAL VEG COVER			80	70	90	80	90	70	70	80	
GROUND COVER (%)											
Soil		45		10	1	2		5	2	5	50
Gravel		25		1	1			1	<1		5
Rock				1							
Bedrock		22		80	89	84		85	82	79	32
Wood		2		3	2	8		3	7	10	2
Basal Veg		3		5	7	6		4	4	5	5
Lichen & Moss					1			1	<1	1	1
LANDSCAPE											
Slope (degrees)		31	32			15	35			30	35
Aspect (degrees)		260	30	North	330	30	330			335	345

Notes:

Plot 2.3: 20m x 20m, representing low-elevation stand on upper slope next to *Cercocarpus ledifolius* stand.

Stand 20: Douglas-fir woodland with open, patchy canopy and a dense overstory. To east is opening of *Ceanothus velutinus* and *Elymus trachycaulus*.

Stand 23: Open woodland of Doug-fir poles and small trees; canopy patchy due to windthrow. No distinct shrub layer.

Stand 37: Open Douglas-fir woodland of poles and small trees; canopy patchy due to windthrow gaps. No distinct shrub layer. *Arnica* most common species throughout; *Calamagrostis* dominates near top of stand. To south, on S-facing slope, is curl-leaf mountain mahogany.

Stand 39: Patchy overstory, mainly of trees 6"-1-" dbh, with scattered larger trees and patches of saplings and poles. Snowberry grows in patches of several hundred square meters. Stand occupies all of upper part of steep valley wall.

Stand 42: Open woodland with scattered shrubs and a patchy, rather sparse herbaceous layer on west side of steep ridge and slope below. Farther up ridge is *Ceanothus velutinus* stand; below is mountain big sagebrush stand.

Stand 46: Open woodland with patchy shrub layer of snowberry and Douglas-fir saplings. To southeast, on S-facing slope, is *Balsamorhiza* vegetation.

Stand 47: Canopy moderately dense with some gaps. Few shrubs present. *Arnica* widespread; *Calamagrostis* patchy but dense in patches, and probably contributes most cover. Occupies south side of ravine, surrounded by mountain big sagebrush and snowberry.

Table 1-1 (continued)

- Stand 78: North side of knob. Douglas-fir of various sized, to ca. 10" dbh, form patchy overstory. Shrubs are patchy as well. ON slope above is curl-leaf mountain mahogany stand.
- Stand. 79: Trees of various sizes (to 10" dbh) form canopy with openings. Beneath openings, chokecherry forms tall shrub layer, but chokecherry is rare elsewhere. Snowberry is present throughout but tallest and with most cover beneath canopy openings. This woodland patch grows on north side of knob; other patches occur on other north-facing slopes. Stand 80 adjoins this patch to east. Valleys are mountain big sagebrush and snowberry; curl-leaf mountain mahogany stands occur on south- and west-facing slopes. Stand 80: To east of Stand. 79. Douglas-fir to 12" dbh forms overstory with gaps. Ninebark grows beneath canopy gaps; snowberry and chokecherry are scattered and patchy.
- Stand 82: Small patch of several acres on – to E-facing slope; merges with aspen woodland (Stand. #83). Douglas-fir overstory of mixed sized (mostly 8"-10" dbh) with some gaps. Shrub layer open but definitely distinct. Understory moderately dense (densest in gaps); Arnica most common species beneath densest tree canopy, and other species most common beneath canopy gaps.

Table 1-2. Plant canopy cover, ground cover, and landscape position of samples from other conifer types

	Abilas/ Arncor Stand	Abilas/ Arncor Stand	Pincon/ Calrub Stand
Species	442	91	48
TREES			
<i>Abies lasiocarpa</i>	40	30	
<i>Pinus contorta</i>		1	50
<i>Pinus flexilis</i>		1	
<i>Pseudotsuga menziesii</i>	10	1	
<i>Populus tremuloides</i>	3		1
SHRUBS			
<i>Abies lasiocarpa</i> , sapling	3	1	
<i>Amelanchier</i> sp.			1
<i>Paxistima myrsinites</i>		1	3
<i>Ribes viscosissimum</i>		1	
<i>Rosa woodsii</i>		1	3
<i>Rubus parviflorus</i>			1
<i>Salix scouleriana</i>		1	1
<i>Shepherdia canadensis</i>		1	1
<i>Spiraea betulifolia</i>			1
<i>Symphoricarpos oreophilus</i>		1	
GRAMINOIDS			
<i>Calamagrostis rubescens</i>		1	50
<i>Carex rossii</i>		1	
<i>Poa nervosa</i> var. <i>wheeleri</i>			1
<i>Trisetum spicatum</i>		1	
FORBS			
<i>Arnica cordifolia</i>	1	20	3
<i>Aster ascendens</i>		1	
<i>Aster engelmannii</i>		1	
<i>Chimaphila umbellata</i>			1
<i>Fragaria vesca</i>	3	1	
<i>Geranium viscosissimum</i>		1	
<i>Carex vallicola</i>		1	1

<u>Table 1-2 (continued)</u>	Abilas/ Arncor Stand	Abilas/ Arncor Stand	Pincon/ Calrub Stand
Species	442	91	48
Mahonia repens		1	3
Pyrola chlorantha		1	1
Thalictrum fendleri		1	
TOTAL VEG COVER		80	70
GROUND COVER (%)			
Soil		5	5
Gravel			
Rock			
Bedrock			
Litter		84	81
Wood		6	10
Basal Veg		4	4
Lichen & Moss		1	
LANDSCAPE			
Slope (degrees)	1		15
Aspect (degrees)		55	30

Notes:

- Stand 442: Moderately dense woodland with an open undergrowth. Shrub-sized fir saplings are scattered throughout beneath the tall canopy of fir and Doug-fir some 50 ft. (15 m) tall and the subcanopy of aspen ca. 32 ft. (10 m) tall.
- Stand 91: Ca. 10 acres on south side of valley. Subalpine fir forms open canopy with many gaps. Canopy contains a few Doug-fir, and a few lodgepole pines. Down valley, to west, stand contains more Doug-fir in the overstory.
- Stand 48: Woodland with moderately closed canopy and no shrub layer; merges with an aspen woodland and is more-or-less an inclusion in them. Merges with aspen woodland (stand 49) to west; lodgepole pine present at base of that stand.

Table 1-3. Plant canopy cover, ground cover, and landscape position of samples from aspen woodlands.

	Amealn/ Symore/ Tall Forb	Amealn/ Symore/ Brocar	Symore/ Calrub	Symore/ Poapra	Symore/ Poapra	Symore/ Thafen	Symore/ Thafen	Shecan
Species	Plot	Stand	Stand	Stand	Plot	Stand	Stand	Stand
TREES	40	55	112a	112b	2.1	81	32	57
<i>Abies lasiocarpa</i>								
<i>Pinus contorta</i>								
<i>Pinus flexilis</i>					1			
<i>Pseudotsuga menziesii</i>					3			
<i>Populus tremuloides</i>	40	30	70	50	10	40	30	40
SHRUBS	70				40			
<i>Acer glabrum</i>					10			
<i>Amelanchier</i> sp.	20	10	1	1	1		1	3
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	1							
<i>Ceanothus velutinus</i>	1							
<i>Cornus sericea</i>					3			
<i>Juniperus communis</i>					1			
<i>Juniperus scopulorum</i>	1				1	1		
<i>Paxistima myrsinites</i>	1				10			
<i>Prunus virginiana</i>	40	20	1	3		3	10	3
<i>Ribes cereum</i>					1			
<i>Rosa woodsii</i>	3	3		1	10			10
<i>Rubus idaeus</i>					1			
<i>Salix scouleriana</i>	10	3						3

Table 1-3 (continued)	Amealn/ Symore/ Tall Forb	Amealn/ Symore/ Brocar						
	Plot	Stand	Stand	Stand	Plot	Stand	Stand	Stand
Species	4.8	55	112a	112b	2.1	81	32	57
<i>Sambucus racemosa</i>					1			
<i>Shepherdia canadensis</i>		3			3	1		30
<i>Sorbus scopulina</i>		1						
<i>Symphoricarpos oreophilus</i>	10	30	10	40	1	20	3	3
GRAMINOIDS	30				3			
<i>Bromus carinatus</i>	3							
<i>Bromus inermis</i> var. <i>inermis</i> *	1							
<i>Calamagrostis rubescens</i>			30				10	
<i>Carex vallicola</i>	1						1	
<i>Danthonia californica</i>	1			1				
<i>Elymus glaucus</i>	3	30		1		1	3	
<i>Elymus repens</i> *	3							
<i>Elymus trachycaulus</i> var. <i>trachycaulus</i>				1	1			10
<i>Leucopoa kingii</i>					1			
<i>Medica bulbosa</i>	1							
<i>Poa nervosa</i> var. <i>wheeleri</i>	1							1
<i>Poa nevadensis</i>	1			1				
<i>Poa pratensis</i> *	10			10	10			
<i>Stipa nelsonii</i> var. <i>nelsonii</i>	3	1					1	1
<i>Trisetum spicatum</i>								

Table 1-3 (continued)	Amealn/ Symore/ Tall Forb	Amealn/ Symore/ Brocar						
	Plot	Stand	Stand	Stand	Plot	Stand	Stand	Stand
Species	4.8	55	112a	112b	2.1	81	32	57
FORBS	30				30			
<i>Agastache urticifolia</i>	10	3				1		3
<i>Antennaria rosea</i>				1				
<i>Apocynum</i> sp.	1							
<i>Aquilegia coerulea</i>					3			
<i>Arnica cordifolia</i>		3					1	
<i>Aster engelmannii</i>						1		
<i>Aster perelegans</i>								
<i>Astragalus agrestis</i>			3	20				
<i>Castilleja linariifolia</i>					1			
<i>Disporum trachycarpum</i>					1			
<i>Epilobium angustifolium</i>	1				1			
<i>Erigeron speciosus</i>	1							
<i>Fragaria vesca</i>						3		
<i>Fragaria virginiana</i>					1			
<i>Geranium viscosissimum</i>		3			1	10	3	3
<i>Habenaria unalaschensis</i>	1							
<i>Hackelia patens</i>	1							
<i>Helenium hoopesii</i>			3	1				
<i>Helianthella uniflora</i>	1							1
<i>Heracleum sphondylium</i>					1			

Table 1-3 (continued)	Amealn/	Amealn/						
	Symore/	Symore/	Symore/	Symore/	Symore/	Symore/	Symore/	Shecan
	Tall Forb	Brocar	Calrub	Poapra	Poapra	Thafen	Thafen	
Species	Plot	Stand	Stand	Stand	Plot	Stand	Stand	Stand
	4.8	55	112a	112b	2.1	81	32	57
<i>Heuchera parviflora</i>					1			
<i>Hieracium albiflorum</i>								
<i>Lomatium dissectum</i> var. <i>multifidum</i>								
<i>Lupinus sericeus</i>	1				1	10	10	
<i>Mahonia repens</i>							?	
<i>Maianthemum racemosum</i>	3				3			
<i>Mitella</i> sp.					1			
<i>Osmorhiza depauperata</i>	1		3	1	1	10	10	
<i>Penstemon cyananthus</i>	1							
<i>Potentilla glandulosa</i> var <i>psudorupestris</i>	1							
<i>Potentilla gracilis</i> var. <i>pulcherrima</i>				1				
<i>Pyrola chlorantha</i>								
<i>Rudbeckia occidentalis</i>			1	1		10		
<i>Senecio multilobatus</i>	1							
<i>Sedum lanceolatum</i>					1			
<i>Senecio multilobatus</i>	1				1			
<i>Senecio serra</i>								1
<i>Swertia perennis</i>								1
<i>Taraxacum</i> sp.*			3	20	1			
<i>Thalictrum fendleri</i>						10	3	
TOTAL VEG COVER	90	95	95	95	90	80		90

Table 1-3 (continued)	Amealn/	Amealn/						
	Symore/	Symore/	Symore/	Symore/	Symore/	Symore/	Symore/	Shecan
	Tall Forb	Brocar	Calrub	Poapra	Poapra	Thafen	Thafen	
	Plot	Stand	Stand	Stand	Plot	Stand	Stand	Stand
Species	4.8	55	112a	112b	2.1	81	32	57
GROUND COVER (%)								
Soil	10	15	7	7	5	35	5	10
Gravel	<1		<1		2	<1	<1	1
Rock	<1		<1		5	<1	<1	<1
Bedrock								
Litter	62	70	79	78	79	55	83	81
Wood	20	7	5	7	3	3	5	10
Basal Veg	7	8		8	5	6	6	7
Lichen & Moss					1			
LANDSCAPE								
Slope (degrees)		25			32			
Aspect (degrees)	65	10			0		70	30

