MONTANA STATE UNIVERSITY

Grizzly bear distribution, use of habitats, food habits and habitat characterization in Pelican and Hayden Valleys, Yellowstone National Park
by Dean Chalmus Graham

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in Fish and Wildlife Management
Montana State University
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Abstract:
In 1975 and 1976 I conducted a habitat analysis, distribution and food habits study of grizzly bears in Pelican and Hayden Valleys, Yellowstone National Park. A general reconnaissance method of analysis was employed to identify vegetation communities. I determined grizzly food habits by scat analysis and feeding site examinations. Nutritional quality of food items and soil characteristics were determined by standard analytical procedures. Twelve non-forest vegetation types (v.t.) were identified. Five vegetation types yielded estimated standing crops between 550 and 4,709 kg/ha each. Underground production estimates of three grizzly foods ranged from a trace to 165 kg/ha. Moisture content of grass species sheltered by forest canopy tended to be considerably higher than the same species on exposed sites. Nutritional quality of vegetation adjacent to streams was similar to that beneath canopy late in the growing season. Sugar content of Perideridea gairdneri was significantly higher ($P < .05$) than that of Melica spectabilis. Fifty-one percent (132) and 31 percent (80) of the 261 grizzly observation sites were found in Festuca idahoensis/Deschampsia oaespitosa v.t. and in the Avtemesia oana/ Festuoa idahoensis v.t., respectively. Grizzly observation sites were concentrated in the southern half of Pelican Valley and appeared to be directly correlated with the degree of timber/grass edge. Seventy-five percent of all sites were within 50m of the timber. Graminoids and forbs accounted for 48.6 percent (95 percent occurrence) and 34.8 percent (93 percent occurrence), respectively, of the total scat volume of 40 scats. A grizzly feeding site examination showed that vegetation with a moisture content of 40 percent was consumed. Movement to and from the valleys appeared to be partially in response to food availability. Grizzlies fed upon pocket gopher caches" in the spring and grubbed extensively for yampa roots in the fall. The tendency of grizzlies to select dig sites with ample soil moisture suggests a hypothesis of an indirect relation between soil water storage capacity and bear use. Grizzlies employed a patch feeding strategy which may result in greater long-term efficiency in exploiting the environment. Grizzly distribution patterns suggest that grizzlies prefer feeding sites adjacent to hiding cover. Because they prefer feeding sites in close proximity to timber, grizzlies will emphasize foraging in forest types or on streams immediately adjacent to timber edge in late summer.

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GRIZZLY BEAR DISTRIBUTION, USE OF HABITATS, FOOD HABITS AND HABITAT CHARACTERIZATION IN PELICAN AND HAYDEN VALLEYS, YELLOWSTONE NATIONAL PARK

by

DEAN CHALMUS GRAHAM

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of the requirements for the degree

of

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in

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Approved:

Harold D. Picton
Chairperson, Graduate Committee

James M. Pickett
Head, Major Department

Henry L. Parsons
Graduate Dean

MONTANA STATE UNIVERSITY
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ABSTRACT

In 1975 and 1976 I conducted a habitat analysis, distribution and food habits study of grizzly bears in Pelican and Hayden Valleys, Yellowstone National Park. A general reconnaissance method of analysis was employed to identify vegetation communities. I determined grizzly food habits by scat analysis and feeding site examinations. Nutritional quality of food items and soil characteristics were determined by standard analytical procedures. Twelve non-forest vegetation types (v.t.) were identified. Five vegetation types yielded estimated standing crops between 550 and 4,709 kg/ha each. Underground production estimates of three grizzly foods ranged from a trace to 165 kg/ha. Moisture content of grass species sheltered by forest canopy tended to be considerably higher than the same species on exposed sites. Nutritional quality of vegetation adjacent to streams was similar to that beneath canopy late in the growing season. Sugar content of *Perideridea gairdneri* was significantly higher ($P < .05$) than that of *Melica spectabilis*. Fifty-one percent (132) and 31 percent (80) of the 261 grizzly observation sites were found in *Festuca idahoensis/Deschampsia caespitosa* v.t. and in the *Artemesia cana/Festuca idahoensis* v.t., respectively. Grizzly observation sites were concentrated in the southern half of Pelican Valley and appeared to be directly correlated with the degree of timber/grass edge. Seventy-five percent of all sites were within 50m of the timber. Graminoids and forbs accounted for 48.6 percent (95 percent occurrence) and 34.8 percent (93 percent occurrence), respectively, of the total scat volume of 40 scats. A grizzly feeding site examination showed that vegetation with a moisture content of 40 percent was consumed. Movement to and from the valleys appeared to be partially in response to food availability. Grizzlies fed upon pocket gopher caches in the spring and grubbed extensively for yampa roots in the fall. The tendency of grizzlies to select dig sites with ample soil moisture suggests a hypothesis of an indirect relation between soil water storage capacity and bear use. Grizzlies employed a patch feeding strategy which may result in greater long-term efficiency in exploiting the environment. Grizzly distribution patterns suggest that grizzlies prefer feeding sites adjacent to hiding cover. Because they prefer feeding sites in close proximity to timber, grizzlies will emphasize foraging in forest types or on streams immediately adjacent to timber edge in late summer.

INTRODUCTION

Grizzly bears (*Ursus arctos horribilis*) occupy open tundra, grasslands and shrublands, alpine and subalpine meadows and rely heavily upon grasses, forbs and shrubs as a stable food source (Mealey, 1975; Craighead, 1968; Herrero, 1972; Macpherson, 1965; Murie, 1944; Skinner, 1925). Craighead (1968) concluded after research in Yellowstone National Park that "the factor largely influencing range selection and location (of grizzly bears) is the open country habitat composed of grass, sagebrush and forbs."

A comprehensive food habit study (Mealey, 1975) of free-ranging grizzly bears in Yellowstone National Park was conducted in 1973 and 1974. In his study Mealey proposed the existence of three distinct feeding economies: the valley/plateau economy, the mountain economy and the lake economy. The current study was conducted to obtain additional quantitative information on the complex grass/shrub communities of the valley/plateau economy.

Pelican and Hayden Valleys were selected for study. These valleys are representative of the large grass/shrub complexes within the Yellowstone ecosystem (Mealey, 1975). Hornocker (1962), Craighead and Craighead(1971), and Knight (1975a) found that grizzly bears were numerous, readily observable, and could easily be studied within these valleys. Hornocker (1962) observed that nearly 100 grizzlies visited Hayden Valley each summer and that Hayden Valley "appears to be optimum

summer habitat in Yellowstone." Knight (1975a) estimated grizzly bear density at .45 bears/square mile.

Objectives of this study were to map and characterize the grass/shrub habitats and to monitor the location and nutritional quality of important food items. The seasonal distribution of grizzly bear activity as well as pocket gopher use was to be related to the vegetational information. This study will provide a basis for comparisons between an area of present grizzly bear use and other areas thought to be potential grizzly bear habitat. Field work was conducted from June to November, 1975 and from May to November, 1976.

STUDY AREA

Hayden and Pelican Valleys are located at the geographic center of Yellowstone National Park and occupy a combined area of approximately 143 square kilometers (55 square miles). Pelican Valley, lying to the southeast, is approximately one-third the size of Hayden Valley (Figure 1).

Geology

Three major geologic episodes formed Hayden and Pelican Valleys (Keefer, 1972; Eaton et al., 1975). Volcanic activity and the resultant Yellowstone caldera occurred 600,000 years ago. Plateau rhyolite covered the valleys 60,000-75,000 years ago. Pinedale glaciers blocked the valleys and thick silt deposits formed in the resulting lakes 25,000 years ago.

Three principal surficial geologic deposits are found in Pelican and Hayden Valleys (Richmond and Waldrop, 1972 and 1975; U.S. Geological Survey, 1972). Glacial till covers about 15 percent of the area in each valley. Fertile lacustrine and alluvial deposits account for 73 and 84 percent of the area in Hayden and Pelican Valleys, respectively. Alluvial deposits area of two types: 1) fertile fine-grained humic alluvium consisting of silt, sand, clay, pebbles, and some decayed plant material overlies 2) the infertile stream alluvial deposits of sand, gravel, and silt. Humic alluvium probably occupies the shallow swales and run-in sites in both valleys (C. Montagne, 1977,

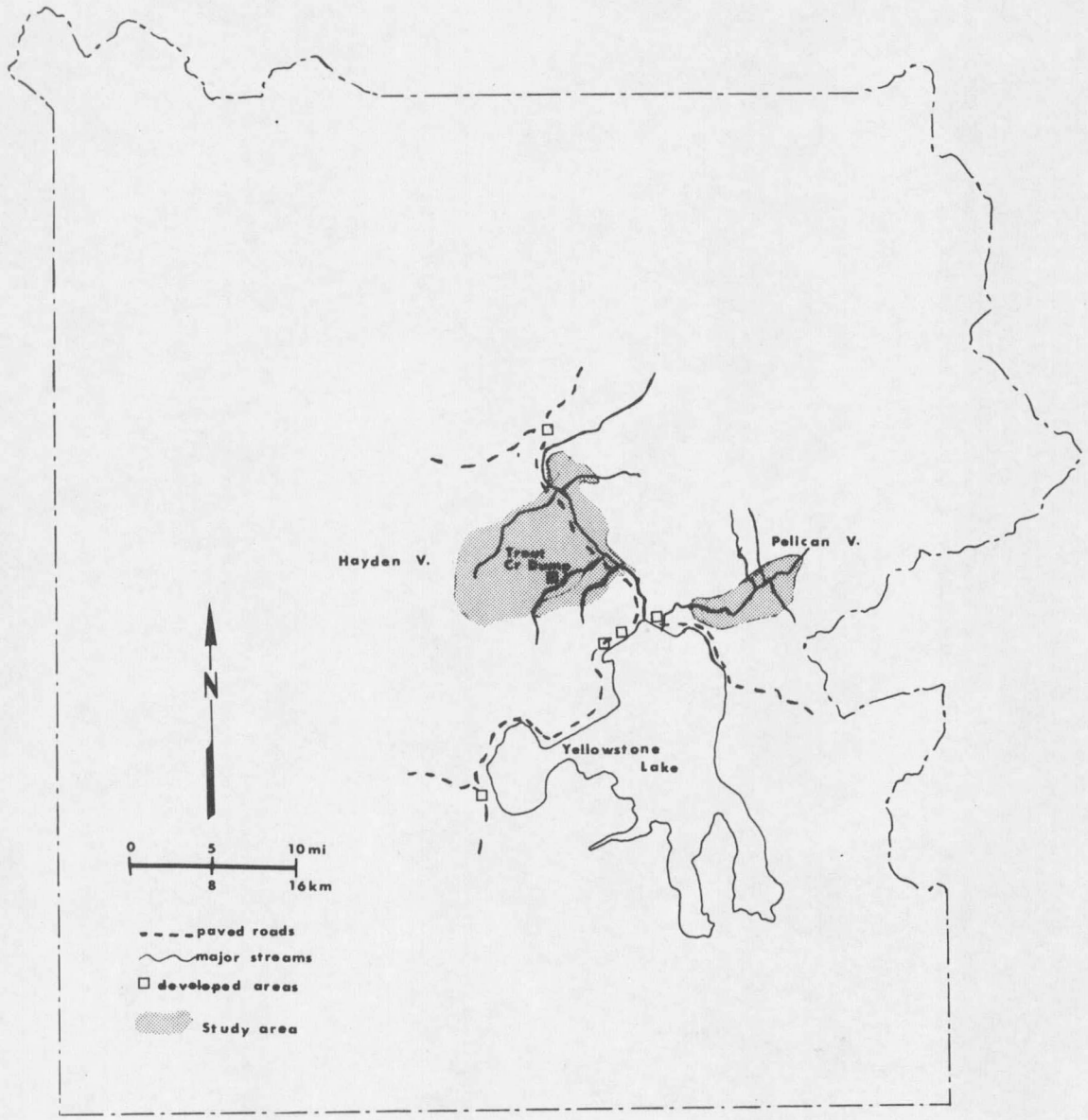


Figure 1. Yellowstone National Park, Wyoming

Personal Communication). Terraces of outwash and stream alluvium lie above the stream channel floors and form gently sloping alluvial fans in Hayden Valley. In Pelican Valley they are found primarily along Astrigent Creek (sand) and north of the junction of Pelican and Raven Creeks (gravel). Pelican Valley is mostly flat with relief occurring principally on its perimeter. In contrast, Hayden Valley exhibits considerable relief except along the Yellowstone River and in parts of the north central, northeast and southeast portion of the valley.

