

VEGETATION MAPPING,
FOSSIL BUTTE NATIONAL MONUMENT

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by

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ABSTRACT

The vegetation of Fossil Butte National Monument in southwestern Wyoming was classified and mapped. The vegetation map was digitized using Arc/Info.

Vegetation in Fossil Butte National Monument includes a number of vegetation types. Alkali sagebrush, basin big sagebrush, and sparse grass types occupy gentle topography at lower elevations. Mountain big sagebrush and grasslands occur on gentle topography at higher elevations. Aspen woodlands grow on north- and east-facing slopes, and conifer woodlands grow on steeper north-facing slopes at higher elevations. Small areas of wet meadow, saline shrub, and mountain shrub types occur in the Monument. Most of the Monument's vegetation has been described, and a floristic inventory is the next logical step in botanical research.

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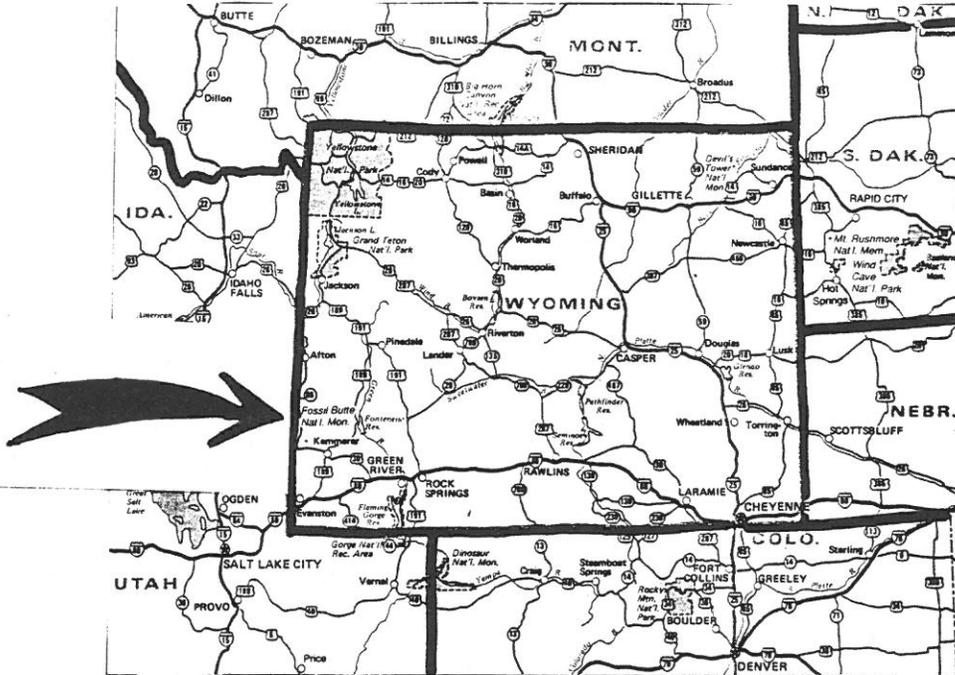
INTRODUCTION

The National Park Service entered into a contract with The Nature Conservancy in 1992 to classify and map natural plant communities for Fossil Butte National Monument and Mount Rushmore National Memorial. This report describes the study at Fossil Butte and presents the results. The study of Mount Rushmore National Memorial is reported in a separate document (Marriott 1993).

STUDY AREA

Fossil Butte National Monument was established in 1972 (Dorn et al. 1984) in southwestern Wyoming (Figure 1) to protect outcrops of sedimentary rocks rich in fossils of Tertiary-age fish. The Monument covers 3321 ha (8303 acres) of land. The southwestern part (roughly half) of the Monument lies in the valley of Chicken Creek. The geological substrates in that part of the Monument are Quaternary gravel and stream deposits and the main body (primarily mudstone) of the Eocene-aged Wasatch Formation (McGrew and Casilliano 1990, Figure 7). Topography is mainly south- and west-facing slopes at elevations of 2019 to 2286 meters (6626 to 7500 feet). The northern part of the Monument lies atop Cundick Ridge, a gently-rolling, steep-sided, north-south trending divide at 2316 to 2464 meters (7600 to 8084 feet) elevation underlain by

Figure 1. Location of Fossil Butte National Monument.



the limestones, mudstones, and shales of the Angelo and Fossil Butte members of the Eocene-age Green River Formation (McGrew and Casilliano 1990). Streams draining off the divide have eroded steep-sided valleys into the western and eastern sides of Cundick Ridge. The drainage divide continues southeast to Fossil Butte, another steep-sided, gently-rolling divide at 2240 to 2316 meters (7600 to 7350 feet) elevation, in the southeastern corner of the Monument. Fossil Butte also is formed in the Angelo and Fossil Butte members of the Green River Formation (McGrew and Casilliano 1990). The eastern edge of the Monument includes the heads of valleys draining eastward into the North Fork of Twin Creek.

The climate at Fossil Butte is cool and dry. Table 1 shows climate data for Kemmerer, Wyoming, ca. 16 km (10 miles) east of and ca. 170 meters (560 feet) lower than the Monument. Note that precipitation is distributed throughout the year, with only a small peak in May and June.

METHODS

Two vegetation maps have been produced in past work at Fossil Butte National Monument. The first, by Beetle and Marlow (1974), shows 13 vegetation units mapped at a scale of ca. 1:48,700. The second map, by Dorn et al. (1984), was produced from aerial photographs at a scale of 1:15,840 and shows 12 vegetation units at that scale. Field work at Fossil

Table 1. Climate data from Kemmerer, Wyoming, ca. 16 km (10 miles) east of and 170 meters (560 feet) lower than Fossil Butte National Monument. Data are from Martner (1986).

Month	Average annual precipitation, mm	Average daily mean temperature, °C
JAN	18	-7.7
FEB	14	-6.7
MAR	13	-3.6
APR	18	2.6
MAY	30	8.9
JUN	31	12.9
JUL	15	17.6
AUG	19	16
SEP	20	11.2
OCT	17	5.3
NOV	15	-1.7
DEC	15	-6.5
AVE. ANNUAL TOTAL:	227	DAILY MEAN: 4.01

Butte consisted of reconnaissance on foot to check the accuracy of the Dorn et al., (1984) map (i.e., to see if the boundaries between vegetation units on the map were accurate and if any of the vegetation polygons on that map should be divided or combined) and to describe the composition of the map units (i.e., to record the most common species present in each vegetation map unit and estimate their canopy coverage). The information on species composition was used to compare vegetation types at Fossil Butte National Monument with vegetation described in the literature from other locations. These comparisons will allow resource managers to refer to pertinent literature for information useful in managing vegetation at Fossil Butte National Monument.

RESULTS AND DISCUSSION

Field work for this project showed that the vegetation map of Dorn et al. (1984) was an accurate representation of the vegetation in the Monument. Consequently, that map was digitized with few changes: boundaries between map units were changed slightly in several places from the 1984 map, and labels on several map units were changed. The resulting 1:15,600-scale map of the Monument is in Appendix 1.

Units shown on that map are described below. Some of the map units include only one vegetation type, but other map units are mixtures of a dominant vegetation type with inclusions of other vegetation types too small to map. Each map unit description includes a description of the dominant vegetation type in that unit. Minor vegetation types in the unit usually are described in other sections on map units where they are dominant vegetation types. Data from individual stands of some vegetation types are given in Appendix 2. Locations of these stands are shown on Figure 2. Dorn et al. (1984) provide additional information on the map units. Scientific names and common names of plants are given in Appendix 3. Letters in parentheses are map labels.

General Vegetation Pattern

The vegetation in the Chicken Creek basin in the southwestern part of the Monument is sagebrush shrubland with a few areas of grasses and forbs. Basin big sagebrush (Artemisia tridentata var. tridentata) and alkali sagebrush (Artemisia arbuscula var. longiloba) types cover much of the Quaternary gravel and stream deposits and the Wasatch Formation at the lower elevations. A large stand of grass-forb type occurs along the western boundary of the Monument, and the wet meadow type occurs along parts of Chicken Creek. The steeper slopes around the margins of the Chicken Creek basin support stands of the mountain big sagebrush (Artemisia tridentata var. vaseyana) type, the aspen (Populus tremuloides) type, and the mountain shrub type.

Fossil Butte and Cundick Ridge support a mix of vegetation types. The mountain shrub type and unvegetated/barren areas occur on steep escarpments around the edges of those uplands. Stands of the aspen type occur on north- and east-facing slopes, primarily on the east side of Cundick Ridge. The mixed timber type grows on north-facing slopes, mainly in the northwestern part of the Monument and north of Fossil Butte. The gently-sloping top of Cundick Ridge is covered mainly with mountain big sagebrush and alkali sagebrush types. The top of Fossil Butte is primarily

mountain shrub type, mountain big sagebrush type, and some alkali sagebrush type.

Each of the vegetation map units is described below. Table 2 shows the percentage of the land area in the Monument in each vegetation map unit.