<u>Table 1-3 (continued)</u>			Symore/	Psemen/
	Calrub	Amealn	Thafen	Arncor
	Stand	Stand	Stand	Stand
Species	49	83	92	17
TREES				
<i>Abies lasiocarpa</i>			40	
<i>Pinus contorta</i>	10			
<i>Pinus flexilis</i>				
<i>Pseudotsuga menziesii</i>		10		
<i>Populus tremuloides</i>	40	60	50	60
SHRUBS				
<i>Acer glabrum</i>				
<i>Amelanchier</i> sp.				
<i>Artemisia tridentata</i> var. <i>vaseyana</i>				
<i>Ceanothus velutinus</i>	10			
<i>Cornus sericea</i>				
<i>Juniperus communis</i>				
<i>Juniperus scopulorum</i>				
<i>Paxistima myrsinites</i>	3			
<i>Prunus virginiana</i>		20		
<i>Ribes cereum</i>				
<i>Rosa woodsii</i>	1	10	1	
<i>Rubus idaeus</i>				
<i>Salix scouleriana</i>	1			
<i>Sambucus racemosa</i>				
<i>Shepherdia canadensis</i>		10		
<i>Sorbus scopulina</i>				
<i>Symphoricarpos oreophilus</i>		10	20	3

Table 1-3 (continued)			Symore/	Psemen/
	Calrub	Amealn	Thafen	Arncor
	Stand	Stand	Stand	Stand
Species	49	83	92	17
GRAMINOIDS				
Bromus carinatus			1	
Bromus inermis var. inermis*				
Calamagrostis rubescens	40			
Carex vallicola				
Danthonia californica				
Elymus glaucus			1	3
Elymus repens*				
Elymus trachycaulus var. trachycaulus			1	
Leucopoa kingii				
Medica bulbosa				
Poa nervosa var. wheeleri	1		1	3
Poa nevadensis				
Poa pratensis*				
Stipa nelsonii var. nelsonii				
Trisetum spicatum	<1			
FORBS				
Agastache urticifolia			1	
Antennaria rosea				
Apocynum sp.				
Aquilegia coerulea				
Arnica cordifolia	3	1	10	70
Aster engelmannii				
Aster perelegans				

Table 1-3 (continued)			Symore/	Psemen/
	Calrub	Amealn	Thafen	Arncor
	Stand	Stand	Stand	Stand
Species	49	83	92	17
<i>Astragalus agrestis</i>				
<i>Castilleja linariifolia</i>				
<i>Disporum trachycarpum</i>				
<i>Epilobium angustifolium</i>				
<i>Erigeron speciosus</i>				
<i>Fragaria vesca</i>				
<i>Fragaria virginiana</i>				
<i>Geranium viscosissimum</i>		40	1	
<i>Habenaria unalaschensis</i>			1	
<i>Hackelia patens</i>				
<i>Helenium hoopesii</i>				
<i>Helianthella uniflora</i>				
<i>Heracleum sphondylium</i>				
<i>Heuchera parviflora</i>				
<i>Hieracium albiflorum</i>	1			
<i>Lomatium dissectum</i> var. <i>multifidum</i>			1	
<i>Lupinus sericeus</i>			1	
<i>Mahonia repens</i>		10	1	
<i>Maianthemum racemosum</i>				
<i>Mitella</i> sp.				
<i>Osmorhiza depauperata</i>			3	
<i>Penstemon cyananthus</i>				
<i>Potentilla glandulosa</i> var. <i>psudorupestris</i>				
<i>Potentilla gracilis</i> var. <i>pulcherrima</i>				

Table 1-3 (continued)			Symore/	Psemen/
	Calrub	Amealn	Thafen	Arncor
	Stand	Stand	Stand	Stand
Species	49	83	92	17
Pyrola chlorantha	1			
Rudbeckia occidentalis				
Senecio multilobatus				
Sedum lanceolatum				
Senecio multilobatus				
Senecio serra				
Swertia perennis				
Taraxacum sp.*				
Thalictrum fendleri		1		
TOTAL VEG COVER		85	85	
GROUND COVER (%)				
Soil	5	20	5	
Gravel			<1	
Rock			1	
Bedrock				
Litter	88	68	86	
Wood	2	5	2	
Basal Veg	4	7	6	
Lichen & Moss	1			
LANDSCAPE				
Slope (degrees)	22	35		
Aspect (degrees)	20	60	280	100

Table 1-3 (continued).

Notes:

- Plot 2.1: 15m x 15m, representing decadent, small aspen stand at foot of north-facing slope. Most trees are poles (<9" dbh).
- Plot 4.8: Entire patch of aspen saplings on lee side of ridge in matrix of sagebrush.
- Stand 17: Aspen stand of ca. 1 acre in matrix of Douglas-fir/arnica woodland. Trees mostly 6" dbh, ca. half of them bent downhill at base, almost to ground.
- Stand 32: Woodland with several openings, on east-facing hillside. To north is conifer woodland. Low shrubs (*Prunus* and *Symphoricarpos*) common and patchy. *Calamagrostis* patchy but contributes most cover of herbs
- Stand 41: Woodland on upper slope with trees ca. 8" (20 cm) dbh and 33' (10 m) tall. Doug-fir present throughout canopy; trees to ca. 33' (10 m) tall. *Ceanothus* present throughout. Undergrowth moderately dense. To north and downslope is subalpine fir - Doug-fir woodland; at top of slope is *Ceanothus* shrub stand.
- Stand 49: Open woodland of aspen saplings & poles with scattered lodgepole pine; merges with lodgepole pine/pinegrass stand (stand 48) to east. *Ceanothus* is patchy but obvious; *Calamagrostis* forms patches at least 100 sq m. Subalpine fir is present at bottom of slope.
- Stand 55: Decadent aspen patch ca. ½ acre (20m x 100m), on lee (east side) of ridge line, in matrix of mountain big sagebrush vegetation. Aspen saplings form patchy overstory above dense tall shrub layer.
- Stand 57: Patch of aspen saplings (many dead) ca. 2 acres (50m x 150m) on steep slope in matrix of mountain big sagebrush vegetation. Saplings form patchy overstory above dense shrub layer. Herbs in openings.
- Stand 81: Stand covering several hectares in bottoms of draws and along east side of bottom of N. Fk. Mill Cr. valley. Aspen trees form sparse tall overstory; aspen sapling form dense subcanopy. Tall shrub layer of *Prunus* is patchy; lower shrub layer of snowberry denser. Undergrowth rich in species. Vegetation grazed and trampled. Windthrown and broken aspen trunks common on ground.
- Stand 83: Covers 1-2 acres on east-facing, lower valley side; merges to south with Doug-fir stand 82. Robust aspen saplings form canopy with few Doug-fir. *Prunus* forms tall shrub layer in large patches; *Symphoricarpos* (with *Shepherdia*) forms low shrub layer of smaller patches.
- Stand 92: Ca. 2 acres on west-facing side of valley; opposite slope is subalpine fir (stand 91). Aspen overstory is uniform; subalpine fir saplings are common throughout, sometimes in dense patches.
- Stand 112a: Upper part of slope; merges downslope with stand 112b. Dense aspen saplings beneath scattered taller trees. *Symphoricarpos* forms scattered patches; *Calamagrostis* in dense patches, contributes most cover to undergrowth.
- Stand 112b: Lower part of slope nearest IGO Speedway; merges upslope with 112a. Part of stand has open overstory of tall trees with a few dense clumps of saplings beneath, an open (but distinct) *Symphoricarpos* layer, and forbs dominating the undergrowth. Other parts have few shrubs beneath the overstory, and an undergrowth of *Rudbeckia occidentalis* with exotic grasses (*Poa pratensis*, *Dactylis glomerata*, *Bromus* spp.)

Table 1-4. Plant canopy cover, ground cover, and landscape position of the big-tooth maple sample.

Species	Plot 1.4
TREES	70
<i>Acer glabrum</i>	70
SHRUBS	30
<i>Amelanchier</i> sp.	20
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	1
<i>Cercocarpus ledifolius</i> var. <i>intercedens</i>	1
<i>Juniperus scopulorum</i>	1
<i>Paxistima myrsinites</i>	1
<i>Prunus virginiana</i>	10
<i>Symphoricarpos oreophilus</i>	20
GRAMINOIDS	10
<i>Bromus tectorum</i> *	1
<i>Carex beckii</i> var. <i>subrostrata</i>	1
<i>Carex rossii</i>	1
<i>Elymus cinereus</i>	1
<i>Elymus spicatus</i>	1
<i>Elymus trachycaulus</i> var. <i>trachycaulus</i>	3
<i>Leucopoa kingii</i>	3
<i>Poa secunda</i> var. <i>elongata</i>	3
FORBS	20
<i>Arabis sparsiflora</i> var. <i>subvillosa</i>	1
<i>Claytonia perfoliata</i>	1
<i>Crepis acuminata</i>	1
<i>Descurainia californica</i>	1
<i>Epilobium brachycarpum</i>	1
<i>Galium aparine</i>	10
<i>Gilia tenerrima</i>	1
<i>Helianthella uniflora</i>	1
<i>Lithospermum ruderale</i>	1
<i>Mahonia repens</i>	3
<i>Senecio multilobatus</i>	1
<i>Carex vallicola</i>	1
<i>Verbascum thapsus</i> *	1
TOTAL VEG COVER	80

Table 1-4 (continued).

GROUND COVER (%)	
Soil	1
Gravel	5
Rock	67
Bedrock	1
Litter	20
Wood	2
Basal Veg	3
Lichen & Moss	1
LANDSCAPE	
Slope (degrees)	38
Aspect (degrees)	115

Notes:

Plot 1.4: 15m x 15, representing a patch of maple several hundred square meters

Table 1-5. Plant canopy cover, ground cover, and landscape position of curl-leaf mountain mahogany/bluebunch wheatgrass samples.

	Plot	Plot	Plot	Plot	Plot	Plot	Stand	Stand
Species	1.5	1.3	1.8	2.2a	1.2	2.2b	34	77
TREES				3		3		
<i>Pinus flexilis</i>						3		
<i>Pseudotsuga menziesii</i>				3		3		
SHRUBS	60	60	40	40	40	30		
<i>Amelanchier</i> sp.	1		1	1	10	1		
<i>Artemisia cana</i> var. <i>viscidula</i>	3							
<i>Artemisia nova</i>								1
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	1							
<i>Cercocarpus ledifolius</i> var. <i>intercedens</i>	60	50	30	30	20	20	10	10
<i>Cercocarpus montanus</i>		1			10	1		1
<i>Chrysothamnus viscidiflorus</i>								1
<i>Holodiscus dumosus</i>	1							
<i>Juniperus scopulorum</i>				3				1
<i>Paxistima myrsinites</i>				1		3		
<i>Prunus virginiana</i>	1	1	1			1		
<i>Pseudotsuga menziesii</i> (sapling)						1		1
<i>Ribes cereum</i>						1		
<i>Symphoricarpos oreophilus</i>					10		3	1
GRAMINOIDS	40	10	40	10	40	30		
<i>Bromus inermis</i> var. <i>inermis</i> *		1			1			
<i>Bromus inermis</i> var. <i>purpurascens</i>			3					
<i>Bromus tectorum</i> *	20							1
<i>Carex rossii</i>		1		1	1			
<i>Elymus cinereus</i>	3	1		1	1			
<i>Elymus spicatus</i>	30	10	10	3	20		10	1
<i>Elymus trachycaulus</i> var. <i>trachycaulus</i>			1	1				
<i>Leucopoa kingii</i>	1	1	10	1		3	3	
<i>Medica bulbosa</i>			10					
<i>Oryzopsis hymenoides</i>		1		3	10			1
<i>Poa nervosa</i> var. <i>wheeleri</i>			1			1		
<i>Poa secunda</i> var. <i>elongata</i>	1		10	3	1	1		