Climate

The mean (1948-1970) annual temperature is 0.2°C (32.3°F) at the Lake Yellowstone weather station (Dirks, 1974). The mean daily maximum of the warmest month (July) is 22°C (71.6°F) and the mean daily minimum of the coldest month (January) is -18°C (-1.1°F). The extremes recorded since 1948 ranged from a high 32°C (89.0°F) in July, 1955 to a low -46°C (-50°F) in January, 1963. June, July, and August are the only months with mean daily minimums above 0°C.

Most precipitation is in the form of snowfall. Mean annual precipitation is 46.5 cm (18.29 inches). A short dry season occurs in July (Houston, 1976).

Vegetation

Both valleys are nearly treeless expanses supporting a varied flora of shrubs, forbs, grasses and sedges. Forest zones surround

both valleys (Despain, 1973). A spruce-fir zone occupying the fertile andesitic soils lies to the east, south and northeast of Pelican Valley. These stands are in various successional stages from young seral stages dominated by lodge pole pine (*Pinus contorta*) to nearly mature stands of spruce (*Picea engelmanni*) and fir (*Abies lasiocarpa*).

Hayden Valley is surrounded by a lodgepole pine forest zone which occupies the infertile rhyolite soils. This zone extends east of Hayden Valley south to the northwest and west edge of Pelican Valley. Spruce-fir stands are interspersed throughout the lodgepole pine zone. Despain (1973) suggests that glacial deposits of andesitic soils within the boundaries of the rhyolitic soils or more favorable moisture regimes (pond margins, north slopes, drainages) may account for some of the spruce-fir intrusions into this zone.

Fauna

Animal species within the study area which are important to grizzlies are elk (*Cervus elaphus*), bison (*Bison bison*), moose (*Alces alces*), northern pocket gophers (*Thomomys talpoides*), voles (*Microtus sp.*), and black bear (*Ursus americanus*).

The major streams support cutthroat trout (*Salmo clarki*) and long-nosed suckers (*Castostomus catostomus*). A fish trap located near the mouth of Pelican Creek tends to attract grizzlies during the spawning runs of both trout and suckers.

History of Human Influence on Grizzlies

Both Chittenden (1973) and Haines (1974) have written vivid accounts of the exploration and establishment of present day Yellowstone National Park. As Park visitors increased to about .3 million during the 1930s (Cole, 1971), large open-pit dumps were established throughout the Park for garbage disposal. One dump was located on Trout Creek in Hayden Valley. In addition, two bear feeding stations were opened in 1919 in the Canyon Village area to facilitate tourist viewing of the bears (Condin, 1956; Hornocker, 1962).

Skinner (1924,1925) reported heavy use of these dumps by grizzlies and suggested that artificial food resulted in changes in their behavior and food habits. Cole (1971) found aggregations of about 20-30 bears at the Trout Creek and Rabbit Creek dumps during the summer of 1969. Craighead et al. (1969) document "a special type of migration" from winter dens to the Trout Creek dump. They observed that the Trout Creek dump annually attracted between 98 and 132 grizzlies.

During the 1930s, the Park Service formally acknowledged the problem of the alteration of bear habits caused by artificial food supplies. The feeding stations were closed by 1941. The closure of open pit dumps began in the 1930s. Management of the Trout Creek dump remained unchanged until 1968 when the volume of edible garbage was greatly reduced. Trout Creek was finally closed in 1971, after the 1970 season. Today, any grizzlies resident in Pelican and Hayden

Valleys are free-ranging and utilize only natural foods when feeding in the valleys.

A heavily travelled highway which crosses the eastern one-third of Hayden Valley joins Canyon Village on the north with three major development areas on the south (Figure 1). Human influences in Hayden Valley are presently restricted to visitors along the highway. Off-road recreationists are minimal. A second less travelled highway traverses Pelican Valley's southeast edge. A dense timber stand isolates the valley proper from the highway. Pelican Valley is heavily used by recreationists throughout late summer and fall.

METHODS

Grizzly Bear Distribution and Food Habits

Grizzly distribution was determined by direct observation and by locating grizzly sign. Direct observations were made by using an 8x binoculars and a 32x spotting scope. Grizzly sign was located by traversing the open valleys, the perimeter of each valley, and timbered areas surrounding each valley either on foot or on horseback.

Scats, visual observations of feeding activity, and feeding site examinations were used to determine grizzly bear food habits. Grizzly scats were collected, identified, and analyzed following the procedures used by Mealey (1975). Plant species presence and cover, plant species selected by bears, and the type, extent, and duration of activity were recorded for each digging, grubbing, or grazing site.

Residues of pocket gopher caches were collected from bear digging sites. Gopher cache residues and selected graminoids were subjected to proximate analysis by the Chemistry Analytical Laboratory at Montana State University (Assoc. of Official Analytical Chemists, 1975). Starch was determined by the method described by Banks et al., (1970). Total sugars were extracted from samples using $CHCl_3$: CH_3OH: H_2O. Percent of total carbohydrates (sugars) in this extract were analyzed by the phenol sulfuric acid method (Dubois, 1956). The extract was also used to determine the percent of reducing sugars using 3,5-dinitrosalacylic acid (Whealan, 1964). The reducing sugar percents may be slightly high,

because any other reducing material present in the solution would produce the same positive reaction as reducing sugars. The presence of small amounts of other reducing materials may explain why in some cases of low sugar concentration reducing sugar is apparently slightly higher than total sugar. Succulence (percent water) was determined by weighing in the field on a triple beam balance, oven drying at 60°C, and reweighing on a Mettler open pan balance.

Pocket gopher activity was estimated based on visual estimates of percent ground disturbance. Activity was recorded as lacking (<1%), slight (1-5%), moderate (6-25%), intense (26-50%), very intense (>50%).

Vegetation

General reconnaissance methods were used to obtain visual estimates of canopy cover, litter and bare soil (Knight, 1975b). Communities to be sampled were selected while walking transect routes across each valley. The goal was to sample representative and homogeneous stands within each vegetation type. Sampling was not done in ecotones and sample areas did not cross community boundaries. The vegetation types, which have been described by Mueggler and Handl (1974), were designated habitat types (h.t.). All other vegetation types were designated community types (c.t.).

Sampling was accomplished by spiraling outward from a selected point within each community and was continued until the rate of addition of new species became low. Plant species present at each site were listed. Nomenclature follows that of Hitchcock et al. (1969), Booth and Wright (1959), Booth (1972), and Hermann (1970). Within each plot the cover class of each plant species (modified from Daubenmire, 1959) was estimated for the entire plot (Knight, 1975b).

Above ground, dry weight production estimates of graminoids were made by clipping 2x5 dm microplots in early September. Below ground, dry weight production estimates of *Perideridia gairdneri* and *Melica* were made by extracting the soils in 2x5 dm microplots to a depth of 10 cm and by screening the vegetative material.

Soils

Soil study sites were selected where grizzly digs occurred at sites of at least moderate pocket gopher activity.

Soil moisture was measured with a Beckman Soil Moisture Bridge and Beckman gypsum blocks. One set of blocks were installed in stacks of three at each site at 10, 30, and 60 cm. Resistance readings were made approximately twice monthly from June through September. Resistances were converted to soil moisture tensions recorded in atmospheres using a pressure membrane apparatus to calibrate the soil moisture bridge and gypsum blocks (Weaver, 1974).

Soil samples were collected in September from five sites: 3 from *Festuca idahoensis/Deschampsia caespitosa* h.t., one from a *Festuca idahoensis/Agropyron caninum* h.t., and one from an *Artemesia cana/Festuca idahoensis* c.t. Three samples were collected at each site. Each sample consisted of a pool of fifty soil cores taken with an Oakfield tube sampler at depths from 0-10, 10-30, and 30-60 cm. Soil cores were collected at one meter intervals along five randomly selected ten meter transects. Samples were frozen to prevent moisture loss and reduce microbial activity until they could be transported to the laboratory for analysis where they were dried at 60°C. Standard laboratory techniques were used to determine texture (Bouyoucos, 1939), electrical conductivity and pH (U.S. Salinity Lab. Staff, 1954), extractable Ca, Mg, Na, K (Chapman, 1965), modified Bray P. (Smith et al., 1957), Cu, Zn, Fe, Mn (Norvell and Lindsay, 1969), and organic matter (Sims et al., 1971).

Detailed soil profile descriptions and laboratory characterizations were made for three sites representing the *Festuca idahoensis/Deschampsia caespitosa, Festuca idahoensis/Agropyron caninum,* and *Artemesia cana/Festuca idahoensis* vegetation types. Profile pits ($1.2m^2$) were dug to a depth of approximately 185 cm (6 ft.). The C horizon was reached in all pits and the pits extended below the active root zone.

Soil profile descriptions were prepared using the guidelines of the Soil Survey Manual (Soil Survey Staff, 1951) and were recorded and processed using the Montana Automatic Data Processing (ADP) System (Decker et al., 1975). Percent coarse fragments were estimated visually. Bulk density and water availability were determined for each horizon (Black, 1965). Cation exchange capacity was measured by ammonium saturation (Black, 1965).

Soil samples of approximately 4 liters were collected from each horizon in the profile. Subsamples were analyzed by the MSU soils testing laboratory. Soil temperatures were determined in the field at 50 cm using a glass laboratory thermometer.

RESULTS

Grizzly Bear Distributions and Use of Vegetation Types

Grizzly distributions for 1974, 1975, and 1976 are shown for each valley in Figures 2 and 3. Two hundred sixty-one observation sites determined by presence of scats, tracks, digs, forage sites, grubbing sites, and live observations were recorded from my data (1975 and 1976) and from National Park Service (1974-1976) grizzly bear observation records. Only eleven observations from Park Service files for which the vegetation type could be determined are included.

Edge effect appears to be an important factor governing grizzly distribution. Grizzly bear observations were most heavily concentrated in the south half of Pelican Valley. In the south half of the valley, there are nearly 110 km of timber/grass edge over about 10 km straight line distance compared with 29 km in the north half of the valley over the same straight line distance (Figure 2). Similarly, the heaviest concentration of grizzly sign in Hayden Valley was in the northwest corner where there is approximately 6 miles of edge in the one square mile of heaviest bear use (Figure 3).