Aspen Map Unit (A)

The aspen map unit covers approximately 5% of Fossil Butte National Monument (Table 2). This unit consists only of aspen (Populus tremuloides) woodlands. Stands occur on relatively moist areas, such as sites below east-facing rims (often on slump blocks) that receive melt water from snowbanks on the rims above; north-facing slopes; and around springs on various aspects. Data were collected on dominant plant species in six stands (Appendix 2, Stands 1 - 6). In all six stands, aspen forms a tree overstory and mountain snowberry (Symphoricarpos oreophilus) is a major contributor to the shrub understory. A variety of other shrubs, including Saskatoon serviceberry (Amelanchier alnifolia), chokecherry (Prunus virginiana), and russet buffaloberry (Shepherdia canadensis), are present, but they generally contribute less cover than does the mountain snowberry. The dominant herbaceous species generally are blue wildrye (Elymus glaucus) and starry false-solomonseal

Table 2. Statistics for map units on the Fossil Butte National Monument vegetation map. Areas were calculated by Arc/Info from the map in Appendix 1.

Map Label	Map Unit	Number of Polygons	Area of Average Polygon (ha)	Total Area (ha)	Percent of Monument
A	Aspen	41	4.2	174	5
B	Basin big sagebrush	29	36	1045	31
C	Cottonwood	3	1.2	4	0.1
G	Grass-forb	23	9.3	213	6
H	Wet meadow	3	9.7	29	0.9
L	Alkali sagebrush	67	11.3	753	23
M	Mountain big sagebrush	27	22.4	606	18
R	Mountain shrub	70	3.8	264	8
S	Saline	7	2.4	16	0.5
T	Mixed timber	15	5.7	97	3
U	Unvegetated/Barren	36	3.4	118	4
W	Willow	2	<1	<1	<0.1
Total Monument				3319	99.5

(Maianthemum stellatum), although other species contribute substantial cover in some stands.

The structure of the vegetation varies from stand to stand. The aspen trees generally are quite tall, but the canopy may be sparse, as in stand 1, or dense, as in stand 2. Stands with open overstories (stands 1, 3, and 5) have relatively dense shrub and herb understories, while the shrub and herb layers are sparse beneath dense tree overstories (stands 2, 4, and 6). Most of the shrubs are less than 1 m

(3.3 ft) tall, but shrubs up to 4 m (13 ft) tall may be present.

Mueggler (1988) described aspen communities from the Intermountain West, including western Wyoming, and the aspen stands at Fossil Butte National Monument fit into his classification. Stands 1, 2, and 3 belong to the Populus tremuloides/Amelanchier alnifolia-Symphoricarpos oreophilus/Bromus carinatus community, which is a minor type at low elevations in the region. Stands 4 and 6, with only small amounts of serviceberry, belong to the Populus tremuloides/Symphoricarpos oreophilus/Bromus carinatus community, a major community at intermediate elevations. Stand 5 seems to belong to the Populus tremuloides/Shepherdia canadensis community, an incidental type from western Wyoming and eastern Idaho. These three types are so similar in composition that they cannot be separated on aerial photographs. Consequently they are included in the same map unit.

Mueggler (1988) suggests that the dominance of the herbaceous layer by graminoids and the small amounts of forbs indicates substantial impact from sheep grazing.

Basin Big Sagebrush Map Unit (B)

The basin big sagebrush unit covers 31% of the Monument (1045 ha, or ca. 2600 acres), primarily on gentle slopes and

broad ridges in Chicken Creek valley and to the south, east, and north of Fossil Butte. Stands occur mainly on Quaternary gravel and stream deposits and on the fine-textured rocks of the main body of the Wasatch Formation. The map unit consists primarily of basin big sagebrush vegetation, with small stands of alkali sagebrush. The basin big sagebrush vegetation is described in this section, and the alkali sagebrush vegetation is described in a later section.

The basin big sagebrush vegetation type appeared to be rather uniform in composition and structure, so data were collected from only two stands that appeared to represent most of the type (stands 7 and 8, Appendix 2). Basin big sagebrush forms a shrub canopy that is generally rather open, but the sagebrush may form dense patches. Other shrubs, such as alkali sagebrush and Douglas rabbitbrush (Chrysothamnus viscidiflorus) may be present but they contribute little cover. Mutton bluegrass (Poa fendleriana) was the most common species in the herbaceous layer. Dorn et al. (1984) list a variety of additional species commonly present in the herbaceous layer, including thickspike wheatgrass (Elymus lanceolatus), slender wheatgrass (Elymus trachycaulus), Sandberg bluegrass (Poa secunda), sulfur buckwheat (Eriogonum umbellatum), Hoods phlox (Phlox hoodii) and needleleaf sedge (Carex stenophylla).

Basin big sagebrush vegetation has received little systematic study, and the stands from Fossil Butte do not seem

to fit into any of the communities described in the literature. Those communities generally occur on alluvial sites and have tall shrub layers, and often contain substantial amounts of basin wild rye (Elymus cinereus).

According to Dorn et al. (1984), basin big sagebrush at Fossil Butte National Monument dominates on deep, loamy-textured soils while alkali sagebrush dominates on clay soils. The mosaic of the two vegetation types in the map unit reflects a mosaic of soil types.

Cottonwood Map Unit (C)

The cottonwood map unit is represented by three small stands, one on the southeastern end of Fossil Butte and the other two at the south foot of Cundick Ridge. The stands account for only 0.1% (4 ha) of the area of the Monument (Table 2). This map unit includes only stands of cottonwood vegetation.

All three cottonwood stands occur on southwest-facing scarps around seeps (Dorn et al. 1984). According to Dorn et al. (1984), narrowleaf cottonwood (Populus angustifolia) forms the overstory in the stands, and yellow willow (Salix lutea), a tall shrub, is present. The major understory species are starry false-solomonseal (Maianthemum stellatum) and fireweed willowherb (Epilobium angustifolium). The stand at the foot

of Fossil Butte was visited during fieldwork for this project, and the trees were observed to be small (< 30 cm diameter).

Narrowleaf cottonwood communities have been described from riparian zones in western Wyoming (Youngblood et al., 1985). Those communities generally have dense cottonwood overstories and dense shrub or herbaceous layers. The cottonwood stands at Fossil Butte, growing on upland sites, seem quite different from those streamside cottonwood woodlands.

Grass-Forb Map Unit (G)

This map unit covers 6% (213 ha) of the Monument, primarily on broad ridge-tops in Chicken Creek Valley. Small areas of this unit also occur on Cundick Ridge and Fossil Butte.

The major vegetation type in the map unit is a sparse mixture of low shrubs, graminoids, and forbs represented by stands 15 through 19 (Appendix 2). The most common shrubs are common winterfat (Krascheninnikovia lanata) and Douglas rabbitbrush. Low individuals of basin big sagebrush often are present, as are Nuttall saltbush (Atriplex gardneri) or shadscale saltbush (Atriplex confertifolia). The most common graminoids are western wheatgrass (Elymus smithii) and Sandberg bluegrass. Hoods phlox is the most common forb, and it may be joined in the stand by a variety of other low-

growing forbs, especially starveling milkvetch (Astragalus jejunus), mat wildbuckwheat (Eriogonum brevicaule), and stemless goldenweed (Haplopappus acaulis). The amount of cover of each species varies from stand to stand. Forb cover is relatively great in stands 15 and 19, and grass cover is relatively great in stand 18.

Stand 20 may represent a slightly different vegetation type rich in forbs and with no shrubs. This stand occurs on a site with more gravel on the surface than do the other stands.

Grass and forb communities of southwestern Wyoming have received no systematic study, and no descriptions were found in the literature of vegetation with Sandberg bluegrass, Hoods phlox, and scattered, small shrubs.

Wet Meadow Map Unit (H)

The wet meadow map unit accounts for less than 1% (29 ha) of the Monument (Table 2), primarily along Chicken Creek. No data were collected from stands in this map unit, but observations suggest that the map unit may include two vegetation types. The first type is dominated by beaked sedge (Carex rostrata), woolly sedge (Carex lanuginosa), or Nebraska sedge (Carex nebraskensis) in the wettest places immediately along stream channels and next to seeps. The second type occurs on slightly drier places with less sedge and more grasses, especially tufted hairgrass (Deschampsia cespitosa)

and baltic rush (Juncus balticus). Similar vegetation types have been described from wetlands and riparian areas in western Wyoming, and they typically intergrade.

Alkali Sagebrush Map Unit (L)

This is a major map unit, accounting for 23% (753 ha) of the Monument. It consists primarily of an alkali sagebrush vegetation type. Areas of this map unit in the Chicken Creek Valley also include small stands of the basin big sagebrush vegetation type described above. Areas of the unit atop Cundick Ridge and Fossil Butte include small stands of the mountain big sagebrush type described in the next section.

Data were collected from four stands in the alkali sagebrush vegetation type (Appendix 2, stands 21, 22a & b, and 23). The type is characterized by a low shrub layer dominated by alkali sagebrush. Small amounts of other shrubs may be present. The herbaceous layer usually includes bluebunch wheatgrass (Elymus spicatus), Sandberg bluegrass, and mutton bluegrass. Hoods phlox is a common forb. Dorn et al. (1984) list a variety of other grasses and forbs that commonly occur in this vegetation type.