<u>Table 1-5 (continued)</u>	Plot	Plot	Plot	Plot	Plot	Plot	Stand	Stand
Species	1.5	1.3	1.8	2.2a	1.2	2.2b	34	77
FORBS	30	20	40	3	3	30		
<i>Achillea millefolium</i>						1		
<i>Agastache urticifolia</i>			10					
<i>Antennaria rosea</i>						1		
<i>Arabis sparsiflora</i> var. <i>subvillosa</i>	1				1			
<i>Arabis stricta</i>			1			1		
<i>Arnica cordifolia</i>						3		
<i>Aster ascendens</i>						3		
<i>Aster perelegans</i>		1	3	1				1
<i>Balsamorhiza sagittata</i>	3	20	10	1	1	1	3	3
<i>Camelina microcarpa</i>								1
<i>Castilleja linariifolia</i>						1		
<i>Chaenactis douglasii</i> var. <i>montana</i>								1
<i>Chenopodium atrovirens</i>		1		1	1			1
<i>Cirsium subniveum</i>		1	1	1	1			1
<i>Claytonia perfoliata</i>	1							
<i>Collinsia parviflora</i>		1	1	1		1		
<i>Collomia linearis</i>			1					1
<i>Comandra umbellata</i>	3		1					
<i>Crepis acuminata</i>	1	1			1	1		
<i>Cryptantha torreyana</i>	1							
<i>Cymopterus terebinthinus</i> var. <i>albiflorus</i>		1						1
<i>Descurainia</i>		1		1				1
<i>Epilobium brachycarpum</i>			1					
<i>Erigeron caespitosus</i>				1				
<i>Carex vallicola</i>						1		
<i>Eriogonum microthecum</i>								1
<i>Eriogonum umbellatum</i> or <i>E. heracleoides</i>	1			1				1
<i>Erysimum asperum</i>	1							
<i>Gilia tenerrima</i>	3							
<i>Hackelia patens</i>								1
<i>Haplopappus acaulis</i>								1
<i>Helianthella uniflora</i>			10					
<i>Hydrophyllum capitatum</i>			1					
<i>Penstemon humilis</i>	1	1	1		1			1
<i>Lappula redowskii</i> var. <i>redowskii</i>				1		1		

<u>Table 1-5 (continued)</u>	Plot	Plot	Plot	Plot	Plot	Plot	Stand	Stand
Species	1.5	1.3	1.8	2.2a	1.2	2.2b	34	77
Linnaria dalmatICA*	1							
Mahonia repens	1	3		3	1	3	3	3
Maianthemum racemosum				1				
Mentzelia dispersa	1							
Penstemon cyananthus			1					
Penstemon humilis			1		1	1		
Phlox longifolia						1		
Physaria acutifolia		1						1
Polygonum sawatchense			1					
Sedum debile	1							
Sedum lanceolatum						1		
Senecio multilobatus	1				1	1		
Senecio serra			1					
Sisymbrium loeselii	1	1						
Stellaria jamesiana						1		
Streptanthus cordatus	1	1		1		1		1
Taraxacum sp.*						1		
Thlaspi arvense*								1
Tragopogon dubius*					1			1
Veronica biloba		1						
TOTAL VEG COVER	70	70	90	50	50	70	15	30
GROUND COVER (%)								
Soil	10		16	5	18	35	55	10
Gravel	41	70	1	10	35	30	25	75
Rock	15		1	40	1	5	7	1
Bedrock				2				
Litter	30	35	75	40	40	22	5	10
Wood	1	2	1	1	2	3	1	1
Basal Veg	3	3	6	2	4	4	1	3
Lichen & Moss				1		1		
LANDSCAPE								
Slope (degrees)	34	31	27	33		25	27	34
Aspect (degrees)	150	260	180	260	240	324	250	240

Table 1-5 (continued).

Notes:

Plot 1.5: 10m x 20m, representing patch on E-facing slope, mixed with big tooth maple.

Plot: 1.3: 20m x 30m, in dense part of stand on W-facing slope (same stand as 1.2). Douglas-fir log and burned stump in plot. Mountain mahogany is patchy. Beneath dense patches, snowberry is present. Between patches, bluebunch wheatgrass probably is most common plant.

Plot 1.8: 10m x 20m, representing mountain mahogany stand on limestone outcrop next to meadow (plot 1.7), at base of dipslope.

Plot 2.2a: Small patch (<1 ha) on W-facing slope. Bluebunch wheatgrass restricted to upper part; other grasses more widespread.

Plot: 1.2: 20m x 30m, in sparse part of stand on W-facing slope

Plot 2.2b: On W-facing slope, transitional to Douglas-fir woodland. Cut Douglas-fir stumps to 20" dia. present.

Plot 1.2: 20m x 30m, in sparse part of stand on W-facing slope.

Stand 77: Open woodland with an open herbaceous undergrowth.

Table 1-6. Plant canopy cover, ground cover, and landscape position of true mountain mahogany samples.

	Stand	Plot	Stand
Species	21	5.1	76
SHRUBS		20	
<i>Amelanchier</i> sp.	20	1	1
<i>Cercocarpus montanus</i>	50	20	10
<i>Juniperus scopulorum</i>			1
<i>Prunus virginiana</i>	1		1
<i>Symphoricarpos oreophilus</i>		1	1
GRAMINOIDS		3	
<i>Bromus inermis</i> var. <i>inermis</i> *	1		
<i>Bromus tectorum</i> *	1		
<i>Elymus spicatus</i>	10	1	1
<i>Leucopoa kingii</i>	1		
<i>Melica bulbosa</i>	1		
<i>Oryzopsis hymenoides</i>		1	1
<i>Poa secunda</i> var. <i>elongata</i>	1		
FORBS		3	
<i>Aster ascendens</i>		1	1
<i>Cirsium subniveum</i>	1	1	
<i>Comandra umbellata</i>			1
<i>Crepis acuminata</i>	1		
<i>Cymopterus terebinthinus</i> var. <i>albiflorus</i>		1	
<i>Cynoglossum officinale</i> *		1	
<i>Helianthella uniflora</i>		1	
<i>Isatis tinctoria</i> *	1		
<i>Lithospermum ruderales</i>			3
<i>Oenothera</i> sp.		1	1
<i>Physaria acutifolia</i>		1	1
TOTAL VEG COVER		20	30

<u>Table 1-6 (continued)</u>	Stand	Plot	Stand
	21	5.1	76
GROUND COVER (%)			
Soil		82	30
Gravel		12	65
Rock		1	1
Bedrock		1	
Litter			1
Wood		1	<1
Basal Veg		3	2
LANDSCAPE			
Slope (degrees)		36	35
Aspect (degrees)		100	95

Notes:

Stand 21: Small patch (2-3 acres) near bottom west-facing slope. Patchy shrub layer with sparse undergrowth.

Shrubs browsed in past years, some heavily.

Plot 5.1: 20m x 20m, representing lower part of slope.

Stand 76: Sparse shrub layer with sparse undergrowth. Shrubs moderately to heavily browsed in past years.

Table 1-7. Plant canopy cover, ground cover, and landscape position of mountain big sagebrush samples.

Species	Atv Alliance												
	/Psespi		/Psespi		/Psespi		/Brocar		/Unkn.		/Unkn.		/Unkn.
	Plot	Stand	Plot	Stand	Plot	Plot	Stand	Stand	Stand	Plot	Plot	Plot	Stand
	3.1	52	7.2	51	5.3	3.4	28	30	31	4.3	1.1	4.2	113
TREES													
Pseudotsuga menziesii (sapling)													
SHRUBS													
	30		40		40	30				40	50	30	
Amelanchier sp.	1	3		3	3					1	3		
Artemisia arbuscula var. longiloba			1	10									
Artemisia cana var. viscidula						1							
Artemisia nova				1									
Artemisia tridentata var. tridentata				1									
Artemisia tridentata var. vaseyana	30	20	30	10	20	30	20	20	20	40	30	40	20
Ceanothus velutinus								3					
Cercocarpus ledifolius var. intercedens											1		
Cercocarpus montanus											3		
Chrysothamnus viscidiflorus	1	20	10	10	10	3		10	10	3	10	3	3
Paxistima myrsinites	1												
Pentaphylloides floribunda						1							
Prunus virginiana	1									1	1		
Purshia tridentata	1				3				1			1	
Ribes cereum		10		3				1	3				
Rosa sp.													
Symphoricarpos oreophilus	1	10		3	3	1	3	10	10	1	3	3	
Tetradymia sp.													

Table 1-7 (continued)

	/Psespi	/Psespi	/Psespi	/Psespi	/Brocar	/Unkn.	/Unkn.	/Unkn.	/Unkn.	/Unkn.	/Unkn.	/Unkn.	/Unkn.
Species	Plot	Stand	Plot	Stand	Plot	Plot	Stand	Stand	Stand	Plot	Plot	Plot	Stand
	3.1	52	7.2	51	5.3	3.4	28	30	31	4.3	1.1	4.2	113
<i>Poa interior</i>						1							
<i>Poa nevadensis</i>	1					1		3	1		1		1
<i>Navarretia intertexta</i>	3					40	80	20	20	20	30	20	10
<i>Poa secunda</i> var. <i>elongata</i>		1	1	1	1				1			20	
<i>Poa secunda</i> var. <i>secunda</i>			1	1				10					
<i>Stipa comata</i>	10					1							
<i>Stipa nelsonii</i> var. <i>dorei</i>													
<i>Stipa nelsonii</i> var. <i>nelsonii</i>	1	1	1	1	3	1	10		3	20	20	20	20
FORBS	10		10		20	3				20	30	10	
<i>Carex vallicola</i>			1		3	1	3			1	3	10	1
<i>Agastache urticifolia</i>										1			
<i>Agoseris</i> sp.					1								
<i>Androsace septentrionalis</i> var. <i>subulifera</i>													
<i>Antennaria rosea</i>	1												
<i>Antennaria</i> sp.						1							
<i>Arabis holboellii</i> var. <i>secunda</i>													
<i>Artemisia ludoviciana</i>						1							
<i>Aster ascendens</i>					1				3				
<i>Penstemon humilis</i>			1		1							1	
<i>Balsamorhiza sagittata</i>		3											
<i>Calochortus nuttallii</i>					1								
<i>Carduus</i> sp.*	1										1		
<i>Castilleja flava</i>			1										
<i>Castilleja linariifolia</i>				1	1						1		
							Atv Alliance						

Table 1-7 (continued)

	/Psespi	/Psespi	/Psespi	/Psespi	/Brocar	/Unkn.	/Unkn.	/Unkn.	/Unkn.	/Unkn.	/Unkn.	/Unkn.	/Unkn.
	Plot	Stand	Plot	Stand	Plot	Plot	Stand	Stand	Stand	Plot	Plot	Plot	Stand
Species	3.1	52	7.2	51	5.3	3.4	28	30	31	4.3	1.1	4.2	113
Castilleja sulphurea													
Chaenactis douglasii var. montana											1		
Cirsium scariosum						1							
Cirsium subniveum	1		1		1						1	1	1
Clematis hirsutissima						1							
Collinsia parviflora													
Collomia linearis			1		1								
Senecio multilobatus	1					1					1		
Cordylanthus ramosus										1		1	
Crepis acuminata					1						1		
Cryptantha torreyana													
Cymopterus terebinthinus var. albiflorus													
Delphinium sp.					1								
Descurainia pinnata					1								
Descurainia sp.													
Epilobium brachycarpum	1					3							
Epilobium ciliatum													1
Erigeron speciosus					1								
Eriogonum microthecum				1									
Eriogonum umbellatum or E. heracloides	3		1	1	3		?	1	3	1	1		
Erysimum asperum					1								
Erysimum inconspicuum	1					1							
Geranium viscosissimum					1								
Geum macrophyllum						1							
							Atv Alliance						

Table 1-7 (continued)

	/Psespi	/Psespi	/Psespi	/Psespi	/Brocar	/Unkn.							
	Plot	Stand	Plot	Stand	Plot	Plot	Stand	Stand	Stand	Plot	Plot	Plot	Stand
Species	3.1	52	7.2	51	5.3	3.4	28	30	31	4.3	1.1	4.2	113
Potentilla gracilis var. pulcherrima													
Ranunculus inamoenus						1							
Rumex crispus													
Sedum lanceolatum													
Senecio multilobatus						1					1		
Senecio sp.					1								
Silene menziesii var. menziesii													
Sphaeralcea munroana	1												
Stellaria jamesiana													
Swertia perennis													
Taraxacum sp.*			1		1								1
Thalictrum fendleri													
Thlaspi arvense*													
Thlaspi montanum													
Tragopogon dubius*					1								
Trifolium gymnocarpon			1		1								
Valeriana occidentalis													
Verbascum thapsus*	1										3		
Viguiera multiflora											1		
Wyethia amplexicaulis									10				
Zigadenus venenosus			1										
TOTAL VEG COVER	80	50	60	40	80	80			60	80	70	60	