Grizzlies remained in close proximity to timber. Seventy-five percent of all grizzly observation sites were within 50m of the timber (average, 12m) (Table 1). Grizzlies observed at a distance in excess of 100m from timber (15 percent) were usually travelling. The *Festuca idahoensis/Deschampsia caespitosa* h.t. and *Artemesia cana/Festuca*

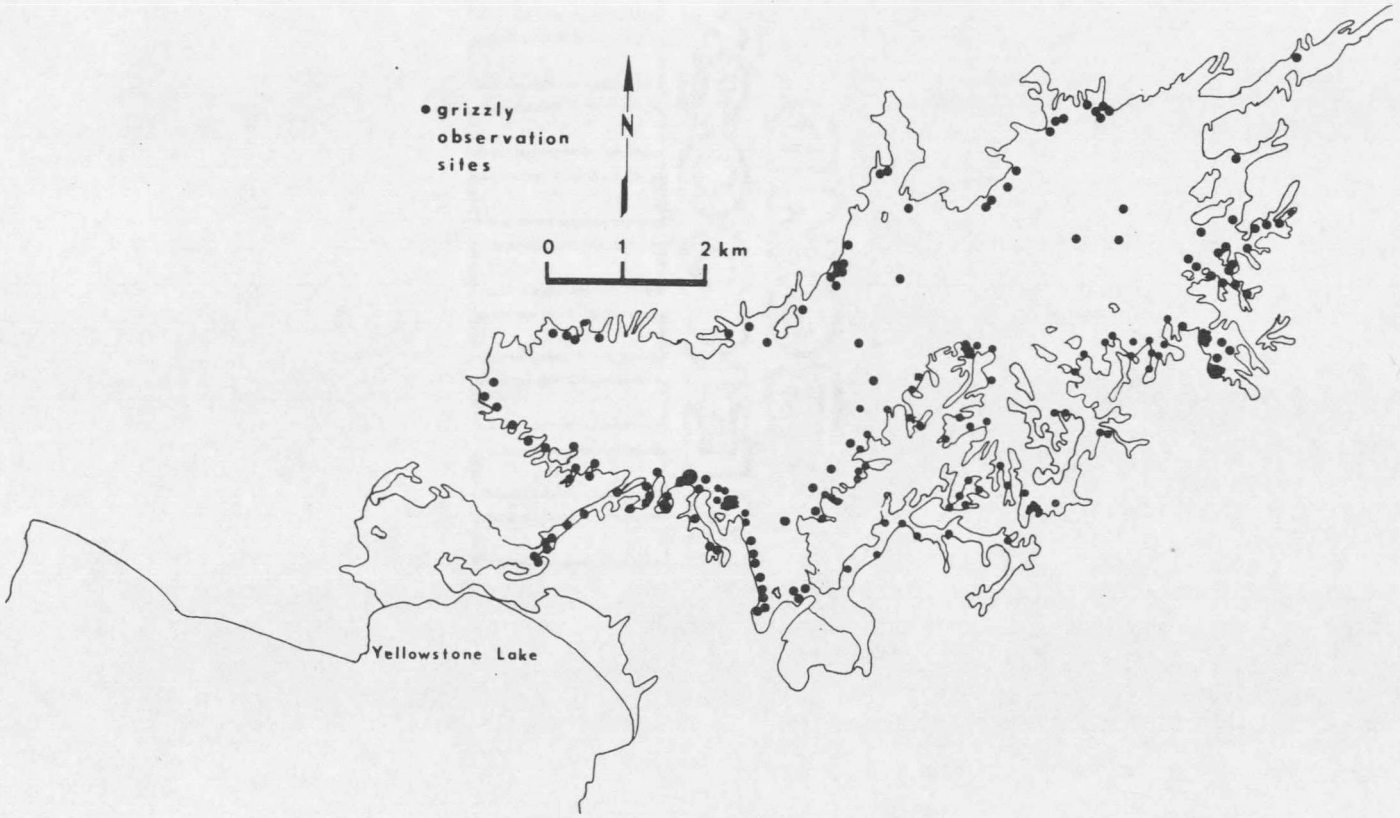


Figure 2. Pelican Valley grizzly bear observation sites determined by presence of scats, tracks, feeding sites and live observations, 1974-1976.

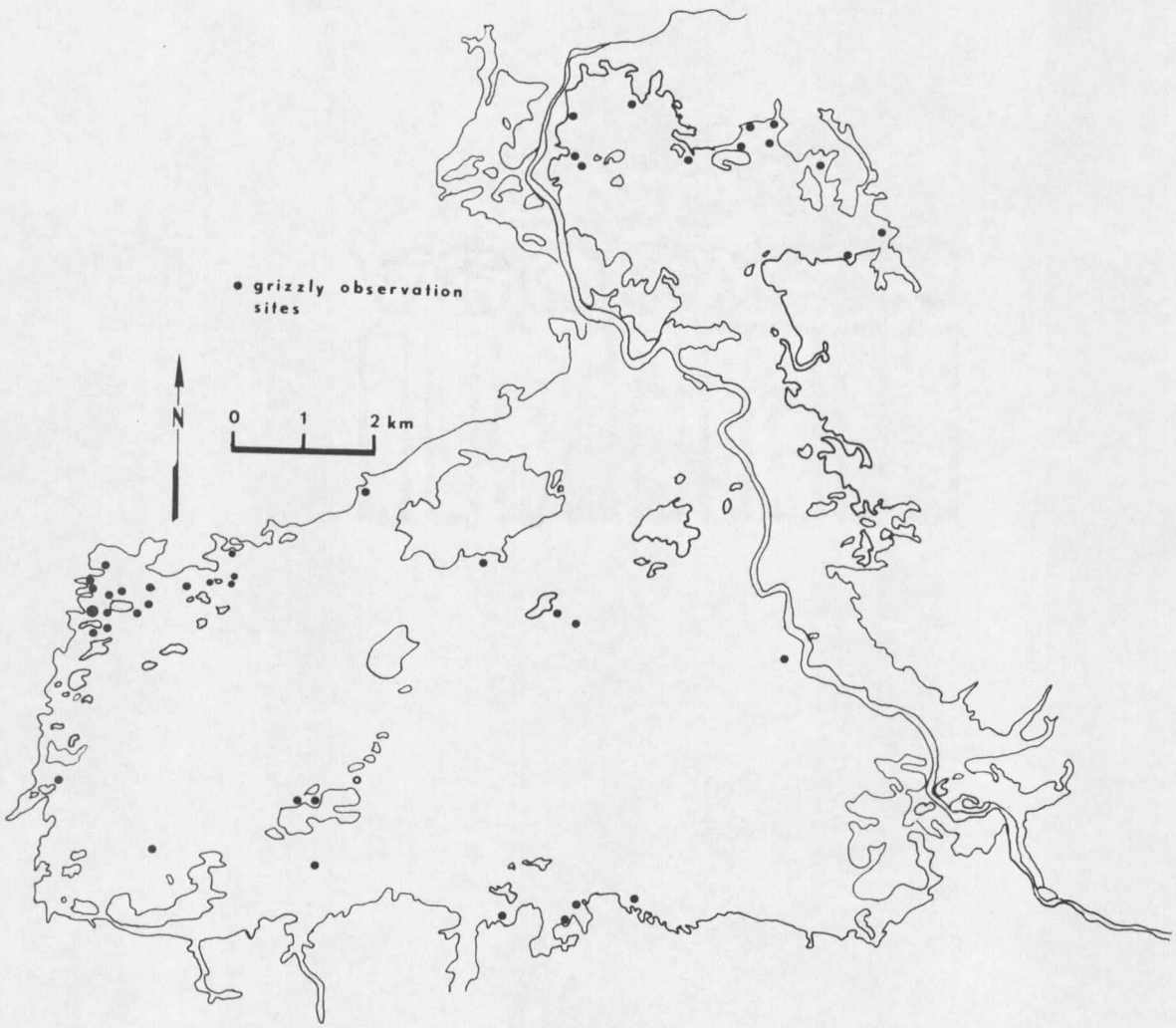


Figure 3. Hayden Valley grizzly bear observation sites determined by presence of scats, tracks, feeding sites and live observations, 1974-1976.

idahoensis c.t. are the primary types immediately adjacent to timber edge in which bear sign was found. One incident which I observed in Pelican Valley indicated that grizzlies rely on timber for escape cover. I had been observing for 50 minutes a single bear grubbing for yampa roots. The bear was never farther than 15m from the timber. When a low flying observation aircraft approached, the bear ran into the timber. The aircraft circled once and left. About one minute later, the bear emerged from the timber, went to the exact location from which he had fled and resumed his grubbing activity as if nothing had happened. Pearson (1975) reported that grizzly bears responded negatively to helicopters.

Table 1. Mean distance of grizzly bear observation sites to tree cover by vegetation type. Percent is percent of total observations within each vegetation type recorded for each distance class: 0-49m, 50-100m, >100m.

Vegetation Type	Total Observation Sites	Percent of Total and Mean Distance to Tree Cover (m)					
		0-49m		50-100m		>100m	
		%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$
ARCA/FEID	80	66	12	9	83	25	322
ARTR/FEID	6	17	15	50	64	33	229
FEID/AGCA	16	50	12	19	52	31	143
FEID/DECA	132	89	13	8	68	3	336
DECA/*Carex*	17	72	9	8	50	20	265
Carex	3	75	3	25	50		
Trifolium spp.	7	43	8	14	91	43	301
Total	261	75	12	10	70	15	293

Grizzly observation sites within vegetation types are presented in Table 2 for both Hayden and Pelican Valleys combined. The *Festuca idahoensis/Deschampsia caespitosa* (FEID/DECA)h.t. and *Artemesia cana/Festuca idahoensis* (FEID/ARCA)c.t. contained 51 percent and 31 percent, respectively, of all observation sites. Seventy-eight percent (103) of the sites in the FEID/DECA h.t. and 68 percent (54) of the sites in the ARCA/FEID c.t. were dig sites. Data is biased in favor of these vegetation types because digs are relatively long lasting and easy to find. Nevertheless, the importance of these types to grizzlies as a food source is undisputed. Eighty-four percent (219) of the 261 observation sites were feeding sites (185 dig sites, 7 foraging and grazing sites, and 27 grubbing sites). Fifty-two percent (114) of the feeding sites occurred in the FEID/DECA h.t. and 32 percent (70) occurred in the ARCA/FEID c.t. Of the 623 individual digs found, 65 percent (407) occurred in the FEID/DECA h.t. and 20 percent (124) occurred in the ARCA/FEID c.t.

If grizzlies were to travel randomly, the percent of observations within each vegetation type would be expected to approximate the percent of the total area each vegetation type occupied. Assuming grizzlies are selective, the data in Table 2 suggests that the *Trifolium, Festuca idahoensis/Deschampsia caespitosa* and *Festuca idahoensis/Agropyron caninum* vegetation types are preferred in that order by grizzlies. The least preferred types are the *Festuca*

Table 2. Percent of total grizzly observation sites (1974-1976) within each vegetation type and the area of each shrub/grass vegetation type expressed as a percent of the total area of all shrub/grass types in Pelican and Hayden Valleys combined.

Vegetation Type	Percent of Total Observation Sites[1]	Area of Each Shrub/grass Vegetation Type (%)	% Obs. / % Area
FEID/AGSM-AGDA h.t.	--	4	--
FEID/AGCA h.t.	6 (16)	3	2
ARTR/FEID h.t.	2 (6)	19	.1
ARCA/FEID c.t.	31 (80)	31	1
POFR/FEID h.t.	--	1	--
FEID/DECA h.t.	51 (132)	8	6
DECA/*Carex* h.t.	7 (17)	17	.4
Carex spp. c.t.	1 (3)	16	.06
Trifolium spp. c.t.	3 (6)	<.5	>6

[1]Number in parentheses indicates total number of observation sites within each vegetation type.

idahoensis/Agropyron smithii-A. dasystachyum, Potentilla fruticosa/Festuca idahoensis, Carex spp. and *Artemesia tridentata/Festuca idahoensis* vegetation types. The percentage of observation sites found in the *Artemesia cana/Festuca idahoensis* c.t. is what is expected based on the availability of the community type.

Grizzly Bear Food Habits

Grizzlies were observed foraging in six different locations. Foods eaten were *Cirsium foliosum* on four occasions and *Trifolium hybridum* on two occasions.

Detailed analysis of 40 scats collected in 1975 and 1976 indicate that graminoids and forbs constitute the bulk of grizzly bear diet in the two valleys (Table 3). Mealey (1975) reported similar results. Graminoids occurred in 95 percent of scats and accounted for 48.6 percent of the total scat volume for both years. Forbs occurred in 93 percent of scats and accounted for 34.8 percent of the total scat volume. By comparison, in the valley-plateau economy of which Pelican and Hayden Valleys are a major portion, Mealey (1975) reported a combined frequency occurrence percent for 1973-1974 of 68.8 for graminoids. Although he did not report a figure for all forbs, *Trifolium* spp. and *Cirsium foliosum* occurred most frequently in all scats with a frequency occurrence percent of 17.6 and 15.3, respectively. My results also indicate that *Trifolium* spp. and *C. foliosum* occurred most frequently with 57 and 20 percent frequency occurrence, respectively.

Although the percent frequency of occurrence of *Melica* and *Perideridia gairdneri* was relatively high in all scats (15 and 18 percent), percent volume was relatively low for each (5.4 and 1.8 percent). These figures are similar to the results reported by Mealey (1975) for the Valley-Plateau Economy. The high digestibility of starch (67 and 58 percent respectively) from corms and roots of these plants (Mealey, 1975) may explain the low percent volume of scats found for both yampa and *Melica*. *Claytonia lanceolata* (spring beauty)

Table 3. Food items in 40 grizzly bear scats from Pelican and Hayden Valleys, 1975 and 1976. Number in parentheses indicates sample size.