Alkali sagebrush is common throughout western and southern Wyoming on soils with a high clay content, but as with most of the lower-elevation shrub types, this vegetation has received no systematic study. The stands in the Monument

seem to resemble vegetation described by Bramble-Brodahl (1978) from the alkali sagebrush/bluebunch wheatgrass (Artemisia longiloba/Agropyron spicatum) habitat type in the Gros Ventre Range of northwestern Wyoming.

Dorn et al. (1984) note that the alkali sagebrush vegetation at Fossil Butte National Monument occurs on deep, clay-rich soils, while the basin big sagebrush and mountain big sagebrush types occur on soils with less clay.

Mountain Big Sagebrush Map Unit (M)

The mountain big sagebrush map unit accounts for 18% (606 ha) of the Monument's land, mostly on top of Cundick Ridge in the northern part of the Monument. This map unit consists primarily of the mountain big sagebrush vegetation type, with small inclusions of alkali sagebrush vegetation, mountain shrub vegetation, and needlegrass-wheatgrass vegetation (described below) . The mountain big sagebrush vegetation type merges into basin big sagebrush vegetation on the slopes at the south end of Cundick Ridge, and the boundary between the mountain big sagebrush and basin big sagebrush map units there is somewhat arbitrary. Mountain big sagebrush and basin big sagebrush are similar morphologically, and determining which species dominates in transitional stands is a problem.

Stands of the mountain big sagebrush vegetation type are characterized by a shrub layer dominated by mountain big

sagebrush. Data from four stands (Appendix 2, stands 24a & b, 25, and 26) indicate that the sagebrush shrub layer usually is quite dense. Other shrubs usually are present, especially mountain snowberry, Douglas rabbitbrush and antelope bitterbrush (Purshia tridentata). These additional shrubs generally contribute significantly less cover than the sagebrush does, but they may codominate the shrub layer (stand 25). The herbaceous layer usually includes western wheatgrass, often with pinewoods needlegrass (Stipa pinetorum), mutton bluegrass, basin wildrye, and king spikefescue (Leucopoa kingii). A variety of forbs may be present, but they typically contribute relatively little cover. The understory species are not distributed uniformly, but rather their distribution patterns are a function of small-scale topography within the stand (stands 24a and 25).

Dorn et al. (1984) note that mountain big sagebrush vegetation in the Monument occurs on deep, loam-textured soils. Vegetation similar to this type has been described from the Skull Point Mine southwest of Kemmerer and named the Artemisia tridentata vaseyana/Agropyron smithii community by Jones (1991).

Data were collected in two small stands of needlegrass-wheatgrass vegetation within the mountain big sagebrush map unit on Cundick Ridge (Appendix 2, stands 13 and 14). These stands appeared typical of herbaceous vegetation growing in several east-facing bowls created by slump blocks. Snow

drifts into these bowls, forming large drifts on the scarps left by the slump blocks. The presence of deep snow apparently prevents the growth of mountain big sagebrush vegetation and provides a favorable environment for dense herbaceous vegetation. The slump blocks below often support aspen woodlands, probably because the meltwater from the drifts provides the soil moisture that the aspen trees need.

The needlegrass-wheatgrass stands are small, covering less than 1 ha. Pinewoods needlegrass and slender wheatgrass dominate the vegetation, and a variety of other grasses may be present, the most common of which are thickspike wheatgrass (Elymus lanceolatus) and California brome (Bromus carinatus). A variety of forbs also is present, including elk thistle (Cirsium scariosum), silvery lupine (Lupinus argenteus), and cushion wildbuckwheat (Eriogonum ovalifolium). Shrubs may be present, especially mountain big sagebrush, mountain silver sagebrush (Artemisia cana var. viscidula), and mountain snowberry, but they contribute little cover and the vegetation is obviously dominated by grasses.

Mountain Shrub Map Unit (R)

The mountain shrub map unit is represented by many small areas covering 264 ha, or 8% of the Monument (Table 2). These areas occur primarily on scarps around Cundick Ridge and

Fossil Butte. The map unit contains a mixed-shrub vegetation type that apparently constitutes one community.

Data were collected from seven stands of the mountain shrub vegetation type (stands 27 - 33, Appendix 2). The vegetation consists of a shrub layer up to 4 meters tall and generally codominated by true mountain mahogany (Cercocarpus montanus) and Saskatoon serviceberry. Other shrubs, especially mountain snowberry, usually are present. Even in stands where these other shrubs contribute most of the canopy cover, mountain mahogany or serviceberry, or both, are present in substantial amounts (stands 28, 29, and 33). The sparse understory usually includes a mix of graminoids and forbs, of which Ross sedge (Carex rossii), basin wildrye, and wayside gromwell (Lithospermum ruderale) are common. Dorn et al. (1984) list other species often found in this vegetation type.

Stands of mountain mahogany, serviceberry, and mountain big sagebrush are intermediate between the mountain shrub type and the mountain big sagebrush type. A mountain shrub patch on the south side of the ridge at the southeastern corner of Cundick Ridge (NE 1/4 Sec 25, T22N, R118W and NW 1/4 Sec 30, T22N, R117W), for which no data were collected, illustrates this transition between types. This patch has an open tall shrub layer of true mountain mahogany and Saskatoon serviceberry with a relatively dense lower shrub layer of mountain big sagebrush. The mountain shrub map unit

consequently includes stands that are transitional to other types.

Most of the shrub stands included in the mountain shrub map unit contain plants that have been heavily browsed, and all stands show some signs of browsing.

Dorn et al. (1984) suggest that conifer or aspen vegetation may replace some stands of the mountain shrub type. Stand 28, with an open overstory of aspen trees, may represent this process.

Vegetation with Saskatoon serviceberry and true mountain mahogany in the shrub layer and Ross sedge in the understory has been reported from the foothills of the Sierra Madre in south-central Wyoming, on rocky soils (Andy Warren, personnel communication to G. Jones). Both shrubs are widespread in the southern part of the state. This vegetation has not, however, been systematically studied and is considered to be a general serviceberry-mountain mahogany (Amelanchier alnifolia-Cercocarpus montanus) type.

Saline Map Unit (S)

The saline map unit is represented by a few small areas in the southern part of the Monument that account for only 0.5% (16 ha) of the Monument (Table 2). This unit was not studied during the 1992 fieldwork, but Dorn et al. (1984) describe a sparse vegetation dominated by Nuttall saltbush,

shadscale saltbush, common winterfat, or black greasewood (Sarcobatus vermiculatus) or a combination of these shrubs.

Mixed Timber Map Unit (T)

The mixed timber map unit occurs as small areas primarily on east- and north-facing slopes of Fossil Butte and Cundick Ridge. It accounts for 3% (97 ha) of the Monument's area (Table 2).

Data were collected from four stands in the mixed timber map unit in the eastern part of the Monument (Appendix 2). Stands 9, 10, and 11 constitute a sequence of stands from the steep upper part of a scarp down through a bench in the middle of the scarp to the steep lower part of the scarp. They have moderately-dense overstories dominated by Douglas fir (Pseudotsuga menziesii) with small amounts of limber pine (Pinus flexilis) or aspen, or both. Stand 9 on the upper part of the scarp has essentially no shrubs or herbs beneath the trees, but the two lower stands have small amounts of tall shrubs and dense layers of mountain snowberry. These stands apparently represent a Douglas fir/mountain snowberry community that has been described from the mountains of western Wyoming (Jones 1991). Dense Douglas fir stands were also observed through binoculars on north-facing slopes of Morgan Canyon in the northwestern part of the Monument.

The data from the fourth stand, number 12, was collected on a scarp with a sparse limber pine overstory above a dense shrub layer of Saskatoon serviceberry and true mountain mahogany and a low shrub layer of mountain snowberry. Similar vegetation was observed through binoculars on the slopes of Morgan Canyon in the northwestern part of the Monument. Steele et al. (1983) have described similar vegetation from the mountains of western Wyoming and consider it to be transitional between limber pine woodlands and mountain mahogany shrublands, as it appears to be at Fossil Butte. Jones (1991) considers this vegetation to be a limber pine/true mountain mahogany community.

The limber pine/mountain mahogany vegetation on the scarp in stand 12 is continuous with the limber pine woodland on the slump block at the foot of the slope, where limber pine forms an overstory above a shrub layer of mountain snowberry. Mountain mahogany and serviceberry are absent from the woodland on the slump block, and many dead aspen trees are present. No limber pine/mountain snowberry community is known from the literature, but Mueggler (1988) has described an uncommon aspen-limber pine community from the mountains of western Wyoming, Utah, and Nevada. Stands of this community often include mountain snowberry. Mueggler says that limber pine probably will not come to dominate these stands and they'll remain a mix of limber pine and aspen, but the composition of this stand at Fossil Butte suggests otherwise.

Review of these Fossil Butte stands shows that the mixed timber map unit includes Douglas fir woodlands, limber pine woodlands, and vegetation transitional to mountain shrublands. The presence of conifers apparently causes these different vegetation types to look similar on aerial photos.

Unvegetated/Barren Map Unit (U)

This map unit, which accounts for 4% (118 ha) of the Monument (Table 2), includes areas which have no vegetation or only scattered plants. The largest patches of this map unit are outcrops of the Fossil Butte member of the Green River Formation along the western and southern sides of Fossil Butte. Smaller patches occur on the saddle between Fossil Butte and Cundick Ridge, and on the soft sediments of the Wasatch Formation (main body) atop small ridges in Chicken Creek valley. Dorn et al. (1984) list several forbs that grow on these sparsely-vegetated sites.