Table 1-7 (continued)					Atv Alliance								
	/Psespi	/Psespi	/Psespi	/Psespi	/Brocar	/Unkn.		/Unkn.	/Unkn.	/Unkn.	/Unkn.	/Unkn.	/Unkn.
	Plot	Stand	Plot	Stand	Plot	Plot	Stand	Stand	Stand	Plot	Plot	Plot	Stand
Species	3.1	52	7.2	51	5.3	3.4	28	30	31	4.3	1.1	4.2	113
GROUND COVER (%)													
Soil	50	55	30	20	40	30	60	20	60	15	8	40	70
Gravel	2	25	1	67	1	1	3	1	5	1	50	1	<1
Rock	7	3	5	7	1	1	1	1	5	1	1	1	<1
Bedrock													
Litter	35	12	58	6	51	61	29	55	25	84	35	50	25
Wood	1	<1	1	<1	1	1		3	1	3	1	3	
Basal Veg	5	4	5	2	8	6	7	5	4	6	5	6	4
Lichen & Moss			<1										
LANDSCAPE													
Slope (degrees)	25	31			20	6	3	1 to 5	24	24	11	14	
Aspect (degrees)	100	140	270		270	295	170	10	250	80	165	90	

Table 1-7 (continued)	Atv - Purtri			Alliance			Atv - Symore			
	/Psespi	/Psespi	/Psespi	/Psespi	/Psespi	/Elytra	/Elytra	/Elytra	/Elytra	/Elytra
	Plot	Plot	Plot	Plot	Plot	Stand	Plot	Stand	Stand	Plot
Species	3.3	3.6	3.5	4.6	5.1	40	3.2	58	56	3.7
TREES										
Pseudotsuga menziesii (sapling)					1					
SHRUBS	20	50	40	40	30		50			60
Amelanchier sp.	1	1	1	1	3		3	10	3	3
Artemisia arbuscula var. longiloba				1	1					
Artemisia cana var. viscidula										
Artemisia nova										
Artemisia tridentata var. tridentata										
Artemisia tridentata var. vaseyana	10	20	20	20	20	10	20	20	20	10
Ceanothus velutinus							1			
Cercocarpus ledifolius var. intercedens										
Cercocarpus montanus										
Chrysothamnus viscidiflorus	1	10	20		3		20	20	20	20
Paxistima myrsinites		1	1							
Pentaphylloides floribunda										
Prunus virginiana			1							
Purshia tridentata	10	10	20	20	10		3			
Ribes cereum										
Rosa sp.										1
Symphoricarpos oreophilus	1	3	10	10	10	10	20	20	20	40
Tetradymia sp.					1					

Table 1-7 (continued)	Atv - Purtri			Alliance			Atv - Symore			Alliance	
	/Psespi	/Psespi	/Psespi	/Psespi	/Psespi	/Elytra	/Elytra	/Elytra	/Elytra	/Elytra	/Elytra
	Plot	Plot	Plot	Plot	Plot	Stand	Plot	Stand	Stand	Plot	
Species	3.3	3.6	3.5	4.6	5.1	40	3.2	58	56	3.7	
GRAMINOIDS	30	30	30	10	20		30			60	
<i>Bromus anomalus</i>								1		1	
<i>Bromus carinatus</i>											
<i>Bromus commutatus</i> *											
<i>Bromus inermis</i> var. <i>inermis</i> *											
<i>Bromus inermis</i> var. <i>purpurascens</i>	3		1			10	1			1	
<i>Bromus tectorum</i> *	1			1			1				
<i>Carex douglasii</i>											
<i>Carex rossii</i>	1		1				1		3		
<i>Carex vallicola</i>										1	
<i>Carex xerantica</i> ?			3				3			10	
<i>Dactylis glomerata</i> *	1										
<i>Elymus cinereus</i>	1				1		1			1	
<i>Elymus elymoides</i>				1							
<i>Elymus glaucus</i>											
<i>Elymus smithii</i>			1		1		1		1		
<i>Elymus spicatus</i>	20	20	10	10	10		1	?	10		
<i>Elymus trachycaulus</i> var. <i>trachycaulus</i>						10		1		10	
<i>Festuca idahoensis</i>								1		3	
<i>Juncus balticus</i>											
<i>Koeleria macrantha</i>		1			1			1	1	1	
<i>Leucopoa kingii</i>	1	3	3	3	10	10					
<i>Medica bulbosa</i>	3					3				1	
<i>Oryzopsis hymenoides</i>				1							

Table 1-7 (continued)										
	/Psespi	/Psespi	/Psespi	/Psespi	/Psespi	/Elytra	/Elytra	/Elytra	/Elytra	/Elytra
Species	Plot	Plot	Plot	Plot	Plot	Stand	Plot	Stand	Stand	Plot
	3.3	3.6	3.5	4.6	5.1	40	3.2	58	56	3.7
Castilleja sulphurea										1
Chaenactis douglasii var. montana					1					
Cirsium scariosum										
Cirsium subniveum	1	1	1	1	1		1			
Clematis hirsutissima			1							1
Collinsia parviflora		1					1			
Collomia linearis	1	1								
Senecio multilobatus		3			1					1
Cordylanthus ramosus										
Crepis acuminata	1	1	1	1	1					
Cryptantha torreyana	1		1				1			
Cymopterus terebinthinus var. albiflorus						1				
Delphinium sp.										1
Descurainia pinnata				1						
Descurainia sp.										1
Epilobium brachycarpum	1	1	3				1			
Epilobium ciliatum										
Erigeron speciosus		1								
Eriogonum microthecum				1						
Eriogonum umbellatum or E. heracloides		3	3	1	3		3		3	1
Erysimum asperum		1								1
Erysimum inconspicuum										1
Geranium viscosissimum										3
Geum macrophyllum										1
		Atv -	Purtri	Alliance			Atv -	Symore	Alliance	

Table 1-7 (continued)

	/Psespi	/Psespi	/Psespi	/Psespi	/Psespi	/Elytra	/Elytra	/Elytra	/Elytra	/Elytra
Species	Plot	Plot	Plot	Plot	Plot	Stand	Plot	Stand	Stand	Plot
	3.3	3.6	3.5	4.6	5.1	40	3.2	58	56	3.7
<i>Geum triflorum</i>										1
<i>Hackelia patens</i>	1		1							
<i>Helianthella uniflora</i>	1	1		1				3	1	
<i>Heuchera parviflora</i>			1							1
<i>Hydrophyllum capitatum</i>										
<i>Ipomopsis spicata</i>			1		1					
<i>Lactuca serriola</i>										
<i>Linanthus septentrionalis</i>							1			
<i>Linum lewisii</i>					1					1
<i>Lithospermum ruderale</i>										
<i>Lomatium dissectum</i> var. <i>multifidum</i>		1								
<i>Lupinus sericeus</i>	1					1		3		1
<i>Madia glomerata</i>										
<i>Mahonia repens</i>	3	3	3	1	1		3			
<i>Maianthemum stellatum</i>										
<i>Opuntia polyacantha</i>				1						
<i>Orthocarpus luteus</i>										
<i>Penstemon cyananthus</i>		1	1							
<i>Penstemon humilis</i>	1	1	3	1	1		1			1
<i>Phacelia sericea</i>			1							
<i>Phlox hoodii</i>										
<i>Phlox longifolia</i>	1									1
<i>Polygonum sawatchense</i>	1	1	1				1			1
<i>Potentilla glandulosa</i>			1				1			1
		Atv -	Purtri	Alliance			Atv -	Symore	Alliance	

Table 1-7 (continued)										
	/Psespi	/Psespi	/Psespi	/Psespi	/Psespi	/Elytra	/Elytra	/Elytra	/Elytra	/Elytra
	Plot	Plot	Plot	Plot	Plot	Stand	Plot	Stand	Stand	Plot
Species	3.3	3.6	3.5	4.6	5.1	40	3.2	58	56	3.7
Potentilla gracilis var. pulcherrima										1
Ranunculus inamoenus										
Rumex crispus										1
Sedum lanceolatum		1	1							
Senecio multilobatus			1		1		1			1
Senecio sp.		1					3			
Silene menziesii var. menziesii										1
Sphaeralcea munroana				1						
Stellaria jamesiana										1
Swertia perennis								1	1	1
Taraxacum sp.*										1
Thalictrum fendleri										1
Thlaspi arvense*			1							
Thlaspi montanum										1
Tragopogon dubius*	1									
Trifolium gymnocarpon		1			1					
Valeriana occidentalis										1
Verbascum thapsus*	1									
Viguiera multiflora	1	1			1		1			
Wyethia amplexicaulis										
Zigadenus venenosus					1					
TOTAL VEG COVER	60	60	70		60	60	80	85	80	90

Table 1-7 (continued)	Atv - Purtri			Alliance			Atv - Symore		Alliance	
	/Psespi	/Psespi	/Psespi	/Psespi	/Psespi	/Elytra	/Elytra	/Elytra	/Elytra	/Elytra
	Plot	Plot	Plot	Plot	Plot	Stand	Plot	Stand	Stand	Plot
Species	3.3	3.6	3.5	4.6	5.1	40	3.2	58	56	3.7
GROUND COVER (%)										
Soil	42	40	40	28	45	60	45	25	10	5
Gravel	3	10	3	50	3	3	15	<1	2	
Rock	35	25	5	7	7	7	1	<1		
Bedrock										
Litter	15	19	44	10	39	26	33	65	81	87
Wood	1	1	1	1	1	1	1	<1	1	1
Basal Veg	4	5	7	4	5	3	5	7	6	7
Lichen & Moss		<1								
LANDSCAPE										
Slope (degrees)	33	29	38	17	20	15 - 20	25	12		23
Aspect (degrees)	150	275	290	100	260	85	120	340		350

Notes

- *Artemisia tridentata* var. *vaseyana*/*Elymus spicatus* Type -

Plot 3.1: 20m x 30m, representing mountain big sagebrush vegetation on E-facing fan at foot of slope. Most species have little cover and are restricted to rock piles. Fan in general is mountain big sagebrush with some antelope bitterbrush.

Stand 52: Moderately dense shrub stand of ca. 0.1 acre on southeast-facing slope on sandstone.

Plot 7.2: 20m x 20m, representing vegetation on W-facing slope.

Stand 51: Open, low shrub vegetation covering all of west side of ridge (west-facing slope) at head of valley. Merges upslope with black sage stand. Trails along contours; bitterbrush have been moderately grazed in past years.

Plot 5.3: 20m x 20m, representing mixed shrub and grass on N-facing slopes. A common type, occurring in patches of 200 sq m to ca. 1 ha.

-*Artemisia tridentata* var. *vaseyana*/*Bromus carinatus* Type -

Plot 3.4: 20m x 20m, representing W-facing fan at foot of slope.

Table 1-7 (continued)

- *Artemisia tridentata* var. *vaseyana* Alliance -

Stand 28: Patch representing vegetation on alluvial fans and valley bottom. Pocket gopher diggings abound; ungulate trails present.

Stand 30: On broad ridge with swale. Merges below (to south) with mountain big sage-antelope bitterbrush (plot 3.3).

Stand 31: Moderately dense shrub vegetation with open undergrowth. Covers much of S-facing slope and merges upslope with stand 30. Pocket gopher diggings common.

Plot 4.3: 20m x 20m, representing dense, tall stand of mountain big sagebrush on N-facing slope.

Plot 1.1: 15m x 15m, representing mountain big sagebrush vegetation on fans at foot of slope.

Plot 4.2: 20m x 20m, representing dense, tall sagebrush on E-facing slope.

Stand 113: Stand on east side of ridge, between ridgeline above and aspen woodland below; covers several acres along the upper part of the slope. Sagebrush layer varies in density.

- *Artemisia tridentata* var. *vaseyana*-*Purshia tridentata*/*Elymus spicatus* Type -

Plot 3.3: 20m x 30m, representing part of mountain big sagebrush stand with few other shrubs, on upper slope.

Plot 3.6: 20m x 30m, representing upper, gentler part of W-facing slope.

Plot 3.5: 20m x 30m, representing open shrub vegetation on W-facing slope

Plot 4.6: Represents entire E-facing slope.