	1975 (20)		1976 (20)		Combined (40)	
	% freq occur.	% vol of scats	% freq occur.	% vol of scats	% freq occur.	% vol of scats
Graminoids	95	54.5	90	42.8	95	48.6
Cyperaceae	10	7.0	10	0.5	10	3.8
Poaceae	25	10.3	45	15.5	35	12.9
Agropyron caninum	5	T[1]	--	--	3	T
Bromus carinatus	5	T	5	T	5	0.1
Deschampsia caespitosa	5	T	5	T	5	T
Melica spectabilis (corms)	5	0.3	25	10.5	15	5.4
Phleum alpinum	5	T	5	0.3	5	0.1
Forbs	100	31.3	85	38.3	93	34.8
Cirsium foliosum	30	3.3	20	10.8	20	7.0
Fragaria virginiana	15	2.3	--	--	8	1.1
Lupinus spp.	10	0.3	--	--	5	0.1
Perideridia gairdneri (roots)	5	0.3	30	3.5	18	1.8
Polygonum bistortoides	15	0.3	5	T	10	0.1
Ranunculus spp.	40	3.8	5	T	23	1.9
Trifolium spp.	50	6.5	65	22.3	57	14.4
Trifolium hybridum	5	3.0	--	--	3	1.5
Vaccinium scoparium	15	2.0	--	--	8	1.0

Table 3 (cont.)

	1975 (20)		1976 (20)		Combined (40)	
	% freq occur.	% vol of scats	% freq occur.	% vol of scats	% freq occur.	% vol of scats
Alga	5	0.5	--	--	3	0.3
Equisetum	10	0.8	5	3.8	8	2.3
Pinus spp.	15	8.8	5	5.0	10	6.9
Unident.	--	--	10	0.8	5	0.4
Cervidae	5	2.5	10	T	8	1.3
Formicidae	20	1.8	10	0.8	15	1.3
Debris	--	--	0.3	8.8	13	4.4

[1] T - trace

was reported by Mealey (1975) to be present in scats from valley areas only in his 1973 collections. Frequency occurrence percent was 3.3 and percent of diet volume was 1.60. Spring beauty was not found in any of the 40 scats which I collected.

Eighty-four percent of grizzly sign was associated with feeding activity. Although some dig sites were quite extensive (up to one-tenth hectares), most feeding sites covered less than 45 square meters. Bears would dig, grub and graze in these microsite locations and then move to an adjacent microsite or to a site a considerable distance away before resuming their feeding activity. On two occasions I observed a bear feeding in a clover patch of less than 35 square meters. After foraging about thirty minutes, the bears left the site which still supplied an abundance of readily available succulent and highly nutritional clover. They traveled about 100m into a *Festuca idahoensis/ Deschampsia caespitosa* h.t. where they began grubbing for yampa roots. Pearson (1975) reported that grizzlies never completely consumed all berries on a single bush but moved on to other bushes or to a different food source. Amstrup and Beecham (1976) reported that black bears "often left sites that seemed to be optimal for foraging and traveled elsewhere."

Nutritional Quality of Food Items and of Available Forage

Although *Melica* and *Perideridia gairdneri* represented a small percent of the total scat volumes (Table 3), they were an important

food source for grizzlies. Each spring until about the end of the first week in June, grizzlies feed heavily upon pocket gopher caches. Primary contents of these caches are roots of *Perideridia*, *Melica*, and *Claytonia*. Residues of gopher caches from bear dig sites were collected in the spring of 1975. Contents were separated into species components and analyzed for nutritive quality. Again, near the end of the first week of August, bears returned to the valleys where both adults and cubs selectively sought out and grubbed for individual yampa roots. *Perideridia*, *Melica*, and *Claytonia* roots were collected in the fall of 1976 from the same spring dig sites where bears were grubbing for yampa. Nutritive quality was also determined for these samples (Table 4).

Starch content of *Perideridia* and *Melica* from grub sites was 40 and 10 percent, respectively. These results are similar to results of Mealey (1975). Starch content of both species taken from dig sites (gopher caches) was about 50 percent less than those taken from grub sites. The protein content of *Melica* was about 6 percent which was similar to that reported by Mealey. Protein in *Perideridia* was about 7% compared to 4.8 percent reported by Mealey.

Significant differences ($P < .05$) were found in the levels of reducing sugars, sodium and potassium between *Perideridia* samples from the dig and grub sites. The content of total sugars, calcium and phosphorus differed ($P < .05$) in *Melica* from the two sources. Sugar,

Table 4. Chemical analyses of roots of *Perideridia gairdneri, Melica spectabilis* and *Claytonia lanceolata* collected from seven bear dig sites compared with analyses of roots collected from seven bear grub sites. Data from grub sites are averages of 20 2x5 dm plots taken at seven different sites.[1]

Species	Site Type[2]	Vacuum Moisture	Protein	Total Sugar	Reducing Sugar	Starch	Na	K	Ca	P
P. gairdneri	Dig	4.66	7.31	35.84+	5.48+	24.90(2)	.049	1.84+	.18+	.23+
	Grub	5.91	7.09	32.14	9.63*	40.00(2)	.072*	1.059*	.15	.24
M. spectabilis	Dig	5.33	6.68	5.82	2.72	4.2(2)	.046	.68	.069	.11
	Grub	6.42	5.42	2.92*	4.13	10.05(2)	.023	.50	.030*	.14*
C. lanceolata	Dig	2.5	11.56	10.9	3.8	--	.042	2.66	.12	.27
	Grub	7.4	9.37	11.4	4.4	--	.025	2.17	.05	.25

[1]Asterisk indicates significant difference between dig and grub sites determined by t test ($P < .05$) for all analyses except for starch and except for analyses of *C. lanceolata* (only one site contained *C. lanceolata*). Plus indicates content of *P. gairdneri* was significantly higher ($P < .05$) than that of *Melica* between similar site types. Sodium of *P. gairdneri* was significantly higher than *Melica* ($P < .05$) only between grub sites.

[2]Dig - spring dig for gopher caches; Grub - fall grubbing for individual yampa roots.

potassium, calcium, and phosphorus content of *Perideridia* was significantly higher ($P < .05$) than that of *Melica* between similar sites. Sodium content of *Perideridia* was significantly higher ($P < .05$) than that of *Melica* only between grub sites.

Moisture content was determined for grass samples collected between early August and early October from several exposed grassland sites (Table 5). Grasses from exposed sites showed a substantial decline in moisture content from early August to late September. Moisture content in one paired sample of *Calamagrostis canadensis* from beneath the forest canopy decreased by only 3 percent between August 23 and October 2. The results in Table 6 indicate that in the fall the moisture content of a species sheltered by forest canopy tended to be considerably higher than the same species on exposed sites. Sharif and West (1968) reported that moisture differences in grasses due to shade could be of the order of 69 percent. Moisture content (Tables 6 and 7) suggest that vegetation beneath forest canopy was physiologically active later into the fall than vegetation from exposed sites. Protein levels were found to be significantly higher ($P < .05$) under the forest canopy. Minerals (except sodium) also tended to be higher (Table 7) but differences were not statistically significant. The K/Na ratios were much higher in grasses beneath forest canopy in two samples. The Ca/P ratios, however, were higher in grass from exposed sites in two samples.

Table 5. Comparison of percent moisture content and percent difference in moisture content of grass samples collected between early August and early October, Pelican Valley, 1975. Samples were collected from five 2x5 dm frames at four different locations in each habitat type.

Habitat Type	FEID/DECA h.t.								ARCA/FEID h.t.						Forest Understory
Species	DeCa	StOc	BrCa	MeSp	AgCa	PhAl	FeId	PoSc	CaRa	DeCa	AgCa	FeId	PoSc	$\bar{x}$	CaCa
% moisture content on collection date															
8-5	57	62	67	55	62	58	62	64	57					60	
8-23															62
8-30									37	42	44	52	47	44	
9-10									37	34			39	37	
9-18															
9-25	26	25	29	12	26	35	28	24		21	19	20	18	24	
10-2															60
% difference in[1] moisture content from earliest to latest date	54	60	57	78	58	40	55	63	35	50	57	62	62	60	3

[1] Percent difference = $\frac{\text{highest content - lowest content}}{\text{highest content}}$ x 100, for each species.

Table 6. Comparison of percent moisture content and percent difference in moisture content of paired grass samples collected beneath forest canopy and from contiguous but exposed sites, Pelican Valley, 1976.

Sample No.	Collection date	Species	Percent Moisture Content		% Difference[1] in Moisture Content
			Forest	Exposed	
1	7-22	*Calamagrostis canadensis*		65	
2	8-19	*C. canadensis*	69	58	16
3	8-23	*C. canadensis*	63		
4	8-23	*Elymus virginicus*	64		
5	9-25	*C. canadensis*	60	40	33
6	9-25	*Poa scabrella*	47	24	49
7	9-25	*Agropyron caninum*	47	31	34
8	9-27	*C. canadensis*	50	29	42
9	9-27	*P. scabrella*	48	20	58
10	9-30	*A. caninum*	40	19	53
11	10-2	*C. canadensis*	61	33	46

[1] Percent difference = $\frac{\%F - \%E}{\%F} \times 100$.

Table 7. Nutritional quality of three grass samples collected beneath the forest canopy compared with nutritional quality of grass samples collected from exposed grassland sites. Two paired samples were collected beneath the forest canopy and from a contiguous exposed grassland site. Figures are percents (oven dry weight).

Grass Sample[1]	Collection Date	Species	Exposure[2]	Moisture		Protein	Ether Extract	Starch	Ash	Crude Fiber	Na	K	Ca	P	K/Na Ratio	Ca/P Ratio
				Oven	Vacuum											
1	8-22	*Calamagrostis canadensis*	F	62.5*	4.9	14.6*				28.9	.03	2.00	.60	.21	66.67	2.86
		Carex rostrata														
		Elymus virginicus														
		Deschampsia caespitosa	E	48.7	4.7	8.6				30.1	.05	1.21	.30	.19	24.20	1.58
		Trisetum wolfii														
		Hordeum brachyantherum														
2	9-25	*Agropyron caninum*	F	46.7	5.1	6.2					.021	1.21	0.18	.35	57.62	0.51
			E	31.3	4.4	5.7					.025	0.89	0.29	.30	35.60	0.97
3	9-25	*Calamagrostis canadensis*	F	59.8	5.5	10.5	3.1	<.2	7.8	30.6	.39	1.78	0.31	.21	4.56	1.48
			E	40.1	5.0	5.3	2.6	<.2	7.0	30.9	.16	.83	0.30	.10	5.19	3.00

[1]Figures for sample 1 are averages of four samples for both forest and exposed sites. Figures for samples 2 and 3 are for one sample for the forest and exposed sites. Asterisk indicates significant difference ($P < .05$) determined for sample 1 only.

[2]F - forest canopy; E - exposed site.

Four paired grass samples were collected for chemical analyses from the same exposed grassland sites in summer and late September (Table 8). As was also shown by others, Mealey (1975), Morton (1976), Crampton and Harris (1969), and Demarchi (1968), percent protein decreased and crude fiber increased as the plants approached maturity. Percent sodium, potassium and phosphorus generally decreased with plant maturity. Sodium and calcium increased in two paired samples and decreased in two paired samples with plant maturity. These changes in mineral content with plant maturity are similar to results reported by Paulsen (1969) and Tew (1969). During this period, the Ca/P ratios tended to increase slightly as the moisture content decreased in three paired grass samples. The K/Na ratio decreased with decreased moisture content in three paired samples.

Data summarized in Table 9 indicate that the nutritional quality of vegetation in the vicinity of streams is similar to that under forest canopy late in the growing season (Table 7). Little difference was noted between plants on the stream bank and those up to 10m from the stream edge except the K/Na ratio was higher in vegetation on the bank in one sample and in the other sample the Ca/P ratio was higher in vegetation 4.5m from the bank.

The data presented in Table 10 suggest that grizzlies will consume vegetation with a moisture content as low as 40 percent. Mealey (1975) suggested that plant moisture content influences plant selection

Table 8. Comparison of percent moisture, protein and mineral analyses of *Agropyron caninum*, *Festuca idahoensis* and *Calamagrostis canadensis* collected in summer and fall, 1976. Samples were collected from five 2x5 dm frames at four different locations. Figures are percents (oven dry weight).