Willow Map Unit (W)

This minor map unit consists of two small stands at the southern foot of Fossil Butte. Together these two stands account for less than 0.1% (< 3 ha) of the Monument (Table 2). No data were collected from these stands in the present project, but Dorn et al. (1984) describe the vegetation as a

shrub layer dominated by yellow willow (Salix lutea) over an understory with baltic rush and starry false-solomonseal. Yellow willow is a common species in Wyoming, but no yellow willow communities have been described.

CONCLUSIONS

Fossil Butte National Monument contains a mosaic of vegetation types characteristic of southwestern Wyoming. Nearly half of the Monument is covered by basin big sagebrush or alkali sagebrush vegetation types, and mountain big sagebrush vegetation accounts for nearly an additional fifth of the area. These three vegetation types occur in large stands on the broad, relatively gentle uplands. Other vegetation types are restricted to specific habitats: the saline vegetation type to soils high in salts; grass-forb vegetation to shallow, rocky soils on ridge-tops; aspen and conifer woodlands to relatively moist slopes; mountain shrub vegetation to steep, often dry slopes; cottonwood and willow types to springs; wet meadows to riparian zones; and needlegrass-wheatgrass vegetation to snowdrift areas.

Three vegetation studies on the Monument (Beetle and Marlow 1974, Dorn et al. 1984, and the present study) have produced a good description of the distribution of vegetation types on Fossil Butte National Monument, and descriptions of the species composition and vegetation structure of the major

vegetation types. Quantitative information has been collected for some of the vegetation types. A few of the vegetation types, particularly the wet meadow type, remain rather poorly known. These descriptions of vegetation types, references to pertinent literature, and the vegetation map will help managers design plans for the Monument.

The vegetation studies have also produced lists of plant species, but these lists are the results of surveys of vegetation types, not of systematic collecting efforts, and hence should not be considered inventories of the Monument's flora -- that is, of the plant species growing there. A systematic floristic inventory would require that the Monument be visited, and specimens collected, several times during the spring, summer, and fall to find all of the species in flower or fruit. This inventory would be useful to managers because it would yield as complete a list as possible of the plant species on the Monument and a set of specimens for positive identification of future plant collections. It would highlight the presence of rare or unusual species that might require some recognition in management plans. For example, tufted twinpod (Physaria condensata), a small mustard, is known from the Monument (Dorn et al. 1984), but the distribution and abundance of the plant is unknown. Tufted twinpod is endemic to southwestern Wyoming and is thought to be rare; it is on the Wyoming Natural Diversity Database's list of plant species of special concern (Fertig 1993).

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Appendix 1. Vegetation Map of Fossil Butte National Monument.

The vegetation map is in the envelope behind this page.

Appendix 2. Data from Individual Stands at Fossil Butte National Monument. Only the dominant understory species are listed, so the cover value in "Total understory" may be different than the total of the species's values listed. Locations of these stands are shown on Figure 2 at the end of this appendix.

Stand #: 1
Map unit: Aspen
Vegetation type: Aspen/Saskatoon serviceberry-mountain
 snowberry/California brome (Populus tremuloides/Amelanchier
alnifolia-Symphoricarpos oreophilus/Bromus carinatus)
Stand location: SE 1/4 SE 1/4 Section 24, T22N, R118W
Aspect: East
Elevation: 2209 m (7250 ft)
Topographic position: slump block at bottom of slope
Investigator: George Jones
Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
<u>Populus tremuloides</u>	30	20
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	5	3
Dwarf shrub (≤ 0.5 m tall)		
<u>Prunus virginiana</u>	10	0.4
<u>Symphoricarpos oreophilus</u>	20	0.4
Graminoids		
<u>Elymus glaucus</u>	25	1.5
Forbs		
<u>Maianthemum stellatum</u>	15	0.4
<u>Senecio</u> sp.	10	1.5
Total understory	100	

Notes: Trees are 15 to 20 cm in diameter. This stand merges into stand 2.

Stand #: 2
Map unit: Aspen
Vegetation type: Aspen/Saskatoon serviceberry-mountain
 snowberry/California brome (Populus tremuloides/Amelanchier
alnifolia-Symphoricarpos oreophilus/Bromus carinatus)
Stand location: SE 1/4 SE 1/4 Sec 24, T22N, R118W
Aspect: East
Elevation: 2209 m (7250 ft)
Topographic position: slump block at bottom of slope
Investigator: George Jones
Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
<u>Populus tremuloides</u>	90	15
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	5	2.5
Dwarf shrub (\leq 0.5 m tall)		
<u>Amelanchier alnifolia</u>	1	0.4
<u>Symphoricarpos oreophilus</u>	8	0.4
Graminoids		
<u>Elymus glaucus</u>	5	1
Forbs		
Total understory	40	

Notes: Dead aspen trees are common. This stand merges into
 stand 1.

Stand #: 3
Map unit: Aspen
Vegetation type: Aspen/Saskatoon serviceberry-mountain
 snowberry/California brome (Populus tremuloides/Amelanchier
alnifolia-Symphoricarpos oreophilus/Bromus carinatus)
Stand location: SW 1/4 SW 1/4 Sec 19, T22N, R117W
Aspect: North
Elevation: 2209 m (7250 ft)
Topographic position: Draw
Investigator: George Jones
Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
<u>Populus tremuloides</u>	50	20
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	15	0.7 - 5
<u>Prunus virginiana</u>	5	0.6
<u>Shepherdia canadensis</u>	5	0.8
<u>Symphoricarpos oreophilus</u>	60	0.7
Dwarf shrub (\leq 0.5 m tall)		
<u>Arctostaphylos uva-ursi</u>	1	0.1
Graminoids		
<u>Elymus cinereus</u>	1	1.3
<u>Elymus glaucus</u>	3	0.6
Forbs		
<u>Galium</u> sp.	2	0.1
<u>Maianthemum stellatum</u>	5	0.1

Stand #: 4
Map unit: Aspen
Vegetation type: Aspen/Mountain snowberry/California brome
 (Populus tremuloides/Symphoricarpos oreophilus/Bromus carinatus)
Stand location: SE 1/4 SE 1/4 Sec 24, T22N, R118W
Aspect: East northeast
Elevation: 2210 m (7250 ft)
Topographic position: draw
Investigator: George Jones
Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
<u>Populus tremuloides</u>	70	15-20
Shrubs (> 0.5 m tall)		
<u>Potentilla fruticosa</u>	<1	0.6
<u>Salix lutea</u> (?)	<1	5
<u>Symphoricarpos oreophilus</u>	25	0.6
Dwarf shrub (\leq 0.5 m tall)		
Graminoids		
<u>Deschampsia cespitosa</u>	3	0.2
<u>Elymus glaucus</u>	10	1
<u>Poa pratensis</u>	30	0.2
Forbs		
<u>Aster</u> sp.	5	0.2
<u>Maianthemum stellatum</u>	5	0.1

Notes: Most of the aspen trees are \leq 15 cm in diameter, but trees in the lower part of the stand are up to 46 cm in diameter. The mountain snowberry is patchy; it forms patches with ca. 40% cover in places and is absent in some places.

Stand #: 5
Map unit: Aspen
Vegetation type: Aspen/Russett buffaloberry (Populus tremuloides/Shepherdia canadensis)
Stand location: SE 1/4 SE 1/4 Sec 14, T22N, R118W
Aspect: East
Elevation: 2365 m (7760 ft)
Topographic position: Slump at head of east-facing draw
Investigator: George Jones
Date: July 27, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
<u>Populus tremuloides</u>	50	25 - 30
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	1	4
<u>Populus tremuloides</u>	5	1
<u>Shepherdia canadensis</u>	20	1
<u>Symphoricarpos oreophilus</u>	50	1
Dwarf shrub (\leq 0.5 m tall)		
Graminoids		
<u>Elymus glaucus</u>	60	0.9
Forbs		
<u>Angelica arguta</u>	10	1
<u>Galium boreale</u>	5	0.3
<u>Lupinus argenteus</u>	10	0.6
<u>Senecio</u> sp.	5	1

Notes: Aspen trees are mostly < 15 cm in diameter, but a few are up to 30 cm.

Stand #: 6
Map unit: Aspen
Vegetation type: Aspen/Mountain snowberry/California brome
 (Populus tremuloides/Symphoricarpos oreophilus/Bromus carinatus)
Stand location: N 1/2 SE 1/4 Sec 23, T22N, R118W
Aspect: Southwest
Elevation: 2240 m (7350 ft)
Topographic position: slope
Investigator: George Jones
Date: July 27 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
<u>Populus tremuloides</u>	60	5 - 25
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	1	4
Dwarf shrub (\leq 0.5 m tall)		
<u>Symphoricarpos oreophilus</u>	20	0.6
Graminoids		
<u>Elymus glaucus</u>	10	0.9
<u>Poa pratensis</u>	10	0.3
Forbs		
<u>Galium boreale</u>	2	0.2
<u>Geranium viscosissimum</u>	5	0.2
<u>Maianthemum stellatum</u>	10	0.2

Notes: Trees in the central part of the stand are 15 cm to 25 cm in diameter. Trees are smaller and shorter at the northwest end of the stand.