Plot 5.1: 20m x 20m, representing most common aspect of the stand, on mid-slope. Some parts of stand contain more *Elymus cinereus*. Relative amounts of shrubs vary, but mountain big sagebrush appears to dominate or co-dominate throughout. Merges upslope with alkali sagebrush.

- *Artemisia tridentata* var. *vaseyana*-*Symphoricarpos oreophilus*/*Elymus trachycaulus* Type -

Stand 40: Open shrub vegetation with moderately dense herbaceous undergrowth, on upper part

Plot 3.2: 20m x 30m, representing shrub-rich part of E-facing valley side.

Stand 58: Patch of moderately dense shrubs ca. 4 acres (1.5 ha) in valley bottom, east of aspen stand 57. Serviceberry is scattered throughout lower shrubs (snowberry, sagebrush, rabbitbrush). Mammal (ground squirrel?) burrows present; ungulate trails present; herbaceous vegetation grazed and trampled in places.

Stand 56: Open shrub stand down east-facing slope from chokecherry stand (#54) and aspen woodland (55). Herbaceous vegetation grazed and trampled in places. Serviceberry browsed as high as ca. 6 ft. (2 m) above the ground.

Plot 3.7: 20m x 30m, representing part of stand on northerly aspect. Mammal (ground squirrel?) burrows common.

Table 1-8. Plant canopy cover, ground cover, and landscape position of the alkali sagebrush samples.

	Plot	Plot	Plot	Plot	Plot	Plot
Species	4.1	7.1	2.6	4.9	5.2	4.4
SHRUBS	30	40	20	20	20	20
Amelanchier sp.						1
Artemisia arbuscula var. longiloba	30	30	20	20	20	10
Artemisia cana var. viscidula		10		1	1	
Artemisia tridentata var. tridentata						1
Artemisia tridentata var. vaseyana				1	1	10
Prunus virginiana						1
Symphoricarpos oreophilus			1		1	1
Tetradymia sp.				1	1	1
GRAMINOIDS	10	20	20	20	40	10
Bromus commutatus*	1					
Bromus tectorum*						1
Elymus cinereus					1	
Elymus elymoides	1	1	1	1		1
Elymus smithii	3			3	3	
Elymus trachycaulus var. trachycaulus			1			
Leucopoa kingii			3	1		3
Medica bulbosa			3			
Oryzopsis hymenoides			1			1
Poa juncifolia	10				3	
Poa pratensis*					1	
Poa secunda var. elongata		20	10	3	1	
Poa secunda var. secunda				3	1	
FORBS	10	20	20	10	3	3
Achillea millefolium					1	1
Agoseris glauca	1	1				
Arenaria kingii						1
Aster ascendens	1	1			1	
Aster perelegans			1			
Astragalus diversifolium var. campestris					1	
Astragalus jejunus var. jejunus						1
Balsamorhiza sagittata			20			
Carex vallicola			1			

<u>Table 1-8 (continued).</u>	Plot	Plot	Plot	Plot	Plot	Plot
Species	4.1	7.1	2.6	4.9	5.2	4.4
Castilleja flava					1	
Chaenactis douglasii var. montana					1	1
Cirsium subniveum		1			1	
Collomia linearis		1				
Cordylanthus ramosus				1	1	
Cymopterus longipes			1			
Descurainia sp.		1				
Epilobium ciliatum var. ciliatum	1					
Eriogonum microthecum				1		
Eriogonum sp.						1
Eriogonum umbellatum or E. heracleoides		1	1	1	1	
Hackelia patens			1			
Haplopappus acaulis			1	1		1
Iva axillaris	1					
Lappula redowskii var. redowskii						1
Linum lewisii	1				1	
Mahonia repens			3			
Navarretia intertexta	1					
Orthocarpus luteus	1					
Orthocarpus tolmei			1			
Penstemon humilis			1			
Phlox hoodii				3	1	3
Phlox longifolia			1		1	
Polygonum aviculare	10					
Carex vallicola		1				
Ranunculus testiculatus						1
Senecio sp.			1			
Streptanthus cordatus			1			
Taraxacum sp.*	1	1				
Tragopogon dubius*	1				1	
Trifolium gymnocarpon	1	1		1		
Veronica biloba		10				
Zigadenus venenosus		1				
TOTAL VEG COVER	40	60	50	60	60	20

<u>Table 1-8 (continued).</u>	Plot	Plot	Plot	Plot	Plot	Plot
Species	4.1	7.1	2.6	4.9	5.2	4.4
GROUND COVER (%)						
Soil	67	35	15	32	68	53
Gravel	1	4	66	50	<1	35
Rock		10	10	1	<1	3
Bedrock			3			
Litter	20	45	3	12	25	5
Wood				<1	<1	1
Basal Veg	3	5	2	3	5	3
Lichen & Moss	10	1	1	1		
LANDSCAPE						
Slope	5	15	30	3		12
Aspect	130	ca. 270	120	255		275

Notes:

Plot 2.6: 10m x 20m, representing one stand on upper slope.

Plot 4.1: 20m x 20m, in small draw, representing patch of several hundred sq. m on shale flat. **Merges with** silver sagebrush in valley bottom, has sharp boundary with mountain big sagebrush on adjacent slopes.

Plot 4.4: 10m, x 20m, in a patch on W-facing shoulder of slope, surrounded by a matrix of mountain big sagebrush.

Plot 4.9: 20m x 20m, in area on upper slope with most alkali sagebrush and least amount of **other shrubs**.

Plot 5.2: 20m x 20m, in area of clear alkali sagebrush dominance, typical of some ridge-tops. Cattle hoofprints and droppings present, grass grazed; ca. 30m from IGO Speedway. Mammal burrows (ground squirrel?) present.

Plot 7.1: 20m x 20m, representing vegetation on upper half of W-facing slope.

Table 1-9. Plant canopy cover, ground cover, and landscape position of the mountain silver sagebrush samples.

	Plot	Plot
Species	3.8	3.9
SHRUBS	20	40
<i>Artemisia cana</i> var. <i>viscidula</i>	10	40
<i>Artemisia tridentata</i> var. <i>vaseyana</i>		1
<i>Pentaphylloides floribunda</i>	3	1
GRAMINOIDS	80	50
<i>Carex douglasii</i>	3	
<i>Carex praegracilis</i>	20	10
<i>Carex xerantica</i> ?	1	
<i>Hordeum brachyantherum</i>	10	
<i>Juncus balticus</i>		1
<i>Koeleria macrantha</i>	1	1
<i>Poa pratensis</i>	30	30
<i>Stipa nelsonii</i> var. <i>nelsonii</i>	1	1
FORBS	10	30
<i>Achillea millefolium</i>	3	3
<i>Cirsium arvense</i> *		1
<i>Cirsium</i> , biennial	1	1
<i>Erysimum cheiranthoides</i>	1	1
<i>Fragaria virginiana</i>	3	3
<i>Geum macrophyllum</i>	1	
<i>Helenium hoopesii</i>		1
<i>Penstemon humilis</i>	1	1
<i>Rumex crispus</i>	1	
<i>Taraxacum</i> sp.*	1	
TOTAL VEG COVER	90%	95%

Table 1-9 (continued).	Plot	Plot
Species	3.8	3.9
GROUND COVER (%)		
Soil	60	
Gravel	1	
Rock		
Bedrock		
Litter	31	
Wood	1	
Basal Vegetation	7	
Lichen & Moss		
LANDSCAPE		
Slope (degrees)	3	1
Aspect (degrees)	80	15

Notes:

Plot 3.8. 20m x 20m. In valley bottom on alluvium. Represents open sagebrush canopy.

Plot 3.9 10m x 20 m. On alluvial stream terrace. Represents dense sagebrush canopy in Huff Cr. enclosure.

Table 1-10. Plant canopy cover, ground cover, and landscape position of the samples from minor shrub types.

	Artnov/ Psespi	Unkn. Type	Paxmyr Plot	Pruvir Plot	Alliance Stand
Species	4.7	2.5	2.5c	1.6	54
TREES			1		
<i>Pseudotsuga menziesii</i>			1		
SHRUBS	10	50	20	30	
<i>Acer glabrum</i>		1	1		
<i>Amelanchier</i> sp.		10	3	1	3
<i>Artemisia nova</i>	10				
<i>Artemisia tridentata</i> var. <i>vaseyana</i>		1		1	
<i>Artemisia arbuscula</i> var. <i>longiloba</i>		1	1		
<i>Ceanothus velutinus</i>		10			30
<i>Cercocarpus ledifolius</i> var. <i>intercedens</i>			1		
<i>Cercocarpus montanus</i>		1	1		
<i>Chrysothamnus viscidiflorus</i>		1			
<i>Paxistima myrsinites</i>		10	10		
<i>Prunus virginiana</i>		3		20	60
<i>Pseudotsuga menziesii</i> (seedling)		1			
<i>Rosa woodsii</i>		1		1	
<i>Symphoricarpos oreophilus</i>		20	1	3	20
GRAMINOIDS	10	20	10	40	
<i>Bromus anomalus</i>					
<i>Bromus inermis</i> var. <i>purpurascens</i>				20	
<i>Bromus tectorum</i> *	1				
<i>Carex rossii</i>		1			
<i>Elymus glaucus</i>					3
<i>Elymus spicatus</i>	10	10	3		
<i>Elymus trachycaulus</i> var. <i>trachycaulus</i>		1	3	10	
<i>Leucopoa kingii</i>		1	10	10	
<i>Medica bulbosa</i>				10	1
<i>Poa nervosa</i> var. <i>wheeleri</i>					1
<i>Poa pratensis</i> *				1	
<i>Poa secunda</i> var. <i>elongata</i>		10	10		
<i>Poa secunda</i> var. <i>secunda</i>	3				
<i>Carex vallicola</i>		1		10	

<u>Table 1-10 (continued).</u>	Artnov/	Unkn.			
	Psespi	Type	Paxmyr	Pruvir	Alliance
	Plot	Plot	Plot	Plot	Stand
Species	4.7	2.5	2.5c	1.6	54
FORBS	5	20	20	40	
<i>Achillea millefolium</i>		1	1	1	
<i>Agastache urticifolia</i>		10		10	10
<i>Alyssum alyssoides*</i>	1				
<i>Arenaria kingii</i>	1				
<i>Arnica cordifolia</i>		1	3		
<i>Aster ascendens</i>		1	1		
<i>Aster perelegans</i>		1		1	
<i>Astragalus spatulatus</i>	1				
<i>Balsamorhiza sagittata</i>		1	10	3	
<i>Castilleja linariifolia</i>	1				
<i>Cirsium</i> sp.		1			
<i>Cirsium subniveum</i>		1			
<i>Collomia linearis</i>				1	
<i>Comandra umbellata</i>		1		1	
<i>Crepis acuminata</i>		1	1		
<i>Cryptantha cespitosa</i>	1				
<i>Cymopterus terebinthinus</i> var. <i>albiflorus</i>	1	1			
<i>Descurainia californica</i>			1	1	
<i>Disporum trachycarpum</i>		1			
<i>Epilobium angustifolium</i>				1	10
<i>Epilobium brachycarpum</i>					
<i>Eriogonum umbellatum</i> or <i>E. heracleoides</i>		1	1		3
<i>Hackelia patens</i>		1			
<i>Carex vallicola</i>	1		1		
<i>Hydrophyllum capitatum</i>		1			
<i>Ipomopsis aggregata</i> var. <i>aggregata</i>		1			
<i>Isatis tinctoria*</i>				1	
<i>Lappula redowskii</i> var. <i>redowskii</i>	1				
<i>Linanthus nuttallii</i>			1		
<i>Linum lewisii</i>	1	1			
<i>Mahonia repens</i>		1	1	1	
<i>Penstemon cyananthus</i>				1	
<i>Penstemon humilis</i>			1		
<i>Phacelia capitata</i>				3	
<u>Table 1-10 (continued).</u>	Artnov/	Unkn.			