Collection Date	Species	Moisture		Protein	Crude Fiber	Na	K	Ca	P	K/Na Ratio	Ca/P Ratio
		Oven	Vacuum								
8-25	*A. caninum*	62	4.8	8.8		.031	1.81	.20	.33	58.39	0.61
9-25		31	4.4	5.7		.025	.89	.29	.30	35.60	0.97
8-5	*F. idahoensis*	62	4.7	11.06		.028	2.04	.35	.20	72.86	1.75
9-25		35	4.3	7.37		.011	2.45	.30	.16	222.73	1.88
7-22	*C. candensis*	65	5.1	16.3	29.6	.027	1.64	.23	.25	60.74	0.92
8-20		63	4.8	10.2	32.5	.140	1.55	.14	.18	11.07	0.78
8-19	*C. canadensis*	69	4.8	12.2	29.2	.039	1.51	.23	.20	38.72	1.15
9-26		25	4.9	5.0	32.5	.08	.64	.24	.13	8.00	1.85

Table 9. Comparison of nutritional quality of grouped grass samples collected on stream banks and at adjacent sites at a distance from stream banks, Pelican Valley. Figures are average percents (oven dry weight) of four samples of *Carex aquitilis/Calamagrostis canadensis* mix and one sample of *Carex microptera*.

Collec-Date	Species	Relation to Stream Bank	Moisture		Protein	Ether Extract	Starch	Ash	Crude Fiber	Na	K	Ca	P	K/Na Ratio	Ca/P Ratio
			Oven	Vacuum											
8-22	CaAq/CaCa[1]	on bank	60.9[2]		11.5				27.4	.015	1.52	0.43	.22	101.33	1.95
		3-10m from bank	54.9		11.4				26.9	.017	1.62	0.38	.21	95.29	1.81
9-29	CaMi[3]	on bank, sheltered	54.9	5.4	8.5	2.9	<.2	7.4	28.0	.130	1.54	0.42	.15	11.85	2.80
		4.5m from bank	32.1	4.6	5.2	2.2	<.2	8.5	29.0	.090	1.04	0.57	.08	11.56	7.13

[1] Differences not significant at P = .05

[2] Oven moisture difference significant at P <.20

[3] Significance not determined

by grizzlies. Blanchard (1978) found moist microsites to be important to grizzlies in the fall. Forage quality and palatability for domestic livestock has been positively correlated with moisture content (Sullivan, 1962; Archibald et al., 1943).

Table 10. Moisture content of food items collected from five grizzly bear foraging sites, Pelican Valley, 1975 and 1976.

Date Observed	Food Item	% Moisture
7-11-75	*Cirsium foliosum*	79
8-11-76	*Trifolium hybridum*	82
8-12-76	*T. hybridum*	80
9-28-76	*C. foliosum*	47
9-30-76	*C. foliosum*	41
10- 3-76	*C. foliosum*	40

Results of nutritional analysis of *Heracleum lanatum*, *Trifolium hybridum* and *Cirsium foliosum* consistently showed higher moisture content than did grasses (Table 11). Sharif and West (1968) also reported moisture content to be consistently greater in forbs than in grasses throughout the season. Protein ranged from 4.9 percent for the remnant of a *C. foliosum* stalk to 19.8 percent for the mature leaves of *H. lanatum*. Except for *C. foliosum*, protein in forbs was consistently higher than in grasses. Protein content (19.8 percent) in mature *H. lanatum* leaves was similar to Klein's (1965) results of 20.6 percent for comparable dates. Mealey (1975) reported a lower (7.3 percent) protein content for *H. lanatum* from Yellowstone Park. An 8.3-9.7

Table 11. Nutritional quality of *Heracleum lanatum*, *Cirsium foliosum* and *Trifolium hybridum*. Figures are percents (oven dry weight).

Collection Date	Species	Moisture		Protein	Crude Fiber	Na	K	Ca	P	K/Na Ratio	Ca/P Ratio
		Oven	Vacuum								
	H. lanatum										
8-14	mature umbel	66	6.4	15.9		.023	3.82	.61	.74	166.09	0.82
	mature leaves	69	6.0	19.8		.035	4.29	1.57	.52	122.57	3.02
	young plant	75	8.3	13.4		.050	4.34	1.80	.42	86.80	4.29
	C. foliosum										
7-11	partial stalk[1]	79	4.8	4.9		.057	5.24	1.69	.44	91.93	3.84
	stalk[2]	78	5.9	9.7		.036	6.24	.99	.63	173.33	1.57
8-5	stalk	90	8.6	8.3	27.7	.062	4.49	.91	.28	72.42	3.25
8-11	*T. hybridum*[2]	80	6.6	19.0	21.0	.065	2.75	1.2	.32	42.31	3.75

[1] Remnant of stalk eaten by grizzly bear

[2] Sample taken from grizzly bear forage site

percent protein content for *C. foliosum* stalks was similar to Mealey's results of 9.0 percent.

Mineral content was highly variable both within and between species. Mineral content of *T. hybridum* was similar to results reported by Hamilton and Gilbert (1968). Forbs were considerably higher than grasses in calcium, phosphorus and potassium. Sodium content was generally higher in forbs than grasses but was similar to the sodium content of grasses beneath forest canopy (Table 7). No consistent trends were seen in either the K/Na or Ca/P ratios among forbs. Both the K/Na and Ca/P ratios for forbs were much higher than for grasses.

Vegetation and Soils

The vegetation of each valley is a mosaic of vegetation types. Sizes of mosaic units are often less than $5m^2$. The broad vegetation units presented in Figures 4 and 5 were chosen on the basis of primary vegetation type, topography, apparent soil moisture, and geology. Intermingled in each unit are vegetation types reflecting a variety of edaphic, topographic and geologic characteristics. A particular vegetation type is not confined to a particular unit. Areas (km^2) of the vegetation units in each valley and their characteristics are presented in Table 12. Soils fertility data, physical characteristics and mineralogy are presented in Appendix B.

1. Breaks
2. Rolling sage/grass
3. Mesic sage/grass
4. Hydric grass
5. Mesic grass/sedge
6. Xeric sage
7. Hydric
8. Thermal
9. *Potentilla fruticosa*
10. Forest

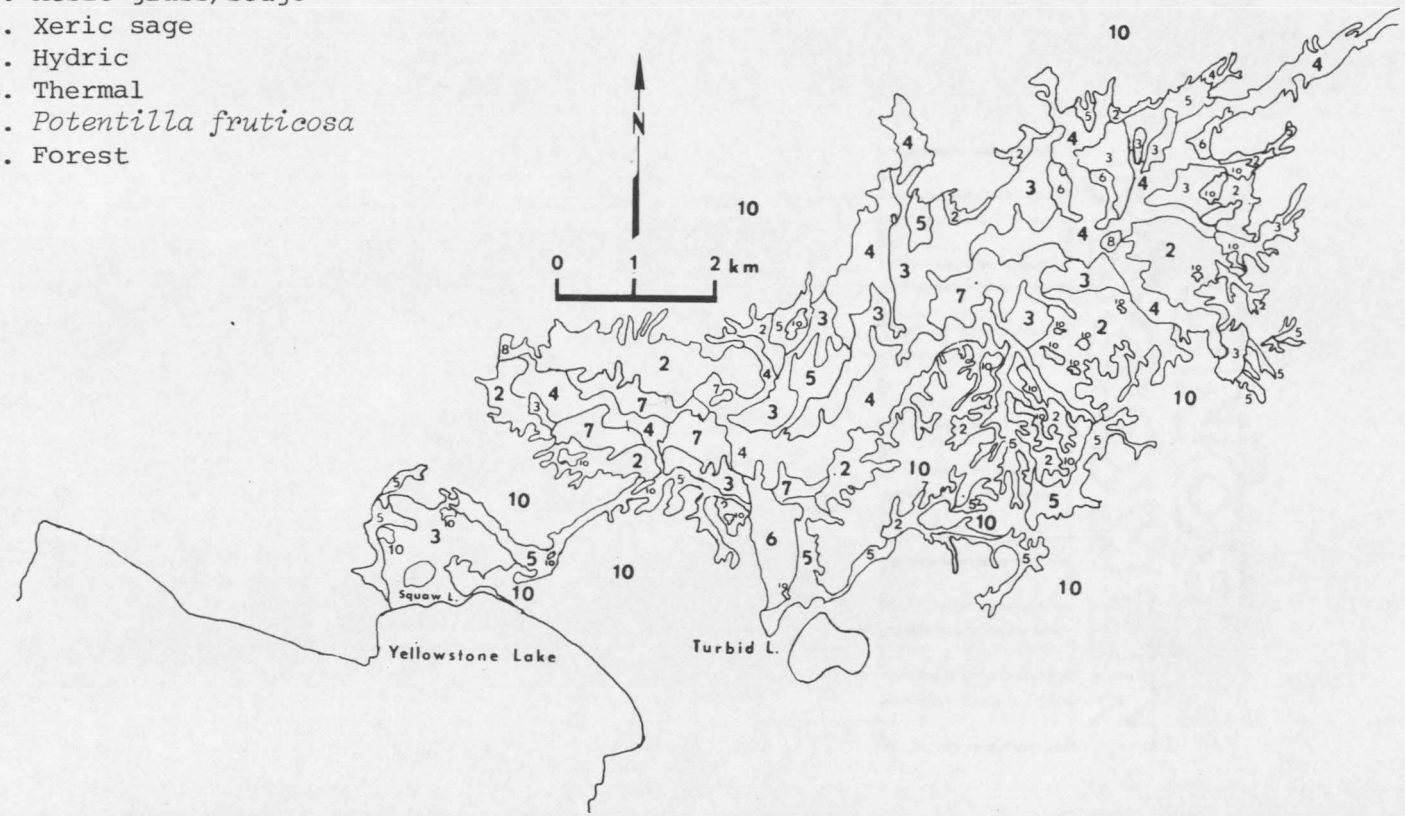


Figure 4. Vegetation units in Pelican Valley.

1. Breaks
2. Rolling sage/grass
3. Mesic sage/grass
4. Hydric grass
5. Mesic grass/sedge
6. Xeric sage
7. Hydric
8. Thermal
9. *Potentilla fruticosa*
10. Forest