Stand #: 7
Map unit: Basin big sagebrush
Vegetation type: Basin big sagebrush (Artemisia tridentata tridentata)
Stand location: NE 1/4 Sec 2, T21N, R118W
Aspect: Southwest
Elevation: 2057 m (6750 ft)
Topographic position: slope
Investigator: George Jones
Date: July 28, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Artemisia tridentata tridentata</u>	10	0.7
Dwarf shrub (≤ 0.5 m tall)		
<u>Artemisia arbuscula longiloba</u>	1	0.2
<u>Chrysothamnus viscidiflorus</u>	6	0.2
Graminoids		
<u>Koeleria macrantha</u>	1	0.2
<u>Poa fendleriana</u>	10	0.2
<u>Poa secunda</u>	1	0.1
Forbs		
<u>Antennaria sp.</u>	1	0.1
<u>Iva axillaris</u>	1	0.1

Stand #: 8
Map unit: Basin big sagebrush
Vegetation type: Basin big sagebrush (Artemisia tridentata tridentata)
Stand location: Sec 1, T21N, R118W
Aspect: Northeast
Elevation: 2030 m (6660 ft)
Topographic position: slope
Investigator: Kris Peterson
Date: July 28, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Artemisia tridentata tridentata</u>	25	0.6
Dwarf shrub (≤ 0.5 m tall)		
<u>Chrysothamnus viscidiflorus</u>	8	0.2
Graminoids		
<u>Carex stenophylla</u>	5	0.1
<u>Elymus smithii</u>	5	0.2
<u>Poa fendleriana</u>	10	0.1

Forbs

Notes: Basin big sagebrush forms a moderately-dense canopy, and is thickest near the top of the slope and near the bottom of the slope (near Chicken Creek). The basin big sagebrush stratum is interrupted by openings occupied by alkali sagebrush.

Stand #: 9
Map unit: Mixed timber
Vegetation type: Douglas fir/Mountain snowberry (Pseudotsuga menziesii/Symphoricarpos oreophilus)
Stand location: N 1/2 NW 1/4 SE 1/4 Sec 24, T22N, R118W
Aspect: North-northeast
Elevation: 2270 m (7450 ft)
Topographic position: Steep upper half of scarp
Investigator: George Jones
Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
<u>Pinus flexilis</u>	1	5
<u>Pseudotsuga menziesii</u>	45	35
Shrubs (> 0.5 m tall)		
Dwarf shrub (\leq 0.5 m tall)		
<u>Symphoricarpos oreophilus</u>	1	0.3

Graminoids

Forbs

Notes: Most of the Douglas fir trees are \leq 20 cm in diameter, but a few are as large as 75 cm. Soil and rock on ground surface are very unstable. This stand lies on the slope immediately stand 10.

Stand #: 10
Map unit: Mixed timber
Vegetation type: Douglas fir/Mountain snowberry (Pseudotsuga menziesii/Symphoricarpos oreophilus)
Stand location: N 1/2 NW 1/4 SE 1/4 Sec 24, T22N, R118W
Aspect: North-northeast
Elevation: 2270 m (7450 ft)
Topographic position: Bench in the middle of scarp
Investigator: George Jones
Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
<u>Populus tremuloides</u>	1	15
<u>Pseudotsuga menziesii</u>	40	30
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	1	4
Dwarf shrub (\leq 0.5 m tall)		
<u>Symphoricarpos oreophilus</u>	60	0.4

Graminoids

Forbs

Notes: Most of the Douglas fir trees are \leq 25 cm in diameter. This stand lies at the foot of the slope that stand 9 occupies.

Stand #: 11
Map unit: Mixed timber
Vegetation type: Douglas fir/Mountain snowberry (Pseudotsuga menziesii/Symphoricarpos oreophilus)
Stand location: SW 1/4 NE 1/4 Sec 24, T22N, R118W
Aspect: Northeast
Elevation: 2255 m (7400 ft)
Topographic position: Lower half of scarp
Investigator: George Jones
Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
<u>Pinus flexilis</u>	1	15
<u>Populus tremuloides</u>	1	8
<u>Pseudotsuga menziesii</u>	35	35
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	2	2
<u>Cercocarpus montanus</u>	2	2
<u>Pinus flexilis</u>	1	1
<u>Pseudotsuga menziesii</u>	1	1
Dwarf shrub (\leq 0.5 m tall)		
<u>Symphoricarpos oreophilus</u>	60	0.5

Graminoids

Forbs

Notes: The mountain snowberry forms large, dense patches, with scattered shrubs between them. The tree saplings are mostly at the foot of the slope. This stand lies on the lower part of the scarp that stands 9 and 10 occur on.

Stand #: 12

Map unit: Mixed timber

Vegetation type: Upper part = Limber pine/True mountain mahogany (Pinus flexilis/Cercocarpus montanus), Lower part = Aspen-Limber pine (Populus tremuloides-Pinus flexilis)?

Stand location: N 1/2 NE 1/4 Sec 25, T22N, R118W and N 1/2 NW 1/4 Sec 30, T22N, R117W

Aspect: North

Elevation: 2255 m (7400 ft)

Topographic position: Upper part of scarp

Investigator: George Jones

Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
<u>Pinus flexilis</u>	15	6
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	40	2
<u>Cercocarpus montanus</u>	60	2
Dwarf shrub (≤ 0.5 m tall)		
<u>Symphoricarpos oreophilus</u>	40	0.4

Graminoids

Forbs

Notes: Most limber pine trees are ca. 25 cm (10 in) in diameter, although some are as large as 35 cm (14 in). The shrubs grow in dense thickets in openings in the tree layer. To the east, many of the limber pines are dead. To the north, where the stand extends onto a slump block with a gentler slope, there is no serviceberry or mountain mahogany in the stand; the vegetation is limber pine over mountain snowberry, with many dead aspen trees lying on the ground.

Stand #: 13
Map unit: Mountain big sagebrush
Vegetation type: Needlegrass-Wheatgrass (Stipa pinetorum-Elymus trachycaulus)
Stand location: NE 1/4 NW 1/4 Sec 24, T22N, R118W
Aspect: East
Elevation: 2274 m (7460 ft)
Topographic position: East facing scarp above small slump block
Investigator: George Jones
Date: July 27, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
Dwarf shrub (≤ 0.5 m tall)		
Graminoids		
<u>Elymus lanceolatus</u>	3	0.2
<u>Elymus trachycaulus</u>	30	0.2
<u>Stipa pinetorum</u>	50	0.2
<u>Bromus carinatus</u>	1	0.2
Forbs		
<u>Aster</u> sp.	7	0.1
<u>Cirsium scariosum</u> (?)	3	0.1
<u>Eriogonum ovalifolium</u>	5	0.2
<u>Helianthella uniflora</u>	5	0.3
Total understory	90	

Notes: This stand seems to lie on a lee slope where snow accumulates. An aspen stand lies to the southeast, on the slump block.

Stand #: 14
Map unit: Mountain big sagebrush
Vegetation type: Needlegrass-Wheatgrass (Stipa pinetorum-Elymus trachycaulus)
Stand location: SE 1/4 SE 1/4 Sec 14, T22N, R118W
Aspect: East
Elevation: 2377 m (7800 ft)
Topographic position: Scarp above slump block
Investigator: George Jones
Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Artemisia tridentata vaseyana</u>	1	0.6
Dwarf shrub (≤ 0.5 m tall)		
<u>Artemisia cana viscidula</u>	3	0.4
<u>Symphoricarpos oreophilus</u>	1	0.3
Graminoids		
<u>Bromus carinatus</u>	3	0.4
<u>Elymus lanceolatus</u> (?)	1	0.25
<u>Elymus trachycaulus</u>	20	0.25
<u>Poa juncifolia</u>	2	0.3
<u>Stipa pinetorum</u>	50	0.25
Forbs		
<u>Cirsium scariosum</u> (?)	4	0.2
<u>Eriogonum ovalifolium</u>	5	0.1
<u>Lupinus argenteus</u>	4	0.3

Notes: This stand lies on a lee slope where snow accumulates, and appears to be part of a pattern of vegetation types shaped by snow deposition. On the flat above the slope, probably where little snow accumulates, the vegetation is alkali sagebrush shrub type. At the top of the slope, where a moderate amount of snow accumulates, is a thin zone of mountain big sagebrush. Below that, on the slope where wind deposits most of the snow, is this grass-forb meadow. Below the slope, on the slump block that receives runoff from the snow, is an aspen stand (# 5).

Stand #: 15
Map unit: Grass-forb
Vegetation type: Unclassified
Stand location: E 1/2 NE 1/4 Sec 2, T21N, R118W
Aspect: Southeast
Elevation: 2054 m (6740 ft)
Topographic position: Broad ridge top
Investigator: George Jones
Date: July 28, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
Dwarf shrub (\leq 0.5 m tall)		
<u>Atriplex gardneri</u>	1	0.2
<u>Chrysothamnus viscidiflorus</u>	3	0.3
<u>Krascheninnikovia lanata</u>	1	0.2
Graminoids		
<u>Elymus smithii</u>	1	0.2
<u>Poa secunda</u>	3	0.2
Forbs		
<u>Artemisia frigida</u>	1	0.1
<u>Astragalus jejunus</u> (?)	5	0.1
<u>Eriogonum brevicaulis</u> (?)	1	0.1
<u>Haplopappus acaulis</u>	1	0.1
<u>Phlox hoodii</u>	30	0.1
Total cover	40	

Notes: This stand merges into stand 16 to the north.