	Psespi	Type	Paxmyr	Pruvir	Alliance
	Plot	Plot	Plot	Plot	Stand
Species	4.7	2.5	2.5c	1.6	54
Phlox longifolia		1	1		
Polygonum sawatchense		1	1		
Potentilla glandulosa		1			
Sedum lanceolatum	1				
Senecio sp.			1		
Streptanthus cordatus		1	1		
Thlaspi montanum				1	
Tragopogon dubius*	1				
TOTAL VEG COVER	20	90	60	90	90
GROUND COVER (%)					
Soil	15	15	5	5	5
Gravel	58	3	56	1	1
Rock	15	1	25	1	<1
Bedrock	1		7		
Litter	7	75	5	87	80
Wood	<1	2		1	5
Basal Veg	2	4	2	5	8
Lichen & Moss	1				
LANDSCAPE					
Slope (degrees)	12	33	30	23	
Aspect (degrees)	180	70	55	170	

Notes:

- Plot 4.7: 20m x 40m, representing upper, W-facing slope and ridge-top. Merges downslope with big sagebrush shrubland.
- Plot 2.5: 10m x 20m, representing mesic part of east-facing slope. Xeric part is represented by adjacent plot 2.6 on shallow soil.
- Plot 2.5c: 20m x 20m, representing upper part of slope.
- Plot 1.6: 10m x 20m, representing part of mesic meadow with dense chokecherry cover. Dry meadow to west is plot 1.7.
- Stand 54: Patch of shrubs ca. 3/4 acre (30m x 100m) on upper part of slope in matrix of mountain big sagebrush. Prunus and Ceanothus form dense shrub layer. Forbs contribute most herbaceous cover.

Table 1-11. Plant canopy cover, ground cover, and landscape position of the grass samples

	Plot	Stand
Species	1.7	45
TREES		
<i>Pseudotsuga menziesii</i>		1
SHRUBS	3	
<i>Amelanchier</i> sp.	1	
<i>Artemisia tridentata</i> var. <i>vaseyana</i>	1	3
<i>Cercocarpus ledifolius</i> var. <i>intercedens</i>		3
<i>Purshia tridentata</i>	1	
<i>Symphoricarpos oreophilus</i>	1	
GRAMINOIDS	60	
<i>Bromus inermis</i> var. <i>purpurascens</i>	10	
<i>Carex rossii</i>	1	
<i>Elymus spicatus</i>	30	3
<i>Leucopoa kingii</i>	10	10
<i>Poa secunda</i> var. <i>elongata</i>	1	
FORBS	20	
<i>Achillea millefolium</i>	1	
<i>Agastache urticifolia</i>	1	
<i>Aster perelegans</i>	1	
<i>Balsamorhiza sagittata</i>	10	3
<i>Comandra umbellata</i>	3	
<i>Crepis acuminata</i>	1	
<i>Haplopappus acaulis</i>		1
<i>Helianthella uniflora</i>	1	
<i>Lithospermum ruderales</i>	1	
<i>Lomatium graveolens</i>		1
<i>Lupinus sericeus</i>		1
<i>Penstemon humilis</i>	3	
<i>Tragopogon dubius</i> *	1	
TOTAL VEG COVER	60	30

Table 1-11 (continued).	Plot	Stand
	1.7	45
GROUND COVER		
Soil	55	48
Gravel	20	47
Rock	10	1
Bedrock		
Litter	11	1
Wood		
Basal Veg	4	3
Lichen & Moss		
LANDSCAPE		
Slope (degrees)	30	Steep
Aspect (degrees)	190	ca. 120

Notes:

Plot 1.7: 10m x 20m, representing dry meadow E of the mesic meadow of plot 1.6.
Stand 45: Sparse vegetation on gravelly slope. Pocket gopher diggings common.

Table 1-12. Plant canopy cover, ground cover, and landscape position of the forb samples.

Species	Psespi -	Balsag -	Poasec?	Psespi -
	Stand 38	Plot 2.4	Plot 2.5b	Cushion? Plot 4.5
TREES				
<i>Pseudotsuga menziesii</i>	1			
SHRUBS				
<i>Amelanchier</i> sp.	1	1	1	1
<i>Artemisia arbuscula</i> var. <i>longiloba</i>				1
<i>Artemisia cana</i> var. <i>viscidula</i>			1	
<i>Cercocarpus montanus</i>		1		1
<i>Chrysothamnus viscidiflorus</i>				1
<i>Paxistima myrsinites</i>		1		
<i>Prunus virginiana</i>				1
<i>Rosa woodsii</i>			1	
<i>Symphoricarpos oreophilus</i>	1	1		
GRAMINOIDS				
<i>Carex rossii</i>	1			
<i>Elymus spicatus</i>	3	1	3	1
<i>Leucopoa kingii</i>	3	1	3	
<i>Oryzopsis hymenoides</i>		1	1	1
<i>Poa secunda</i> var. <i>elongata</i>	3	3	3	1
FORBS				
<i>Astragalus jejunus</i> var. <i>jejunus</i>				1
<i>Balsamorhiza sagittata</i>	10	10	10	
<i>Chaenactis douglasii</i> var. <i>montana</i>			1	
<i>Cirsium subniveum</i>			1	1
<i>Comandra umbellata</i>			1	
<i>Cymopterus longipes</i>		1	1	
<i>Epilobium brachycarpum</i>			1	
<i>Erigeron eatonii</i>		1		
<i>Eriogonum</i> sp.				1
<i>Eriogonum umbellatum</i> or <i>E. heracleoides</i>		1		
<i>Hackelia patens</i>			1	
<i>Haplopappus acaulis</i>		3	3	10
<i>Mahonia repens</i>		3	1	1
<i>Penstemon humilis</i>		1	1	

Table 1-12 (continued).	Psespi - Balsag - Poasec?			Psespi - Cushion?
	Stand	Plot	Plot	Plot
Species	38	2.4	2.5b	4.5
Phlox hoodii				3
Silene menziesii var. menziesii				1
TOTAL VEG COVER		30	30	10
GROUND COVER (%)				
Soil	1	20	15	31
Gravel	52	66	71	65
Rock	30	1	10	1
Bedrock	1	5	1	
Litter	5	5	2	1
Basal Veg	2	1	1	2
Lichen & Moss				
LANDSCAPE				
Slope (degrees)		30	30	12
Aspect (degrees)		80	70	60

Notes:

Stand 38: Sparsely vegetated opening in Doug-fir woodland, on steep slope of limestone bedrock and talus.

Balsamorhiza common throughout; Leucopoa and Elymus present throughout.

Plot 2.4: 10m x 20m, representing band of sparse vegetation ca. 10m x 100 m on limestone outcrop, in matrix of curl-leaf mountain mahogany vegetation.

Plot 2.5b: 10m x 20m, representing xeric part of slope on shallow soil

Plot 4.5: 10m x 10m, representing patches of sparse vegetation, each of several hundred sq m in matrix of sagebrush vegetation.

APPENDIX 3 . DESCRIPTIONS OF HERBACEOUS RIPARIAN VEGETATION TYPES.

Several herbaceous vegetation types, and two mountain silver sagebrush types, were described from more than one stream in the study area. The descriptions of these types from the various streams are collected here to illustrate the variability in the types. The correspondence of these types to vegetation types from other classifications is shown in Appendix 1.

Beaked Sedge

- Little Muddy Creek: This type is dominated by beaked sedge and contains fowl mannagrass (*Glyceria striata*), foxtail (*Hordeum brachyantherum*), woolly sedge (*Carex lanuginosa*), and redtop (*Agrostis stolonifera*), and (in some areas) tufted hairgrass (*Deschampsia cespitosa*) as a secondary species.
- Coal Creek: Beaked sedge contributes the most canopy cover. Common associates are spikerush (*Eleocharis quinqueflora*), fowl mannagrass (*Glyceria striata*), woolly sedge (*Carex lanuginosa*), and Nebraska sedge (*Carex nebrascensis*). Although it covers little of the riparian zone, this sedge type occurs throughout the length of Coal Creek (98GJ2.18).

Small-wing Sedge

- Little Muddy Creek: Small-wing sedge (*Carex microptera*), rush (*Juncus longistylis*), and fowl mannagrass (*Glyceria striata*) are present, although field horsetail (*Equisetum arvense*), foxtail (*Hordeum brachyantherum*), Kentucky bluegrass (*Poa pratensis*), willowherb (*Epilobium ciliatum*), and monkeflower (*Mimulus guttatus*) may contribute more cover.

Nebraska Sedge (*Carex nebrascensis*)

- Little Muddy Creek: Nebraska sedge dominates the vegetation strongly, and tufted hairgrass and fowl mannagrass (*Glyceria striata*) are secondary species. Water whorlgrass (*Catabrosia aquatica*) is present.
- Coal Creek: Nebraska sedge, woolly sedge (*Carex lanuginosa*), tufted hairgrass (*Deschampsia cespitosa*), and fowl mannagrass (*Glyceria striata*) are the most common species, and Baltic rush (*Juncus balticus*) is present.
- S. Fk. Mill Creek: Nebraska sedge, fowl mannagrass (*Glyceria striata*), spikerush (*Eleocharis* sp. [probably *E. quinqueflora*]), and rush (*Juncus* sp.) are the major species, and meadow timothy (*Phleum pratense*), an exotic species, grows in the drier parts of this vegetation.

Woolly Sedge (*Carex lanuginosa*)

- Coal Creek: Woolly sedge, fowl mannagrass (*Glyceria striata*), and redtop (*Agrostis stolonifera*) are the major species; beaked sedge (*Carex rostrata*), Nebraska sedge (*Carex nebrascensis*), and Baltic rush (*Juncus balticus*) usually occur in the vegetation. This type

Tufted Hairgrass-Nebraska Sedge (*Deschampsia cespitosa*-*Carex nebrascensis*)

- Little Muddy Creek: Major species are tufted hairgrass and Nebraska sedge, with patches of beaked sedge (*Carex rostrata*) in low spots near the channel.
- Stoner Creek: same as Little Muddy Creek
- Huff Creek: Tufted hairgrass, Nebraska sedge, woolly sedge (*Carex lanuginosa*), strawberry (*Fragaria virginiana*), and potentilla (*Potentilla anserina*) are the major species, and other common species are field-clustered sedge (*Carex praegracilis*) and, near the channel, beaked sedge (*Carex rostrata*). Sweetgrass (*Hierochloa odorata*), buttercup (*Ranunculus macounii*), avens (*Geum macrophyllum*), several *Potentilla* spp., Baltic rush (*Juncus balticus*), and yarrow (*Achillea millefolium*), and shooting star (*Dodecatheon pulchellum*) may be present. Canada thistle (*Cirsium arvense*) is scattered throughout some stands.

Tufted Hairgrass - Sedge Species (*Deschampsia cespitosa*-*Carex* spp.)

- Little Muddy Creek: Along the main part of Little Muddy Creek, the major species are Kentucky bluegrass (*Poa pratensis*), tufted hairgrass (*Deschampsia cespitosa*), and field-clustered sedge (*Carex praegracilis*). Mountain silver sagebrush (*Artemisia cana* var. *viscidula*) may be present, but its canopy cover is usually less than ca. 10%. On the vegetation on drier riparian surfaces on the upstream part of Little Muddy Creek, and on the major tributary, the major species there are tufted hairgrass, Kentucky bluegrass (*Poa pratensis*), yarrow (*Achillea millefolium*), and *Hordeum brachyantherum*. with only small amounts of field-clustered sedge.
- Stoner Creek: same as Little Muddy Creek
- Huff Creek: Tufted hairgrass, field-clustered sedge (*Carex praegracilis*), and Kentucky bluegrass (*Poa pratensis*) co-dominate, and strawberry (*Fragaria virginiana*) and aster (*Aster ascendens*) are common. Baltic rush (*Juncus balticus*) and yarrow (*Achillea millefolium*) are present. Scattered mountain silver sagebrush (*Artemisia cana* var. *viscidula*) and shrubby cinquefoil (*Pentaphylloides floribunda*) usually grow in the vegetation but do not form a distinct shrub layer.

Kentucky Bluegrass - Slender Wheatgrass (*Poa pratensis*-*Elymus trachycaulus* var. *trachycaulus*) (may be degraded form of Tufted Hairgrass-Sedge species type)

- Coal Creek: The major species are Kentucky bluegrass, field-clustered sedge (*Carex praegracilis*), and slender wheatgrass (*Elymus trachycaulus* var. *trachycaulus*); secondary species in some areas are redtop (*Agrostis stolonifera*), yarrow (*Achillea millefolium*), Nelson's needlegrass (*Stipa nelsonii*), strawberry (*Fragaria virginiana*), rosy pussytoes (*Antennaria rosea*), and dandelion (*Taraxacum* sp.). Tufted hairgrass (*Deschampsia cespitosa*) is present in places, but contributes only a little canopy cover. Mountain silver sagebrush (*Artemisia cana* var. *viscidula*) contributes up to ca. 10% canopy cover in some areas.