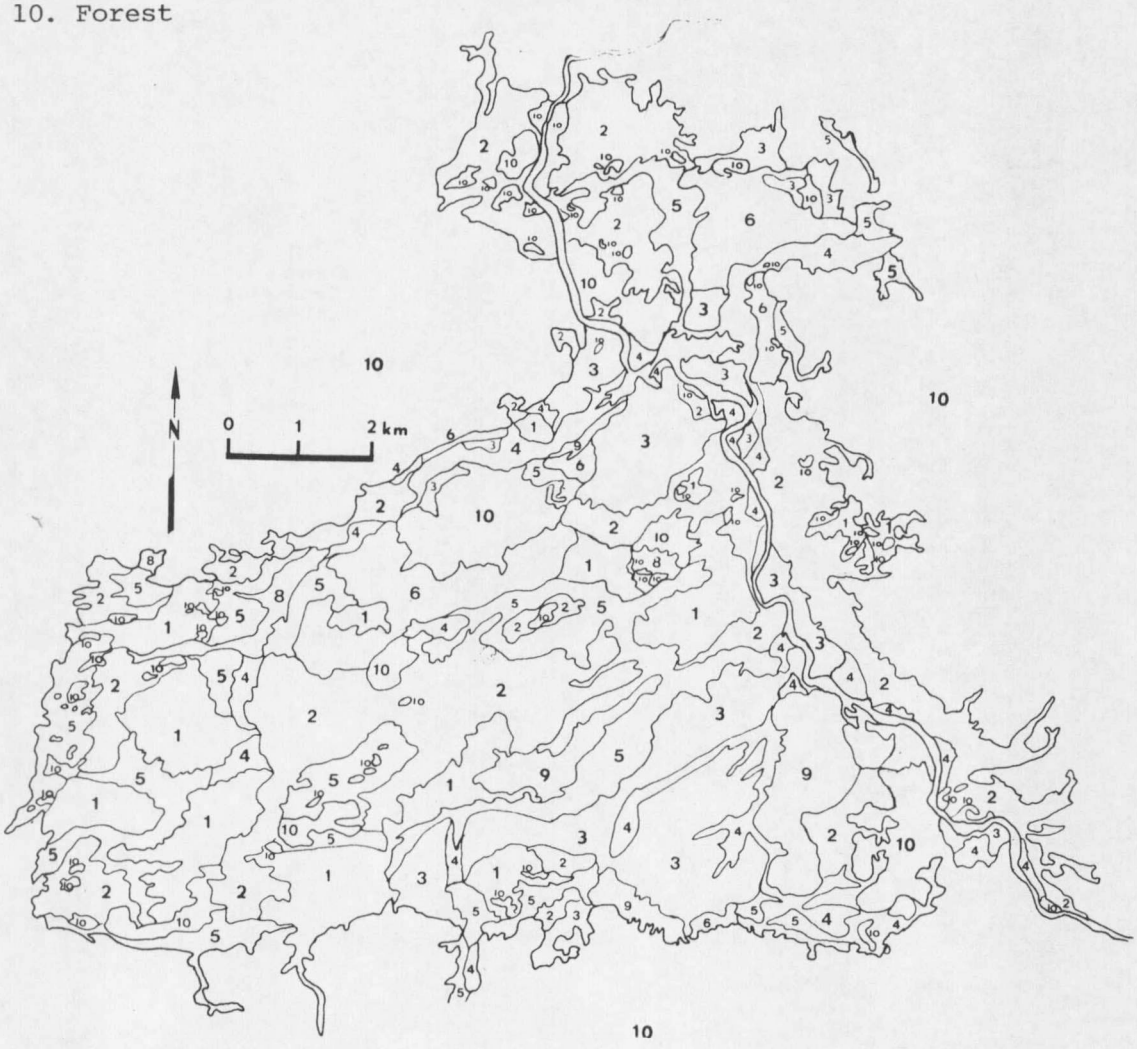


Figure 5. Vegetation units in Hayden Valley.

Table 12. Vegetation units, area (km^2) in Hayden (HV) and Pelican (PV) Valleys and unit characteristics.

Unit No.	Unit	Area km^2 (%) HV	Area km^2 (%) PV	Unit Characteristics
1	Breaks	12.0(12)	0.0	ARTR/FEID, ARCA/FEID v.t.s Bare soil. Slopes = >30°
2	Rolling sage/ grass	25.7(25)	7.4(18)	ARTR/FEID, ARCA/FEID, FEID/DECA, DECA/*Carex* v.t.s. Rolling hills and ridges. Xeric to mesic sites.
3	Mesic sage/ grass	13.3(13)	7.2(18)	ARCA/FEID, DECA/*Carex*, FEID/DECA v.t.s. Flood plain.
4	Hydric grass	7.0(7)	8.2(20)	*Carex* spp. c.t. Pond edges and stream banks.
5	Mesic grass/ sedge	15.4(15)	3.0(7)	DECA/*Carex*, *Carex* spp., FEID/DECA v.t.s. Flood plain.
6	Xeric sage	6.4(6)	1.1(3)	ARTR/FEID, ARCA/FEID v.t.s Ridges, gravel alluvium, till.
7	Hydric	0.0	2.3(6)	ARCA/FEID, DECA/*Carex*; FEID/DECA, *Carex* spp. v.t.s. Flood plain.
8	Thermal	1.3(1)	0.1(0.3)	Thermal areas
9	*Potentilla fruticosa*	4.2(4)	0.0	POFR/FEID h.t. Rolling hills
10	Forest	16.5(16)	11.2(28)	Forest
	Total	101.7	40.5	

Vegetation Type Description

I have identified twelve grass/shrub vegetation types in Pelican and Hayden Valleys. Because the same types were found in both valleys, vegetative characteristics are described jointly. Summary statistics for each vegetation type are presented in Appendix A, Table 18. These data include species composition, average canopy cover in percent and frequency of occurrence of shrubs, graminoids, and forbs. General reconnaissance field data are presented in Appendix C.

Festuca idahoensis/Agropyron smithii-A. dasystachyum (FEID/AGSM-AGDA)h.t. The FEID/AGSM-AGDA h.t. accounts for 4 percent and 1 percent of the non-forested area in Hayden and Pelican Valleys, respectively (Table 13). This type is found on drier, wind swept ridges. It is associated with lacustrine deposits.

Slight pocket gopher activity occurred in 33 percent of the stands. No grizzly bear sign was found in this type.

Poa sandbergii is always present and is the dominant grass. Meuggler and Handl (1974) reported that *Poa cusickii* is associated with or replaces *P. sandbergii* in their habitat classification. *Agropyron dasystachyum* and *Festuca idahoensis* are also always present. *Agropyron smithii* was not present in any of the six stands whereas Mueggler and Handl (1974) reported a 40 percent constancy in ten stands. *Eriogonum umbellatum*, *Antennaria corymbosa* and *Phlox hoodii* are the dominant forbs. No soils data was obtained for this habitat type.

Table 13. Area (km^2) of each vegetation type in Pelican and Hayden Valleys. Number in parentheses indicates percent of total area of shrub/grass vegetation types.

Vegetation Type	Hayden Valley	Pelican Valley
FEID/AGSM-AGDA h.t.	3.7(4)	0.4(1)
FEID/AGCA h.t.	2.5(3)	0.5(2)
ARTR/FEID h.t.	21.3(25)	.2(1)
ARCA/FEID c.t.	22.9(27)	12.8(43)
POFR/FEID h.t.	1.4(2)	0.0
FEID/DECA h.t.	6.5(8)	3.0(10)
DECA/Carex h.t.	14.3(17)	5.5(18)
Carex spp. c.t.	11.7(14)	7.0(24)
Total shrub/grass types	84.3	29.4
Forest	16.3	11.2
Thermal	1.3	.1
Total	101.9	40.7

Festuca idahoensis/Agropyron caninum (FEID/AGCA) h.t. The FEID/AGCA h.t. accounts for 3 percent of the non-forested area in Hayden Valley and 2 percent in Pelican Valley (Table 13). It is usually found on somewhat steeper and drier sites than FEID/DECA h.t. It occurs extensively on the top and north slopes of the east-west ridges in the far northwest corner of Hayden Valley. The FEID/AGCA h.t. occurs primarily on lacustrine deposits.

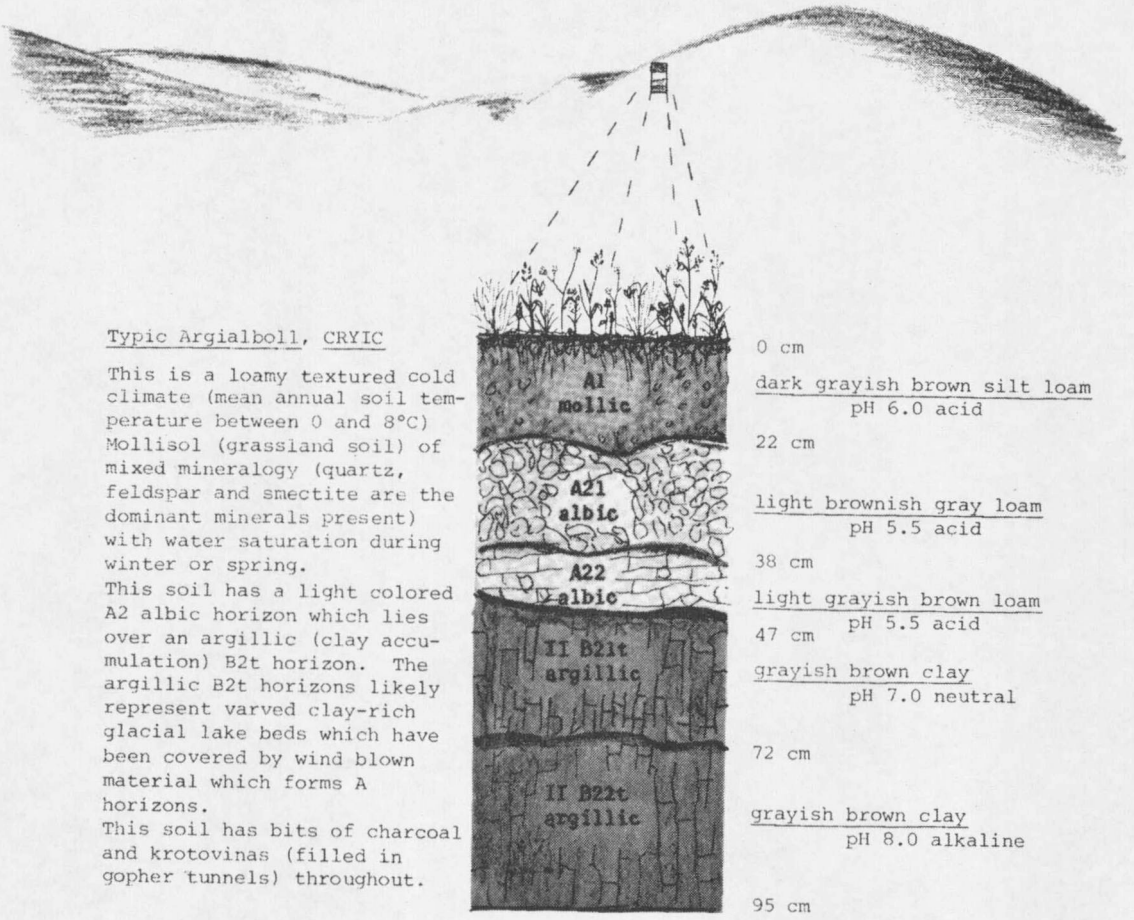
Moderate pocket gopher activity occurred in 82 percent of the stands. Grizzly sign was found in 25 percent of the stands sampled.

The absence of *Deschampsia caespitosa* differentiates the FEID/AGCA h.t. from FEID/DECA h.t. *Festuca idaohensis* is always present and is the dominant grass. Although constantly present, *Agropyron caninum* is less in average percent canopy coverage than either *Danthonia intermedia*, *Bromus carinatus*, *Poa sandbergii*, and *Stipa occidentalis*. *Aster* spp. is the most dominant forb followed by *Perideridia gairdneri*. Other important species are *Achillea millefolium*, *Polygonum douglasii* and *Potentilla gracilis*.

Munn (1977) and Mueggler and Stewart (1977) classified soils from selected stands in the FEID/AGCA h.t. as either Argic or Pachic Cryoborolls. Soil from one FEID/AGCA h.t. stand was classified as Typic Argialboll (Figure 6; Table 4, and Appendix B). The loamy A horizon is 38 cm thick and slightly acidic (pH 5.5). Both the A and B horizons have bits of charcoal and krotovinas scattered throughout.

Soil from 0-10 cm is medium in phosphorus (P) and organic matter content (O.M.) and high in potassium (K). Soil from 10-60 cm depths is high in K but low or very low in both P and O.M. Soils at each depth are high in micronutrients (Zn, Fe, Cu, Mn) and are well below maximum salinity for good vegetation growth.

Artemesia tridentata/Festuca idahoensis (ARTR/FEID) h.t. The ARTR/FEID h.t. accounts for 25 percent of the shrub/grass area in Hayden Valley. The habitat type accounts for only 1 percent of the shrub/grass



Typic Argialboll, CRYIC

This is a loamy textured cold climate (mean annual soil temperature between 0 and 8°C) Mollisol (grassland soil) of mixed mineralogy (quartz, feldspar and smectite are the dominant minerals present) with water saturation during winter or spring.
This soil has a light colored A2 albic horizon which lies over an argillic (clay accumulation) B2t horizon. The argillic B2t horizons likely represent varved clay-rich glacial lake beds which have been covered by wind blown material which forms A horizons.
This soil has bits of charcoal and krotovinas (filled in gopher tunnels) throughout.

Figure 6. Soil profile description of soil site A, Hayden Valley. Principal bear foods: *Melica spectabilis, Erythronium grandiflorum, Perideridia gairdneri, Claytonia lanceolata.*

Table 14. Site soil taxonomic and topographic characteristics and vegetation type for one soil classification site in Hayden Valley (A) and two soil classification sites in Pelican Valley (D,F).