Stand #: 16
Map unit: Grass-forb
Vegetation type: Unclassified
Stand location: E 1/2 NE 1/4 Sec 2, T21N, R118W
Aspect: Southeast
Elevation: 2054 m (6740 ft)
Topographic position: Broad ridge top
Investigator: George Jones
Date: July 28, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
Dwarf shrub (\leq 0.5 m tall)		
<u>Artemisia tridentata tridentata</u>	1	0.2
<u>Atriplex gardneri</u>	1	0.2
<u>Chrysothamnus viscidiflorus</u>	2	0.3
<u>Krascheninnikovia lanata</u>	5	0.2
Graminoids		
<u>Elymus smithii</u>	5	0.2
<u>Poa secunda</u>	1	0.1
Forbs		
<u>Alyssum desertorum</u>	10	0.1
Total cover	10	

Notes: This stand merges into stand # 15 on the south and into stand # 17 on the north.

Stand #: 17
Map unit: Grass-forb
Vegetation type: Unclassified
Stand location: E 1/2 NE 1/4 Sec 2, T21N, R118W
Aspect: South
Elevation: 2054 m (6740 ft)
Topographic position: Broad ridge top
Investigator: George Jones
Date: July 28, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
Dwarf shrub (\leq 0.5 m tall)		
<u>Artemisia tridentata tridentata</u>	1	0.2
<u>Atriplex gardneri</u>	1	0.2
<u>Chrysothamnus viscidiflorus</u>	3	0.2
<u>Krascheninnikovia lanata</u>	1	0.2
Graminoids		
<u>Elymus elymoides</u>	1	0.2
<u>Elymus smithii</u>	5	0.2
<u>Oryzopsis hymenoides</u>	1	0.2
<u>Poa secunda</u>	7	0.1
Forbs		
<u>Astragalus jejunus (?)</u>	1	0.1
<u>Eriogonum brevicaule</u>	1	0.1
<u>Phlox hoodii</u>	4	0.1
Total cover	20	

Notes: This stand merges into stand # 16 on the south.

Stand #: 18
Map unit: Grass-forb
Vegetation type: Unclassified
Stand location: E 1/2 NE 1/4 Sec 2, T21N, R118W
Aspect: West
Elevation: 2054 m (6740 ft)
Topographic position: Gentle west-facing slope
Investigator: George Jones
Date: July 28, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
Dwarf shrub (\leq 0.5 m tall)		
<u>Artemisia arbuscula longiloba</u>	1	0.2
<u>Artemisia tridentata tridentata</u>	1	0.2
<u>Chrysothamnus viscidiflorus</u>	1	0.2
<u>Krascheninnikovia lanata</u>	1	0.2
Graminoids		
<u>Elymus smithii</u>	10	0.2
<u>Poa secunda</u>	7	0.1
Forbs		
<u>Astragalus jejunus</u> (?)	1	0.1
<u>Eriogonum brevicaule</u>	1	0.1
<u>Haplopappus acaulis</u>	1	0.1
<u>Phlox hoodii</u>	6	0.1
Total cover	20	

Notes: This stand lies below and west of stand #17.

Stand #: 19
Map unit: Grass-forb
Vegetation type: Unclassified
Stand location: E 1/2 NW 1/4 Sec 31, T22N, R117W
Aspect: South-southeast
Elevation: 2300 m (7550 ft)
Topographic position: Gentle slope atop Fossil Butte
Investigator: George Jones
Date: July 28, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
Dwarf shrub (< 0.5 m tall)		
<u>Artemisia arbuscula longiloba</u>	1	0.2
<u>Atriplex confertifolia</u>	1	0.2
<u>Chrysothamnus viscidiflorus</u>	1	0.1
<u>Krascheninnikovia lanata</u>	10	0.1
Graminoids		
<u>Elymus smithii</u>	6	0.1
<u>Elymus spicatus</u>	1	0.1
<u>Poa secunda</u>	6	0.1
Forbs		
<u>Artemisia frigida</u>	1	0.1
<u>Haplopappus acaulis</u>	1	0.1
<u>Phlox hoodii</u>	20	0.1
Total cover	30	

Note: This stand merges into stand #20 down the slope and to the southeast.

Stand #: 20
Map unit: Grass-forb
Vegetation type: Unclassified
Stand location: E 1/2 NW 1/4 Sec 31, T22N, R117W
Aspect: South-southeast
Elevation: 2300 m (7550 ft)
Topographic position: Gentle slope atop Fossil Butte
Investigator: George Jones
Date: July 28, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
Dwarf shrub (≤ 0.5 m tall)		
Graminoids		
<u>Elymus smithii</u>	1	0.1
<u>Oryzopsis hymenoides</u>	1	0.1
Forbs		
<u>Artemisia frigida</u>	1	0.1
<u>Cyrtanthe celosioides</u>	2	0.1
<u>Eriogonum brevicaulis</u> (?)	4	0.1
<u>Haplopappus acaulis</u>	1	0.1
<u>Haplopappus nuttallii</u>	1	0.1
<u>Phlox hoodii</u>	1	0.1
Total cover	5	

Notes: Gravel covers most of the soil surface. This stand lies farther down the slope and to the southeast of stand #19.

Stand #: 21
Map unit: Alkali sagebrush
Vegetation type: Alkali sagebrush (Artemisia arbuscula longiloba)
Stand location: SE 1/4 SW 1/4 Sec 19, T22N, R117W
Aspect: North
Elevation: 2194 m (7200 ft)
Topographic position: Gentle slope
Investigator: George Jones
Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
Dwarf shrub (\leq 0.5 m tall)		
<u>Artemisia arbuscula longiloba</u>	7	0.2
Graminoids		
<u>Elymus smithii</u>	7	0.2
<u>Elymus spicatus</u>	5	0.2
<u>Poa fendleriana</u>	1	0.2
<u>Poa secunda</u>	7	0.2
Forbs		
<u>Phlox hoodii</u>	5	0.1

Notes: The stand contains patches with almost no alkali sagebrush and with western wheatgrass cover of ca. 10%.

Stand #: 22a
Map unit: Alkali sagebrush
Vegetation type: Alkali sagebrush (Artemisia arbuscula longiloba)
Stand location: SE 1/4 SW 1/4 Sec 31, T22N, R117W
Aspect: South
Elevation: 2286 m (7500 ft)
Topographic position: Slope atop Fossil Butte
Investigator: George Jones & Kris Peterson
Date: July 27, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
Dwarf shrub (< 0.5 m tall)		
<u>Artemisia arbuscula longiloba</u>	10	0.1
<u>Atriplex confertifolia</u>	4	0.1
Graminoids		
<u>Elymus spicatus</u>	12	0.1
<u>Poa secunda</u>	5	0.1
Forbs		
<u>Haplopappus acaulis</u>	2	0.1
<u>Phlox hoodii</u>	8	0.1

Notes: This part of the stand lies lower on the slope than does the part described below in 22b.

Stand #: 22b
Map unit: Alkali sagebrush
Vegetation type: Alkali sagebrush (Artemisia arbuscula longiloba)
Stand location: SE 1/4 SW 1/4 Sec 31, T22N, R117W
Aspect: South
Elevation: 2286 m (7500 ft)
Topographic position: Broad ridge top on Fossil Butte
Investigator: George Jones & Kris Peterson
Date: July 28, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
Dwarf shrub (\leq 0.5 m tall)		
<u>Chrysothamnus viscidiflorus</u>	2	0.2
<u>Artemisia arbuscula longiloba</u>	20	0.2
<u>Atriplex confertifolia</u>	1	0.2
<u>Tetradymia canescens</u>	4	0.2
Graminoids		
<u>Poa fendleriana</u>	8	0.2
<u>Poa secunda</u>	2	0.1

Forbs

Notes: This part of stand 22 lies on the ridge above the part of the stand described above in 22a.

Stand #: 23

Map unit: Alkali sagebrush

Vegetation type: Alkali sagebrush (Artemisia arbuscula longiloba)

Stand location: W 1/2 NW 1/4 Sec 14, T22N, R118W

Aspect: Northwest to southwest

Elevation: 2438 m (8000 ft)

Topographic position: Gentle slopes around the Bullpen atop Cundick Ridge

Investigator: Kris Peterson

Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
Dwarf shrub (\leq 0.5 m tall)		
<u>Artemisia arbuscula longiloba</u>	30	0.15
Graminoids		
<u>Elymus spicatus</u>	10	0.2
<u>Poa fendleriana</u>	5	0.2

Forbs

Notes: The alkali sagebrush cover is dense overall but rather patchy. The mutton bluegrass occurs mainly in the patches of sagebrush, and the bluebunch wheatgrass occurs mainly between sagebrush patches. This vegetation merges into mountain big sagebrush vegetation.