Kentucky bluegrass (*Poa pratensis*)

- Chalk Creek: The wet soils along small tributaries flowing across the old valley floor support narrow bands of Kentucky bluegrass, foxtail barley (*Hordeum brachyantherum*), and fowl mannagrass (*Glyceria striata*).

Mountain Silver Sagebrush/Tufted Hairgrass (*Artemisia cana* var. *viscidula*/*Deschampsia cespitosa*)

- Little Muddy Creek: Mountain silver sagebrush forms a patchy shrub layer with at least 10% canopy cover, and shrubby cinquefoil (*Pentaphylloides floribunda*) is present near the mouth of Stoner Creek. Kentucky bluegrass (*Poa pratensis*) and field-clustered sedge (*Carex praegracilis*) generally dominate, and tufted hairgrass and slender wheatgrass (*Elymus trachycaulus* var. *trachycaulus*) are present in smaller amounts.
- Stoner Creek: Along the main branch of the stream, this type consists of a sagebrush layer above a herbaceous undergrowth in which the major species are Nelson needlegrass (*Stipa nelsonii*), Kentucky bluegrass (*Poa pratensis*), and field-clustered sedge (*Carex praegracilis*).
- Coal Creek: Mountain silver sagebrush forms a shrub canopy (usually with < 25% cover) that may contain small amounts of mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*). The major species of the herbaceous undergrowth are California brome (*Bromus carinatus*), Kentucky bluegrass (*Poa pratensis*), and slender wheatgrass (*Elymus trachycaulus* var. *trachycaulus*). Tufted hairgrass is present in places but usually contributes only a small amount of canopy cover. Western coneflower (*Rudbeckia occidentalis*) and Canada thistle (*Cirsium arvense*), a noxious weed, form patches in some locations.
- Huff Creek: Mountain silver sagebrush forms the shrub layer, which often contains smaller amounts of shrubby cinquefoil (*Pentaphylloides floribunda*). The understory in the two plots sampled (3.8 and 3.9) consisted of Kentucky bluegrass (*Poa pratensis*) and field-clustered sedge (*Carex praegracilis*) with yarrow (*Achillea millefolium*), strawberry (*Fragaria virginiana*), and various other species. Tufted hairgrass was absent from the two plots but present elsewhere in the vegetation. Shrub cover ranges from a closed canopy (plot 3.9) to an open canopy (plot 3.8), and this type merges into the *Deschampsia cespitosa*-*Carex* spp. Herbaceous Type on slightly lower surfaces.

Mountain Silver Sagebrush (*Artemisia cana* var. *viscidula*) Shrubland

- Stoner Creek: In the upper part of the South Fork, this type consists of a mix of mountain silver sagebrush and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) with Great Basin wildrye (*Elymus cinereus*), Kentucky bluegrass, and field-clustered sedge.
- S. Fk. Mill Creek: Major species in the herbaceous undergrowth are the exotic Kentucky bluegrass (*Poa pratensis*), Nelson's needlegrass (*Stipa nelsonii*), and slender wheatgrass (*Elymus trachycaulus*). All of the major grasses grow in upland sites, which indicates that much of the valley bottom in this reach may no longer qualify as a riparian site.

APPENDIX 4. LIST OF VASCULAR PLANT SPECIES IDENTIFIED

Scientific names are from Dorn (1992), with synonyms used by the Rocky Mountain Herbarium or by Kartesz (1994) for a few species. Common names as used in this report for selected species are also given. An asterisk, *, after the scientific name indicates an exotic species. The letter "s" in front of the scientific name indicates that the identification was made from a specimen. Taxa without the letter "s" were identified in the field using Dorn (1992).

	Scientific Name (Dorn 1992)	Common Name
	TREES	
	<i>Abies lasiocarpa</i>	Subalpine fir
	<i>Pinus contorta</i>	Lodgepole pine
	<i>Pinus flexilis</i>	Limber pine
	<i>Populus tremuloides</i>	Aspen
	<i>Pseudotsuga menziesii</i>	Douglas-fir
	SHRUBS	
	<i>Acer glabrum</i>	Rocky Mountain maple
	<i>Acer grandidentatum</i>	Big-tooth maple
s	<i>Amelanchier alnifolia</i> var. <i>alnifolia</i>	Serviceberry
s	<i>Amelanchier utahensis</i>	Serviceberry
s	<i>Artemisia arbuscula</i> var. <i>longiloba</i>	Alkali sagebrush
	<i>Artemisia cana</i> var. <i>viscidula</i>	Mountain silver sagebrush
	<i>Artemisia nova</i>	Black sagebrush
	<i>Artemisia tridentata</i> var. <i>tridentata</i> (syn. <i>A. tridentata</i> ssp. <i>tridentata</i>)	Basin big sagebrush
	<i>Artemisia tridentata</i> var. <i>vaseyana</i> (syn. <i>A. tridentata</i> ssp. <i>vaseyana</i>)	Mountain big sagebrush
s	<i>Artemisia tridentata</i> var. <i>wyomingensis</i> (syn. <i>A. tridentata</i> ssp. <i>wyomingensis</i>)	Wyoming big sagebrush
s	<i>Betula glandulosa</i>	Bog birch
	<i>Ceanothus velutinus</i>	Snowbrush ceanothus
	<i>Cercocarpus ledifolius</i> var. <i>intercedens</i>	Curl-leaf mountain mahogany
s	<i>Chrysothamnus nauseosus</i> var. <i>nauseosus</i>	Douglas rabbitbrush
s	<i>Chrysothamnus viscidiflorus</i> var. <i>lanceolatus</i>	Rubber rabbitbrush
	<i>Cornus sericea</i> (syn. <i>C. stolonifera</i>)	Red-osier dogwood
	<i>Holodiscus dumosus</i>	Bush rockspiraea
	<i>Juniperus communis</i>	Common juniper
	<i>Juniperus scopulorum</i>	Rocky Mountain juniper
s	<i>Paxistima myrsinites</i>	Boxleaf myrtle
	<i>Pentaphylloides floribunda</i>	

	(syn. <i>Potentilla fruticosa</i>)	Shrubby cinquefoil
	<i>Purshia tridentata</i>	Antelope bitterbrush
	<i>Ribes cereum</i>	Wax currant
s	<i>Ribes inerme</i>	Smooth currant
s	<i>Ribes viscosissimum</i>	
s	<i>Rosa woodsii</i>	Wood's rose
	<i>Rubus idaeus</i>	
	<i>Rubus parviflorus</i>	
s	<i>Salix boothii</i>	Booth willow
s	<i>Salix geyeriana</i>	Geyer willow
s	<i>Salix lasiandra</i> var. <i>caudata</i>	Pacific or whiplash willow
s	<i>Salix lutea</i> (syn. <i>S. eriocephala</i> var. <i>watsonii</i>)	Yellow willow
s	<i>Salix scouleriana</i>	Scouler willow
	<i>Sambucus racemosa</i>	
	<i>Shepherdia canadensis</i>	Russet buffaloberry
	<i>Sorbus scopulina</i>	
	<i>Spiraea betulifolia</i>	
	<i>Symphoricarpos oreophilus</i>	Utah snowberry
	<i>Tetradymia</i> sp.	Horsebrush
	GRAMINOIDS	
s	<i>Agrostis stolonifera</i>	Redtop
s	<i>Alopecurus arundinaceus</i>	
s	<i>Bromus anomalus</i>	Nodding brome
s	<i>Bromus carinatus</i>	California brome
s	<i>Bromus commutatus</i> *	Cheatgrass
s	<i>Bromus inermis</i> var. <i>inermis</i> *	Smooth brome
s	<i>Bromus inermis</i> var. <i>purpurascens</i>	
	<i>Bromus tectorum</i> *	Cheatgrass
s	<i>Calamagrostis rubescens</i>	Pinegrass
s	<i>Calamagrostis stricta</i>	
s	<i>Carex beckii</i> var. <i>subrostrata</i>	
s	<i>Carex disperma</i>	
s	<i>Carex douglasii</i>	
s	<i>Carex lanuginosa</i>	Woolly sedge
s	<i>Carex microptera</i> var. <i>microptera</i>	Small-wing sedge
s	<i>Carex nebrascensis</i> ?	Nebraska sedge
s	<i>Carex praegracilis</i>	Field-clustered sedge

s	<i>Carex rossii</i>	Ross's sedge
s	<i>Carex rostrata</i>	Beaked sedge
s	<i>Carex stenophylla</i>	
s	<i>Carex vallicola</i>	
s	<i>Carex xerantica?</i>	
s	<i>Catabrosa aquatica</i>	
	<i>Dactylis glomerata*</i>	Orchardgrass
s	<i>Danthonia californica</i>	
s	<i>Eleocharis quinqueflora</i> (syn. <i>E. pauciflora</i>)	Spikerush
	<i>Elymus cinereus</i>	Basin wildrye
s	<i>Elymus elymoides</i> var. <i>elymoides</i>	
	<i>Elymus glaucus</i>	
s	<i>Elymus lanceolatus</i> var. <i>lanceolatus</i>	Thickspike wheatgrass
s	<i>Elymus lanceolatus</i> var. <i>riparius</i>	Streambank wheatgrass
s	<i>Elymus repens*</i>	Quackgrass
	<i>Elymus smithii</i> (syn. <i>Pascopyrum smithii</i>)	Western wheatgrass
	<i>Elymus spicatus</i> (syn. <i>Agropyron spicatum</i> , <i>Pseudoroegneria spicata</i>)	Bluebunch wheatgrass
s	<i>Elymus trachycaulus</i> var. <i>trachycaulus</i>	Slender wheatgrass
s	<i>Festuca idahoensis</i>	Idaho fescue
s	<i>Glyceria striata</i>	Fowl mannagrass
s	<i>Hierochloa odorata</i>	Sweetgrass
s	<i>Hordeum brachyantherum</i>	Foxtail barley
	<i>Juncus balticus</i>	Baltic rush
s	<i>Juncus ensifolius</i> var. <i>montanus</i>	
s	<i>Juncus longistylis</i>	
s	<i>Koeleria macrantha</i>	Junegrass
	<i>Leucopoa kingii</i> (syn. <i>Festuca kingii</i>)	King spikefescue
s	<i>Medica bulbosa</i>	Onion grass
s	<i>Oryzopsis exigua</i>	
	<i>Oryzopsis hymenoides</i>	Indian ricegrass
s	<i>Phalaris arundinacea</i>	
s	<i>Poa interior</i>	Interior bluegrass
s	<i>Poa nervosa</i> var. <i>wheeleri</i>	Wheeler bluegrass
s	<i>Poa nevadensis</i>	Big bluegrass
s	<i>Poa pratensis*</i>	Kentucky bluegrass
s	<i>Poa secunda</i> var. <i>elongata</i>	
s	<i>Poa secunda</i> var. <i>secunda</i>	Sandberg bluegrass
s	<i>Stipa comata</i> var. <i>intermedia</i>	Needle-and-thread
s	<i>Stipa nelsonii</i> var. <i>dorei</i>	Nelson's needlegrass
s	<i>Stipa nelsonii</i> var. <i>nelsonii</i>	Nelson's needlegrass

s	<i>Stipa x bloomeri</i> (county record?)	
s	<i>Trisetum spicatum</i>	
FORBS		
	<i>Achillea millefolium</i>	Yarrow
	<i>Agastache urticifolia</i>	
s	<i>Agoseris glauca</i> var. <i>dasycephala</i>	
s	<i>Alyssum alyssoides</i> *	
s	<i>Androsace septentrionalis</i> var. <i>subulifera</i>	
s	<i>Antennaria anaphaloides</i>	
s	<i>Antennaria microphylla</i>	
s	<i>Antennaria rosea</i>	
	<i>Apocynum</i> sp.	
s	<i>Aquilegia coerulea</i>	
s	<i>Arabis glabra</i>	
s	<i>Arabis holboellii</i> var. <i>secunda</i>	
s	<i>Arabis sparsiflora</i> var. <i>subvillosa</i>	
	<i>Arabis stricta</i>	
s	<i>Arenaria kingii</i> var. <i>glabrescens</i>	
	<i>Arnica cordifolia</i>	
s	<i>Arnica longifolia</i>	
	<i>Artemisia ludoviciana</i>	
s	<i>Aster ascendens</i>	
s	<i>Aster engelmannii</i>	
s	<i>Aster perelegans</i>	
s	<i>Astragalus agrestis</i>	
s	<i>Astragalus diversifolius</i> var. <i>campestris</i> (syn. <i>A. convallarius</i>)	
s	<i>Astragalus jejunus</i> var. <i>jejunus</i>	
s	<i>Astragalus spatulatus</i>	
	<i>Balsamorhiza sagittata</i>	Arrowleaf balsamroot
s	<i>Calochortus nuttallii</i>	
	<i>Camelina microcarpa</i>	
	<i>Carduus</i> sp.*	
s	<i>Castilleja angustifolia</i> var. <i>dubia</i>	
s	<i>Castilleja flava</i>	
s	<i>Castilleja linariifolia</i>	
s	<i>Castilleja sulphurea</i>	