Site	Location	Soil Classification	Elevation (m)	Aspect (°)	Slope (%)	Mid-monthly Soil Temperature June	July	Aug. (°C)	Vegetation Type
A	Hayden Valley	Typic, Argiaboll, cryic	2439	335	23	5.0	12.5	11.5	FEID/AGCA h.t.
D	Pelican Valley	Argiaquic Argiaboll, cryic	2415	35	5	6.0	12.5	11.0	ARCA/FEID c.t.
F	Pelican	Aquic Cryoboroll	2366	320	7	7.5	12.5	12.0	FEID/DECA h.t.

area in Pelican Valley where it is found in small patches in five disjunct locations (Table 13). ARTR/FEID h.t. is found on flat ground and on slopes of all aspects. It usually occupies the position from midslope to ridge top. Two apparently moisture related phases exist in the ARTR/FEID h.t. The more xeric phase occupies windswept ridges and soils associated with till and sand and gravel alluvium. The more mesic sites are associated with lacustrine sediments.

Pocket gopher activity ranging from slight to moderate occurred in 39 percent of the stands sampled. Grizzly sign was found in 7 percent of the stands.

Artemesia tridentata is present in all stands and has an average canopy cover of 44 percent. *Chrysothamnus parryi* is the only other shrub present. On the more xeric sites, *A. tridentata* is scrubby in appearance and about 30 cm high. On the more mesic sites, *A. tridentata* is robust and attains a height of at least 1.3m. Other species common to both the mesic and xeric sites were similarly shorter in stature and less robust on the more xeric sites.

Festuca idahoensis is the dominant graminoid. *Danthonia intermedia* is the other most consistently present grass. *Agropyron caninum, Poa sandbergii, Bromus carninatus, Stipa occidentalis* are common grasses. Common forbs include *Phlox hoodii, Achillea millefolium, Agoseris glauca, Antennaria microphylla, Geum triflorum,* and *Potentilla gracilis.*

Neither soils classification nor soil fertility data were obtained in this habitat type. Soils from representative stands in the ARTR/FEID h.t. were classified by Munn (1977) and Mueggler and Stewart (1977) as Typic Cryoboralf and Pachic Cryoboroll. Their soils were slightly acid to neutral in reaction.

Artemesia cana/Festuca idahoensis (ARCA/FEID) c.t. The ARCA/FEID c.t. was not recognized by Mueggler and Handl (1974) as a habitat type because of its sparse occurrence in western Montana. It is widely distributed in both Hayden and Pelican Valleys and elsewhere in

Yellowstone National Park. Because of its importance in the Park, the ARCA/FEID c.t. may warrant recognition as a habitat type (W. F. Mueggler, 1976, Personal Communication).

The ARCA/FEID c.t. accounts for 27 percent and 43 percent of the shrub/grass area in Hayden and Pelican Valleys, respectively (Table 13). It is found on lower slopes as a narrow band separating the ARTR/FEID h.t. from the FEID/DECA h.t. in Hayden Valley and the FEID/AGCA h.t. from the FEID/DECA h.t. in Pelican Valley. It also occurs extensively on gently rolling hills and flat bottom lands. More mesic ARCA/FEID h.t. sites are associated with lacustrine deposits and more xeric sites are associated with sand and gravel alluvial deposits.

Pocket gopher activity ranging from slight to heavy appeared in 82 percent of the stands sampled. Grizzly bear sign was found in 15 percent of the stands.

Artemesia cana is the only shrub present and has an average canopy cover of 34 percent. *Festuca idahoensis* is the dominant grass. *Agropyron caninum* is usually present and *Deschampsia caespitosa* is common. Where *D. caespitosa* is present, the primary difference in vegetation composition between the ARCA/FEID c.t. and FEID/DECA h.t. appears to be the presence of *A. cana*. Other important grasses are *Melica spectabilis, Stipa occidentalis, Poa sandbergii,* and *Poa scabrella*. Important forbs include *Achillea millefolium, Agoseris glauca, Potentilla gracilis, Perideridia gairdneri,* and *Polygonum douglasii*.

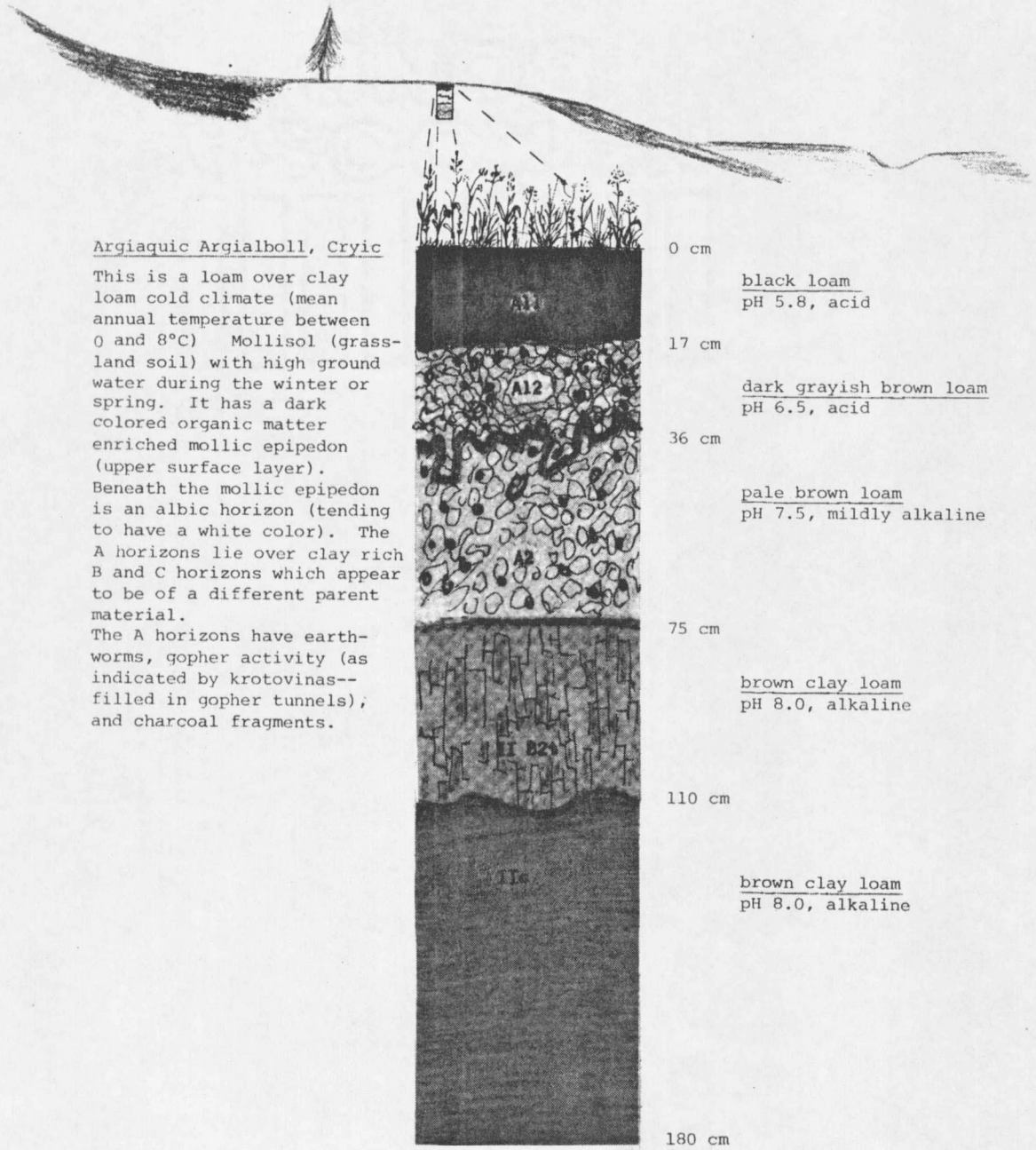
Soil from one ARCA/FEID c.t. stand was classified as Argiaquic Argialboll, Cryic (Figure 7, Table 14, and Appendix B). The loamy horizon is acidic (pH 5.8-6.5) to 36 cm and then mildly alkaline (pH 7.5) to 75 cm. The A horizon has krotovinas and charcoal fragments scattered throughout.

Soil is high in phosphorus from 0-60 cm and high in potassium and organic matter to 10 cm. Soils from 10-60 cm are medium in potassium and high in micronutrients (Zn, Fe, Cu, Mn). Organic matter is medium from 10-30 cm and very low from 30-60 cm. Salinity is well below the maximum for good vegetation production.

Potentilla fruticosa/Festuca idahoensis (POFR/FEID) h.t. The POFR/FEID h.t. is found only in the southeastern portion of Hayden Valley and accounts for only two percent of the total shrub/grass area (Table 13). It is found on the north and west facing slopes and on lower southeast and east facing slopes. The POFR/FEID h.t. occurs primarily on lacustrine deposits.

Generally slight pocket gopher activity was present in 31 percent of the stands. No grizzly bear sign was found in the POFR/FEID h.t.

Potentilla fruticosa is always present and has an average canopy coverage of 25 percent. *P. fruticosa* is the only shrub in the POFR/FEID h.t. described by Mueggler and Handl (1974). In addition to three other shrubs, *Artemesia cana* and *A. tridentata* were found in 38



Argiaquic Argialboll, Cryic

This is a loam over clay loam cold climate (mean annual temperature between 0 and 8°C) Mollisol (grassland soil) with high ground water during the winter or spring. It has a dark colored organic matter enriched mollic epipedon (upper surface layer). Beneath the mollic epipedon is an albic horizon (tending to have a white color). The A horizons lie over clay rich B and C horizons which appear to be of a different parent material.
The A horizons have earthworms, gopher activity (as indicated by krotovinas--filled in gopher tunnels), and charcoal fragments.

Figure 7. Soil profile description of soil site D, Pelican Valley. Principal bear foods: *Melica spectabilis, Perideridia gairdneri.*

and 15 percent, respectively, of the stands sampled. The association of *A. cana* and *P. fruticosa* has also been observed in drainages either in or adjacent to the northern end of Yellowstone National Park (W. F. Mueggler, 1976, Personal Communication).

Deschampsia caespitosa is the dominant grass followed by *Agropyron caninum* and *Festuca idahoensis*. Other important grasses are *Calamagrostis* and *Danthonia intermedia*. *Poa cusickii* is the most abundant *Poa*. *Achillea millefolium*, *Agoseris glauca*, *Antennaria corymbosa*, *Aster foliaceus*, *Geum triflorum*, *Potentilla gracilis*, *Polygonum bistortoides* are the most important forbs.

No soils data was obtained from the POFR/FEID h.t.

Festuca idahoensis/Deschampsia caespitosa (FEID/DECA) h.t. FEID/DECA h.t. accounts for about a tenth of the shrub/grass areas of the two valleys (Table 13). It is found in narrow bands bordering timber edges, occasionally in drier swales and depressions, and in small patches in a mosaic pattern with ARCA/FEID h.t. It is also found as narrow bands along lower edges of slopes of all aspects which separate ARCA/FEID h.t. on upper slopes from DECA/*Carex* h.t. in bottoms of draws. The FEID/DECA h.t. is associated primarily with lacustrine deposits.