Stand #: 24a
Map unit: Mountain big sagebrush
Vegetation type: Mountain big sagebrush (Artemisia tridentata vaseyana)
Stand location: W 1/2 NE 1/4 Sec 24, T22N, R117W
Aspect: Southeast
Elevation: 2243 m (7360 ft)
Topographic position: Gentle slope
Investigator: George Jones
Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Artemisia tridentata vaseyana</u>	30	0.75
Dwarf shrub (≤ 0.5 m tall)		
<u>Chrysothamnus viscidiflorus</u>	1	0.4
<u>Purshia tridentata</u>	3	0.3
<u>Symphoricarpos oreophilus</u>	6	0.4
<u>Tetradymia canescens</u>	1	0.4
Graminoids		
<u>Bromus carinatus</u>	1	0.2
<u>Carex vallicola</u>	15	0.1
<u>Elymus cinereus</u>	2	0.5
<u>Elymus smithii</u>	8	0.1
<u>Poa fendleriana</u>	12	0.1
<u>Stipa pinetorum</u>	12	0.1
Forbs		
<u>Achillea millefolium</u>	3	0.1

Notes: This part of the stand (24a) was on a slight east-facing slope. The needlegrass and the basin wildrye were mostly in swales, and the western wheatgrass and the mutton bluegrass were mostly on mounds with rocky soil. Part 24b (below) was on a south-facing slope. The two parts merge into one another.

Stand #: 24b
Map unit: Mountain big sagebrush
Vegetation type: Mountain big sagebrush (Artemisia tridentata vaseyana)
Stand location: W 1/2 NE 1/4 Sec 24, T22N, R117W
Aspect: South
Elevation: 2243 m (7360 ft)
Topographic position: Slope
Investigator: George Jones
Date: July 26, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Artemisia tridentata vaseyana</u>	30	0.6
Dwarf shrub (\leq 0.5 m tall)		
<u>Chrysothamnus viscidiflorus</u>	1	0.3
<u>Purshia tridentata</u>	3	0.3
<u>Symphoricarpos oreophilus</u>	5	0.3
<u>Tetradymia canescens</u>	1	0.3
Graminoids		
<u>Elymus cinereus</u>	1	0.5
<u>Elymus smithii</u>	2	0.2
<u>Oryzopsis hymenoides</u>	7	0.2

Forbs

Notes: Small patches of alkali sagebrush type and mountain shrub type also occurred on this slope.

Stand #: 25
Map unit: Mountain big sagebrush
Vegetation type: Mountain big sagebrush (Artemisia tridentata vaseyana)
Stand location: S 1/2 NW 1/4 and N 1/2 SW 1/4 Sec 23,
T22N, R118W
Aspect: South-southeast
Elevation: 2286 m (7500 ft)
Topographic position: Slope with slump-blocks
Investigator: George Jones & Kris Peterson
Date: July 25, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	1	2
<u>Artemisia tridentata vaseyana</u>	40	0.75
Dwarf shrub (≤ 0.5 m tall)		
<u>Amelanchier alnifolia</u>	1	0.4
<u>Chrysothamnus viscidiflorus</u>	3	0.4
<u>Purshia tridentata</u>	20	0.4
<u>Symphoricarpos oreophilus</u>	30	0.4
Graminoids		
<u>Elymus cinereus</u>	3	1
<u>Elymus smithii</u>	20	0.2
<u>Leucopoa kingii</u>	10	0.3
<u>Poa fendleriana</u>	20	0.2
<u>Stipa pinetorum</u>	15	0.2
Forbs		
<u>Mahonia repens</u>	3	0.1

Notes: The understory varies according to local topography: needlegrass and western wheatgrass are the main herbaceous species on small ledges (slump blocks) and swales, whereas the understory on slopes is mainly mutton bluegrass, basin wildrye, King spikefescue, and Oregon grape, with more forbs. Small (< 100 m²) patches of alkali sagebrush vegetation occur on tops of ridges. The serviceberry and antelope bitterbrush have been browsed.

Stand #: 26
Map unit: Mountain big sagebrush
Vegetation type: Mountain big sagebrush (Artemisia tridentata vaseyana)
Stand location: E 1/2 NE 1/4 Sec 14, T22N, R118W
Aspect: East & southeast
Elevation: 2438 m (8000 ft)
Topographic position: Slope
Investigator: Kris Peterson & George Jones
Date: July 26, 1993

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Artemisia tridentata vaseyana</u>	40	0.75
Dwarf shrub (≤ 0.5 m tall)		
<u>Symphoricarpos oreophilus</u>	15	0.4
Graminoids		
<u>Elymus smithii</u>	20	0.2
<u>Leucopoa kingii</u>	10	0.3
<u>Poa fendleriana</u>	20	0.2
<u>Stipa pinetorum</u>	10	0.3
Forbs		
<u>Achillea millefolium</u>	3	0.1
<u>Lupinus sericeus</u>	3	0.25

Notes: The mountain big sagebrush overstory is interrupted by herbaceous patches in small drainages and by patches of alkali sagebrush on small ridges. This stand adjoins large stands of alkali sagebrush.

Stand #: 27

Map unit: Mountain shrub

Vegetation type: Serviceberry-Mountain mahogany (Amelanchier alnifolia-Cercocarpus montanus)

Stand location: SW1/4 SE 1/4 and SE 1/4 SW 1/4 Sec 24, and
NW 1/4 NE 1/4 Sec 25, T22N, R118W

Aspect: North

Elevation: 2300 m (7550 ft)

Topographic position: Upper part of steep, north-facing slope

Investigator: George Jones

Date: July 26, 1993

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	15	0.5 - 3
<u>Cercocarpus montanus</u>	15	0.5 - 1.5
Dwarf shrub (\leq 0.5 m tall)		
Graminoids		
<u>Carex rossii</u>	10	0.1
<u>Elymus smithii</u>	2	0.15
<u>Elymus spicatus</u>	3	0.15
Forbs		
<u>Lithospermum ruderale</u>	5	0.2

Stand #: 28
Map unit: Mountain shrub
Vegetation type: Serviceberry-Mountain mahogany (Amelanchier alnifolia-Cercocarpus montanus)
Stand location: SE 1/4 SW 1/4 Sec 19, T22N, R117W
Aspect: North
Elevation: 2180 m (7150 ft)
Topographic position: Draw
Investigator: George Jones
Date: July 27, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
<u>Populus tremuloides</u>	10	12
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	30	4
<u>Artemisia tridentata vaseyana</u>	10	0.6
<u>Cercocarpus montanus</u>	20	1
<u>Shepherdia canadensis</u>	1	1
<u>Symphoricarpos oreophilus</u>	60	0.6
Dwarf shrub (\leq 0.5 m tall)		
<u>Holodiscus dumosus</u>	1	0.4
Graminoids		
Forbs		

Notes: The aspen trees are \leq 15 cm diameter, and many dead aspen are lying on the ground. This stand lies immediately east of aspen stand #3.

Stand #: 29
Map unit: Mountain shrub
Vegetation type: Serviceberry-Mountain mahogany (Amelanchier alnifolia-Cercocarpus montanus)
Stand location: SW1/4 SE 1/4 Sec 19, T22N, R117W
Aspect: East-northeast
Elevation: 2180 m (7150 ft)
Topographic position: Slope
Investigator: George Jones
Date: July 27, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	25	3
<u>Artemisia tridentata vaseyana</u>	2	0.6
<u>Cercocarpus montanus</u>	15	1.5
<u>Prunus virginiana</u>	5	0.6
<u>Symphoricarpos oreophilus</u>	80	0.6
Dwarf shrub (\leq 0.5 m tall)		
<u>Chrysothamnus viscidiflorus</u>	1	0.3
<u>Purshia tridentata</u>	5	0.3
Graminoids		
<u>Elymus cinereus</u>	2	1
<u>Carex rossii</u>	1	0.1
Forbs		
<u>Lithospermum ruderale</u>	5	0.2
Total cover:		
Shrubs	80	
Dwarf shrubs	5	

Notes: The shrubs have been heavily browsed. Trails (apparently game trails) are common in the stand.

Stand #: 30
Map unit: Mountain shrub
Vegetation type: Serviceberry-Mountain mahogany (Amelanchier alnifolia-Cercocarpus montanus)
Stand location: W 1/2 SE 1/4 SE 1/4 Sec 24, T22N, R118W
Aspect: East-southeast
Elevation: 2300 m (7550 ft)
Topographic position: Scarp
Investigator: George Jones
Date: July 27, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	30	1.5
<u>Cercocarpus montanus</u>	15	1.2
<u>Holodiscus dumosus</u>	1	1
Dwarf shrub (\leq 0.5 m tall)		
<u>Purshia tridentata</u>	2	0.4
Graminoids		
<u>Elymus cinereus</u>	5	1
Forbs		

Notes: Basin wildrye is present throughout the stand but is most common in the lower part near the base of the scarp.