s	<i>Chaenactis douglasii</i> var. <i>montana</i>	
s	<i>Chenopodium atrovirens</i>	
s	<i>Chimaphila umbellata</i>	
	<i>Cirsium arvense</i> *	Canada thistle
	<i>Cirsium scariosum</i>	
s	<i>Cirsium subniveum</i>	
s	<i>Claytonia perfoliata</i>	
s	<i>Clematis hirsutissima</i>	
s	<i>Collinsia parviflora</i>	
s	<i>Collomia debilis</i> var. <i>debilis</i>	
s	<i>Collomia linearis</i>	
	<i>Comandra umbellata</i>	
	<i>Cordylanthus ramosus</i>	
s	<i>Crepis acuminata</i>	
s	<i>Cryptantha caespitosa</i>	
s	<i>Cryptantha torreyana</i>	
s	<i>Cymopterus longipes</i>	
s	<i>Cymopterus terebinthinus</i> var. <i>albiflorus</i>	
	<i>Cynoglossum officinale</i> *	Houndstongue
s	<i>Delphinium bicolor</i>	
s	<i>Delphinium nuttallianum</i>	
s	<i>Descurainia californica</i>	
s	<i>Descurainia incana</i> var. <i>macrosperma</i>	
s	<i>Descurainia pinnata</i> var. <i>filipes</i>	
s	<i>Disporum trachycarpum</i>	
s	<i>Dodecatheon pulchellum</i>	
	<i>Epilobium angustifolium</i>	
	<i>Epilobium brachycarpum</i>	
s	<i>Epilobium ciliatum</i> var. <i>ciliatum</i>	
s	<i>Equisetum arvense</i>	
s	<i>Equisetum laevigatum</i>	
s	<i>Erigeron caespitosus</i>	
s	<i>Erigeron eatonii</i>	
s	<i>Erigeron lonchophyllus</i>	
s	<i>Erigeron speciosus</i>	
s	<i>Erigeron tener</i>	
s	<i>Eriogonum heracloides</i>	
s	<i>Eriogonum microthecum</i> var. <i>laxiflorum</i>	

s	Eriogonum umbellatum var. ?	
s	Erysimum asperum var. arkansanum (syn. E. capitatum var. capitatum)	
s	Erysimum cheiranthoides	
s	Erysimum inconspicuum	
	Fragaria vesca	
	Fragaria virginiana	
s	Galium aparine var. aparine	
s	Galium bifolium	
s	Geranium viscosissimum var. viscosissimum	
s	Geum macrophyllum var. perincisum	
	Geum triflorum	
s	Gilia tenerrima	
	Habenaria unalaschensis	
s	Hackelia patens	
s	Haplopappus acaulis	
s	Hedysarum alpinum var. americanum	
s	Hedysarum boreale var. pabulare	
s	Helenium hoopesii (syn. Dugaldia hoopesii)	
s	Helianthella uniflora	
	Heracleum sphondylium	
	Heuchera parviflora	
	Hieracium albiflorum	
s	Hydrophyllum capitatum	
s	Ipomopsis aggregata var. aggregata	
	Ipomopsis spicata	
	Isatis tinctoria*	Dyer's woad
	Iva axillaris	
	Lactuca serriola	
s	Lappula redowskii var. redowskii	
s	Lepidium densiflorum var. densiflorum	
s	Linanthus nuttallii	
s	Linanthus septentrionalis	
	Linnaria dalmatica*	Dalmatian toadflax
	Linum lewisii	
s	Lithophragma parviflorum	
s	Lithospermum ruderales	
s	Lomatium dissectum var. multifidum	
s	Lomatium graveolens	
s	Lupinus argenteus var. rubricaulis	Lupine

s	<i>Lupinus sericeus</i>	Lupine
s	<i>Machaeranthera canescens</i> var. <i>canescens</i>	
s	<i>Madia glomerata</i>	
	<i>Mahonia repens</i>	
	<i>Maianthemum racemosum</i>	
	<i>Maianthemum stellatum</i>	
s	<i>Mentzelia dispersa</i>	
s	<i>Mertensia oblongifolia</i> ?	
s	<i>Microseris nutans</i>	
s	<i>Mimulus guttatus</i>	
	<i>Mitella</i> sp.	
s	<i>Navarretia intertexta</i>	
	<i>Oenothera</i> sp.	
	<i>Opuntia polyacantha</i>	
s	<i>Orthocarpus luteus</i>	
s	<i>Orthocarpus tolmei</i>	
	<i>Osmorhiza depauperata</i>	
s	<i>Osmorhiza occidentalis</i>	
s	<i>Penstemon cyananthus</i>	
s	<i>Penstemon humilis</i>	
	<i>Phacelia capitata</i>	
s	<i>Phacelia heterophylla</i> var. <i>virgata</i>	
s	<i>Phacelia sericea</i> var. <i>sericea</i>	
s	<i>Phlox hoodii</i>	Hood's phlox
s	<i>Phlox longifolia</i>	
s	<i>Physaria acutifolia</i>	
s	<i>Polygonum aviculare</i>	
s	<i>Polygonum sawatchense</i>	
s	<i>Potentilla anserina</i>	
s	<i>Potentilla glandulosa</i> var. <i>pseudorupestris</i>	
s	<i>Potentilla gracilis</i> var. <i>brunnescens</i>	
s	<i>Potentilla gracilis</i> var. <i>pulcherrima</i>	
s	<i>Prunella vulgaris</i> *	
s	<i>Pyrola chlorantha</i>	
s	<i>Ranunculus inamoenus</i> var. <i>inamoenus</i>	
s	<i>Ranunculus macounii</i>	
s	<i>Ranunculus testiculatus</i>	
	<i>Rudbeckia occidentalis</i>	
s	<i>Rumex crispus</i>	
s	<i>Sedum debile</i>	
	<i>Sedum lanceolatum</i>	
s	<i>Senecio multilobatus</i>	
	<i>Senecio serra</i>	

s	<i>Silene douglasii</i> var. <i>douglasii</i>	Douglas's campion
s	<i>Silene menziesii</i> var. <i>menziesii</i>	
s	<i>Sisymbrium loeselii</i>	
s	<i>Solidago missouriensis</i> var. <i>missouriensis</i>	
s	<i>Solidago multiradiata</i> var. <i>scopulorum</i>	
s	<i>Sphaeralcea munroana</i>	
s	<i>Stellaria jamesiana</i> (syn. <i>Pseudostellaria jamesiana</i>)	
s	<i>Stellaria longipes</i>	
s	<i>Streptanthus cordatus</i>	
	<i>Swertia perennis</i>	
s	<i>Synthyris pinnatifida</i>	
	<i>Taraxacum</i> sp.*	Dandelion
s	<i>Thalictrum fendleri</i>	Fendleri's meadow rue
	<i>Thlaspi arvense</i> *	
s	<i>Thlaspi montanum</i>	
	<i>Tragopogon dubius</i> *	
	<i>Trifolium gymnocarpon</i>	
s	<i>Trifolium hybridum</i> *	
s	<i>Valeriana occidentalis</i>	
	<i>Valeriana occidentalis</i>	
	<i>Verbascum thapsus</i> *	
s	<i>Veronica biloba</i>	
s	<i>Viguiera multiflora</i>	
s	<i>Viola adunca</i>	
	<i>Wyethia amplexicaulis</i>	
s	<i>Zauschneria garrettii</i> (syn. <i>Epilobium canum</i> ssp. <i>garrettii</i>)	
	<i>Zigadenus venenosus</i>	

APPENDIX 5. ELEMENT OCCURRENCE RECORD FOR *SILENE DOUGLASII* VAR.
DOUGLASII.

Element Occurrence Record
SILENE DOUGLASII

Identifiers:

Elcode EO# State:
EOCODE: PDCAR0U0L0*001*WY FONUM: IDENT: Y
SNAME: SILENE DOUGLASII
SCOMNAME: Douglas's campion
ELEMENT RANKS: GRANK: G4 NRANK: SRANK: S1

Locators:

NATION: US SITECODE:
SITENAME:
SURVEYSITE:

PRECISION: M

COUNTYCODE: COUNTYNAME LOCALJURIS:
WYLINC Lincoln

QUADNAME: QUADCODE: MARGNUM: DOTNUM: TENTEN:
GENEVA 4211131 2 9,8
HUFF LAKE 4211038 1 0,7

LAT: 421704N S: 421638N
LONG: 1105959W N: 421704N

E: 1105959W
W: 1110108W

TOWNRANGE: SECTION: MERIDIAN: TRSNOTE:
027N119W 32 6P SEC 32 SW4 of SE4
026N119W 06 6P NE4

DIRECTIONS: Overthrust Belt, Raymond Mountain, Raymond Creek, ca 13.5 air miles north of Cokeville. 2 subpopulations within 1 air mile: (1) near mouth of Raymond Canyon (Sec 6 NE4). (2) slopes along upper Raymond Creek (Sec 32 SW4SE4).

PHYSPROV: WATERSHED: 16010102

Status:

SURVEYDATE: 1998-07-09 LASTOBS: 1998-07-09 FIRSTOBS: 1995-07-11
EORANK: EORANKDATE:

EORANKCOM:

EODATA: 1998-07-09: Observed in flower by G. Jones during vegetation survey. Reported as a "minor species" in understory
1995-07-11: Observed by Tom and Jane Cramer.

CONTACTID: CONTACT.NAME:
CONTACT.NOTE:

Description:

EOTYPE: SURVEY

GENDESC: Understory of ACER GRANDIDENTATUM woodland and nearby CERCOCARPUS LEDIFOLIUS VAR INTERCEDENS woodland in limestone talus on 38 degree slope bearing 115 degrees.

MINELEV: 6400 MAXELEV: 7600 SIZE: 1+

Protection:

MACODE:	MANAME:	MATYPE:	CONTAINED:
M.USWYHP*294	RAYMOND MOUNTAIN AREA OF CRITICAL ENVIRONMENTALCONCERN	FBLACEC	Y

M.USWYHP*21	KEMMERER RESOURCE AREA	FBLRA	Y
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M.USWYHP*12	ROCK SPRINGS DISTRICT, BUREAU OF LAND MAN- AGEMENT	FBLDO	Y
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MORELAND: MOREPROT: MOREMGMT: TNCINVOLVE:

MGMTCOM: Also occurs within the Raymond Mountain Wilderness Study Area.

PROTCOM:

Ownership:

OWNER: OWNERINFO:
OWNERCOM:

General Comments:

COMMENTS: First record for Wyoming. Cramer specimen was originally misidentified as SILENE PARRYI.

Additional Topics:
ADDTL.TOPICS:

TOPIC.KEYWORDS:

Documentation:
DATASENS: N BOUNDARIES: Y PHOTOS: N
BESTSOURCE: George Jones

SOURCECODE: CITATION:
PNDJON01WYUS Jones, George P. Ecologist. Wyoming Natural Diversity Database

SPECIMENS: Jones, G. (s.n.). 1998. RM.; Cramer, T. (7661). 1995. RM.

TRANSCRIBR: 99-01-23 WF CDREV:
MAPPER: 99-01-23 WF QC:

Record Maintenance:
LEADRESP: USWYHP
EDITION: 99-01-23 EDAUTHOR: Walter Fertig

Maintenance History:
OFFICE: INITIALS: CHANGE.DATE: CHANGE.FIELDS:
USWYHP WF 99-02-01 25/46/65
USWYHP WF 99-01-23 8/9/12/13/14/15/16/17/18/1
USWYHP WF 99-01-22 4/5/6/17/18/19/25/32/33/38

MANUAL.FILE.NOTE:

APPENDIX 6. PHOTOGRAPHS FROM THE RAYMOND MOUNTAIN WSA AND
ADJACENT STREAMS.