Stand #: 31
Map unit: Mountain shrub
Vegetation type: Serviceberry-Mountain mahogany (Amelanchier alnifolia-Cercocarpus montanus)
Stand location: E 1/2 NW 1/4 Sec 24, T22N, R118W
Aspect: Southeast
Elevation: 2300 m (7550 ft)
Topographic position: Scarp
Investigator: George Jones
Date: July 27, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	25	1
<u>Cercocarpus montanus</u>	25	1
Dwarf shrub (\leq 0.5 m tall)		
<u>Purshia tridentata</u>	1	0.3
<u>Symphoricarpos oreophilus</u>	1	0.3
Graminoids		
<u>Elymus cinereus</u>	10	0.6
Forbs		

Notes: This stand lies on a 35°, unstable scarp.

Stand #: 32
Map unit: Mountain shrub
Vegetation type: Serviceberry-Mountain mahogany (Amelanchier alnifolia-Cercocarpus montanus)
Stand location: NE 1/4 SW 1/4 Sec 31, T22N, R117W
Aspect: South-southeast
Elevation: 2300 m (7540 ft)
Topographic position: Gentle slope atop Fossil Butte
Investigator: Kris Peterson & George Jones
Date: July 28, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Amelanchier alnifolia</u>	10	2
<u>Cercocarpus montanus</u>	35	2
Dwarf shrub (\leq 0.5 m tall)		
<u>Symphoricarpos oreophilus</u>	3	0.4
<u>Purshia tridentata</u>	1	0.2
Graminoids		
<u>Carex rossii</u>	5	0.05
<u>Elymus smithii</u>	3	0.15
<u>Oryzopsis hymenoides</u>	5	0.15
Forbs		
<u>Eriogonum ovalifolium</u>	1	0.1
<u>Lithospermum ruderale</u>	1	0.2
<u>Mahonia repens</u>	5	0.1

Notes: This stand lies along the southwest side of grass-forb stand #19.

Stand #: 33
Map unit: Mountain shrub
Vegetation type: Serviceberry-Mountain mahogany (Amelanchier alnifolia-Cercocarpus montanus)
Stand location: SE 1/4 SW 1/4 Sec 31, T22N, R117W
Aspect: North
Elevation: 2270 m (7450 ft)
Topographic position: Slope
Investigator: Kris Peterson & George Jones
Date: July 28, 1992

<u>Species</u>	<u>% canopy cover</u>	<u>Height (m)</u>
Trees		
Shrubs (> 0.5 m tall)		
<u>Artemisia tridentata vaseyana</u>	10	0.6
<u>Amelanchier alnifolia</u>	15	3
<u>Cercocarpus montanus</u>	5	2
<u>Symphoricarpos oreophilus</u>	45	0.6
Dwarf shrub (< 0.5 m tall)		
<u>Chrysothamnus viscidiflorus</u>	5	0.4
Graminoids		
<u>Carex rostrata</u> <i>rossii</i>	8	0.1
<u>Elymus spicatus</u>	4	0.1
<u>Poa fendleriana</u>	5	0.1
Forbs		

Appendix 3. Scientific names and common names of plants from Fossil Butte National Monument. Scientific names are from Dorn (1992). Where a scientific name differs from the scientific name given in Dorn et al. (1984), their scientific name is given in parentheses. Common names are the same as those used in Dorn et al. (1984), Table 1. Other popular common names are given in parentheses. This table lists only the species mentioned in this report. Beetle and Marlow (1974) and Dorn et al. (1984) list additional plants that they found on the Monument in their work.

TREES

<u>Pinus flexilis</u>	Limber pine
<u>Populus angustifolia</u>	Narrowleaf poplar (Narrowleaf cottonwood)
<u>Populus tremuloides</u>	Quaking aspen
<u>Pseudotsuga menziesii</u>	Common Douglas fir

SHRUBS AND DWARF SHRUBS

<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
<u>Arctostaphylos uva-ursi</u>	Bearberry manzanita (Kinnikinnick)
<u>Artemisia cana</u> var.	Mountain silver sagebrush
<u>viscidula</u>	
<u>Artemisia arbuscula</u> var.	Alkali sagebrush
<u>longiloba</u> (A. <u>longiloba</u>)	
<u>Artemisia tridentata</u> var.	Basin big sagebrush
<u>tridentata</u>	
<u>Artemisia tridentata</u> var.	Mountain big sagebrush
<u>vaseyana</u>	
<u>Atriplex confertifolia</u>	Shadscale saltbush
<u>Atriplex gardneri</u>	Gardner saltbush (Nuttall saltbush)
<u>Cercocarpus montanus</u>	True mountain mahogany
<u>Chrysothamnus viscidiflorus</u>	Douglas rabbitbrush
<u>Holodiscus dumosus</u>	Bush rockspirea
<u>Krascheninnikovia lanata</u>	Common winterfat
(<u>Eurotia lanata</u>)	
<u>Potentilla fruticosa</u>	Shrubby cinquefoil
<u>Prunus virginiana</u>	Common chokecherry
<u>Purshia tridentata</u>	Antelope bitterbrush
<u>Salix lutea</u>	Yellow willow
<u>Shepherdia canadensis</u>	Russet buffaloberry
<u>Symphoricarpos oreophilus</u>	Mountain snowberry
<u>Tetradymia canescens</u>	Gray horsebrush

GRAMINOIDS

<u>Bromus carinatus</u>	California brome
<u>Carex rossii</u>	Ross sedge
<u>Carex stenophylla</u>	Needleleaf sedge
<u>Carex vallicola</u>	Valley sedge
<u>Deschampsia cespitosa</u>	Tufted hairgrass
<u>Elymus cinereus</u>	Basin wildrye
<u>Elymus elymoides</u>	Bottlebrush squirreltail
(<u>Sitanion hystrix</u>)	
<u>Elymus glaucus</u>	Blue wildrye
<u>Elymus lanceolatus</u>	Thickspike wheatgrass
(<u>Agropyron dasystachyum</u>)	
<u>Elymus smithii</u>	Western wheatgrass
(<u>Agropyron smithii</u>)	
<u>Elymus spicatus</u>	Bluebunch wheatgrass
(<u>Agropyron spicatum</u>)	
<u>Elymus trachycaulus</u>	Slender wheatgrass
(<u>Agropyron caninum</u>)	
<u>Koeleria macrantha</u>	Prairie junegrass
<u>Leucopoa kingii</u>	King spikefescue
<u>Oryzopsis hymenoides</u>	Indian ricegrass
<u>Poa fendleriana</u>	Mutton bluegrass
<u>Poa juncifolia</u>	Big bluegrass
<u>Poa pratensis*</u>	Kentucky bluegrass*
<u>Poa secunda</u>	Sandberg bluegrass
<u>Stipa pinetorum</u>	Pinewoods needlegrass

FORBS

<u>Achillea millefolium</u>	Common yarrow
<u>Alyssum desertorum*</u>	Desert alyssum*
<u>Angelica arguta</u>	Lyall angelica (Sharptooth angelica)
<u>Antennaria sp.</u>	Pussytoes
<u>Artemisia frigida</u>	Fringed sagewort
<u>Aster sp.</u>	Aster
<u>Astragalus jejunus</u>	Starveling milkvetch
<u>Cirsium scariosum</u>	Elk thistle
<u>Cryptantha celosioides</u>	Northern cryptantha
<u>Eriogonum brevicaule</u>	Shortstem wildbuckwheat
<u>Eriogonum ovalifolium</u>	Cushion wildbuckwheat
<u>Galium sp.</u>	Bedstraw
<u>Galium boreale</u>	Northern bedstraw
<u>Geranium viscosissimum</u>	Sticky geranium
<u>Haplopappus acaulis</u>	Stemless goldenweed
<u>Haplopappus nuttallii</u>	Nuttall spinyaster
(<u>Machaeranthera grindeloides</u>)	
<u>Helianthella uniflora</u>	Oneflower helianthella
<u>Iva axillaris</u>	Poverty sumpweed
<u>Lithospermum ruderales</u>	Wayside growwell

Lupinus argenteus
Mahonia repens

Maianthemum stellatum
(Smilacina stellata)

Phlox hoodii
Senecio sp.

Silvery lupine
Creeping barberry (Oregon
grape)
Starry false solomonseal

Hood's phlox
Groundsel

*Exotic species

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FILES FOR GIS COVERAGE OF FOSSIL BUTTE NATIONAL MONUMENT

- fossveg.e00 - arc/info export file of fossil butte vegetation layer registered to utm coordinates and "rubber-sheeted" to eliminate distortion from original aerial photos. Digitized from original map before correction.
- oldveg.e00 - arc/info export file of fossil butte vegetation data in digitizer units (inches) and not corrected for distortion in aerial photos. Digitized from original map.
- fossbnd.e00 - arc/info export file of fossil butte boundary line digitized from 1:24,000 USGS quad sheet
- fossrds.e00 - arc/info export file of fossil butte roads and trails digitized from 1:24,000 USGS quad sheet
- fosssec.e00 - arc/info export file of fossil butte section lines digitized from 1:24,000 USGS quad sheet
- fossstr.e00 - arc/info export file of fossil butte streams digitized from 1:24,000 USGS quad sheet
- fossmap.aml - arc/info aml program for producing map composition file of fossil butte data.
- title.txt - ascii text file for use by fossmap.aml
- legend.txt - ascii text file for use by fossmap.aml
- fbutte.txt - ascii text file of information about the coverages.

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List of files in directory DIGIT