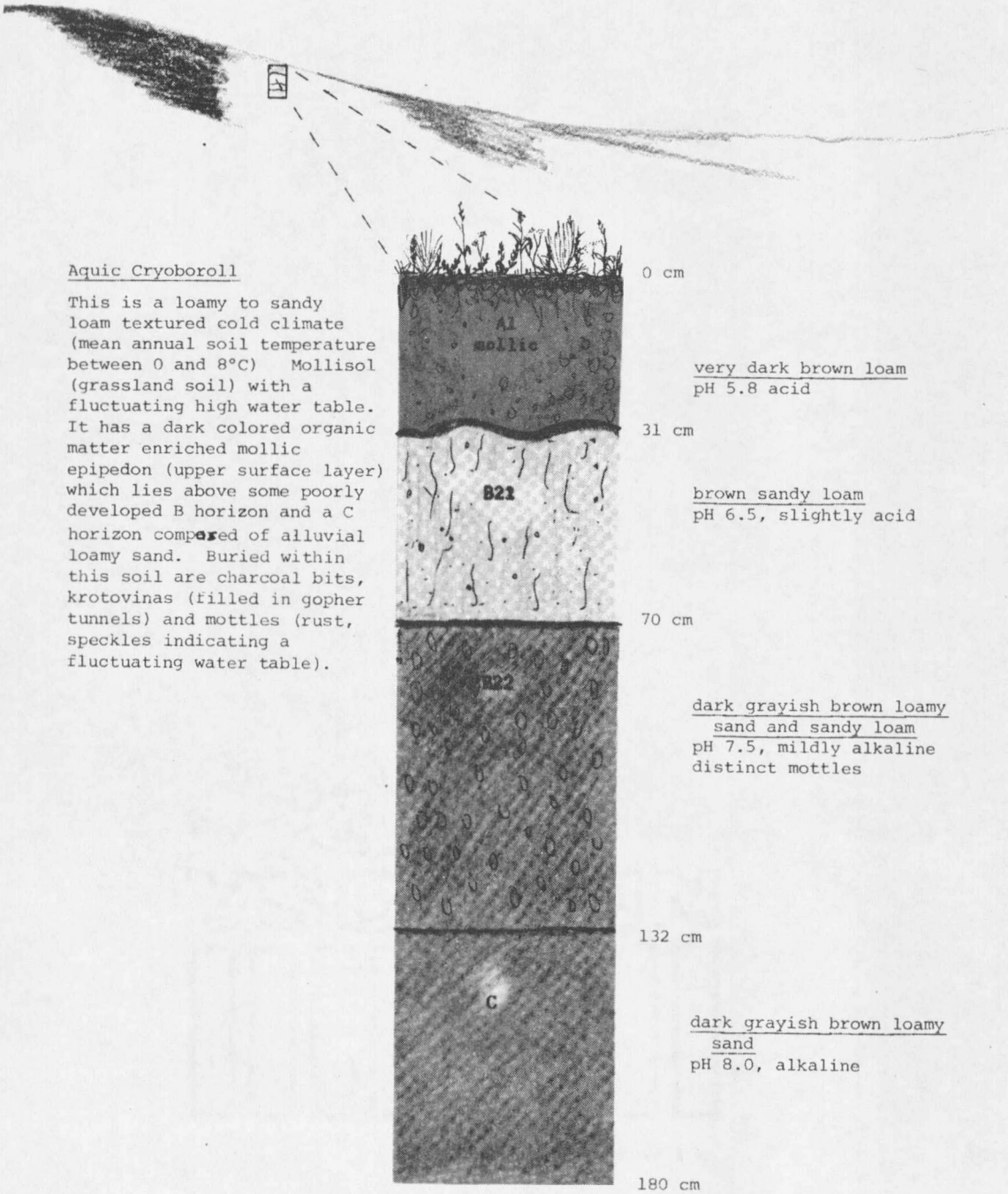
Pocket gopher activity ranging from slight to very heavy occurred in 59 percent of all stands. Grizzly sign was found in 22 percent of stands sampled.

Deschampsia caespitosa is the dominant grass followed by *Festuca idahoensis*. Other important grasses include *Agropyron caninum*, *Melica spectabilis*, *Danthonia intermedia*, *Phleum alpinum*, and *Stipa occidentalis*. Important forbs include *Achillea millefolium*, *Antennaria microphylla*, *Agoseris glauca*, *Cirsium foliosum*, *Perideridia gairdneri*, *Potentilla gracilis*, *Polygonum bistortoides*, and *Trifolium* spp.

Soil from one FEID/DECA h.t. stand was classified as Aquic Cryoboroll (Figure 8, Table 14 and Appendix B). The acidic (pH 5.8) loamy A horizon is 31 cm thick. Mottles throughout the soil indicates a fluctuating water table. Charcoal bits and krotovinas occurs throughout.

Soils from 0-10 cm on this site and sites E and I are very low to medium in phosphorus. Soils from 10-60 cm are medium in both potassium and organic matter. Soils at each depth are high in micronutrients (Zn, Fe, Cu, Mn) and were well below maximum salinity for good vegetation production.

Deschampsia caespitosa/Carex spp. (DECA/*Carex*) h.t. The DECA/*Carex* h.t. accounts for 17 and 18 percent of the shrub/grass areas of Hayden and Pelican Valleys, respectively (Table 13). It is found



Aquic Cryoboroll

This is a loamy to sandy loam textured cold climate (mean annual soil temperature between 0 and 8°C) Mollisol (grassland soil) with a fluctuating high water table. It has a dark colored organic matter enriched mollic epipedon (upper surface layer) which lies above some poorly developed B horizon and a C horizon composed of alluvial loamy sand. Buried within this soil are charcoal bits, krotovinas (filled in gopher tunnels) and mottles (rust, speckles indicating a fluctuating water table).

Figure 8. Soil profile description of soil site F, Pelican Valley. Principal bear foods: *Melica spectabilis, Perideridia gairdneri.*

primarily adjacent to streams or *Carex* communities bordering streams, in swales between ridges, or in run-in sites. The DECA/*Carex* h.t. is primarily associated with humic alluvial deposits.

Pocket gopher activity occurred in 17 percent of the stands sampled. Activity was slight in all stands except two where heavy activity was recorded. Grizzly sign was found in 7 percent of the stands.

The absence of *Festuca idahoensis* differentiates the DECA/*Carex* h.t. from the FEID/DECA h.t. *Deschampsia caespitosa* is the dominant graminoid. Carices are always present. *Trisetum wolfii* and *Phleum alpinum* are common. Important forbs are *Potentilla gracilis*, *Polygonum bistortoides*, and *Perideridia gairdneri*.

No soils data was obtained for this habitat type.

Carex spp. c.t. No *Carex* spp. c.t. was described by Mueggler and Handl (1974). In this study all communities dominated by carices and which could not be keyed to another habitat type were included in a broad *Carex* spp. c.t.

The *Carex* spp. c.t. accounts for 14 and 24 percent of the shrub/grass area of Hayden and Pelican Valleys, respectively (Table 13). The *Carex* spp. c.t. is found primarily along stream banks, in depressions and run-in sites which remain flooded throughout most of the summer, and at the edges of standing pools of water. The community

type is most prevalent along Pelican Creek and its tributaries, and at the mouths of Sour, Alum, Trout, and Elk Antler Creeks in Hayden Valley. The habitat type is primarily associated with humic alluvium.

Neither pocket gopher activity nor grizzly sign was found in any stands.

Carex rostrata, *C. aquitilis*, and *Calamagrostis canadensis* are the dominant graminoids. Several stands consist of *C. rostrata* and/or *C. aquitilis* exclusively. These stands occur in areas of very slow running or standing water which dried later in the summer. Forbs are usually abundant in stands found along moderately flowing streams in soils with moderate drainage.

No soils data was obtained for this community type.

Trifolium spp. c.t. Nearly pure stands of clover (*Trifolium repens* and *T. hybridum*) occur as inclusions within or bordering the DECA/*Carex* h.t. They range in size from about 45 m^2 to 470 m^2 and account for less than 0.5% of the total area. Four clover stands are located on the north central edge of Pelican Valley on upper Astrigent and Pelican Creeks. Grizzly bears extensively grazed the Pelican Valley stands beginning the second week in August. Bison and elk competition eliminated the clover stands in Hayden Valley as a grizzly food source.

Betula glandulosa c.t. A pure stand of *Betula glandulosa* is found along upper Sour Creek in eastern Hayden Valley. This stand had no apparent value to grizzly bears.

Salix spp. c.t. Small stands of *Salix scouleriana* and *S. wolfii* occur intermittently along streams and on seep sites. No evidence of bear use of these sites was found.

Scirpus olneyi c.t. and *Juncus balticus* c.t. One small stand consisting exclusively of *Scirpus olneyi* is located along a small stream in the north central portion of Hayden Valley. This species was not found elsewhere in either valley.

A large pure stand of *Juncus balticus* is located in Hayden Valley near the mouth of Alum Creek. Although no other pure extensive stands of *J. balticus* was found in either valley, the species commonly occur within other communities.

Grizzly sign was not found in either stand.

Production of Herbaceous Species

Standing crop estimates of graminoids within five vegetation types in Pelican and Hayden Valleys made at the end of the growing season, 1976, are presented in Table 15.

Carex aquitilis, C. rostrata and *Calamagrostis canadensis* were the principal species found in the *Carex* spp. c.t. The *Carex* spp. c.t.

Table 15. Estimates of the standing crop of graminoids available at the end of the growing season, 1976, from twenty 2x5 dm plots at four sampling sites in each habitat type.

Vegetation Type	Standing Crop Mean (kg/ha)	SD	Estimated Area of Habitat Type[1] (km^2)	Total Available Forage (kg)[2]
FEID/ AGCA h.t.	550	223	3.0	1,650
ARCA/ FEID c.t.	949	469	35.7	33.879
FEID/ DECA h.t.	1,363	719	9.5	12,949
DECA/ *Carex* h.t.	2,267	544	19.7	44,660
Carex spp. c.t.	4,709	2,118	18.7	88,058

[1]Area of Pelican and Hayden Valleys combined.

[2]Total available forage = mean standing crop x area of habitat type.

was the most productive of any of the five types and was more than twice as productive as the nearest *Deschampsia caespitosa/Carex* h.t.

The DECA/*Carex* h.t., consisting primarily of *Deschampsia caespitosa* and *Carex* spp., produced 2,267 kg/ha. Mueggler and Stewart (1977) reported production of 2,906 kg/ha on one site, 99 percent of which were graminoids.

The *Festuca idahoensis/Deschampsia caespitosa* h.t., whose principal grasses were *Festuca idahoensis, Deschampsia caespitosa* and *Agropyron caninum* produced 1,363 kg/ha. Mueggler and Stewart (1977) estimated (but did not measure) that total production for the FEID/DECA h.t. ranged between 1,300 and 1,700 kg/ha, equally divided between graminoids and forbs.

The *Artemesia cana/Festuca idahoensis* c.t., whose principal grasses included those found in the FEID/DECA h.t. plus *Stipa occidentalis* and *Bromus carinatus*, produced only .8 as much per hectare as did the FEID/DECA h.t. However, it produced in excess of 2.5 times as much total standing crop due to the much larger area it covered.

The *Festuca idahoensis/Agropyron caninum* h.t., whose principal grasses were *Festuca idahoensis, Agropyron caninum, Stipa occidentalis,* and *Bromus carinatus* was the least productive.

Underground standing crop estimates for *Melica spectabilis, Perideridea gairdneri* (yampa) and *Claytonia lanceolata* within three major habitat types available at the end of the growing season, was estimated (Table 16). Underground production of *M. spectabilis* was the greatest of the three species. Standing crop was about equal for the ARCA/FEID c.t. and FEID/DECA h.t. However, the total standing crop of *M. spectabilis* in the ARCA/FEID c.t. was nearly four times more than in the FEID/DECA h.t. due to the larger acreage in the ARCA/FEID c.t. *M. spectabilis* was least abundant in the FEID/AGCA h.t.

P. gairdneri was most abundant in the FEID/AGCA h.t. but the small area of this habitat type resulted in the least standing crop. Yampa was least abundant in the ARCA/FEID c.t. but the large area of this type resulted in the greatest standing crop of 1,645 kg.

Table 16. Estimates of underground standing crop at the end of the growing season of *Melica spectabilis*, *Perideridia gairdneri* and *Claytonia lanceolata* in three habitat types estimated from twenty 2x5 dm plots at each sampling site. Numbers in parentheses indicate number of sampling sites in each habitat type.

Plant Species and Vegetation Type	Standing Crop Mean (kg/ha)	SD	Estimated Area[1] of Habitat Type (hectares)	Total Available (kg)
Melica spectabilis				
FEID/AGCA (1)	110	115	3.0	330
ARCA/FEID (1)	164	176	35.7	5,738
FEID/DECA (5)	165	133	9.5	1,568
Perideridia gairdneri				
FEID/AGCA (1)	65	41	3.0	195
ARCA/FEID (1)	47	57	35.7	1,645
FEID/DECA (5)	60	54	9.5	570
Claytonia lanceolata				
FEID/AGCA (1)	96	79	3.0	288
ARCA/FEID (1)	Trace			
FEID/DECA (5)	Trace			

[1]Area of Pelican and Hayden Valleys combined.

C. lanceolata occurred in only trace amounts in the ARCA/FEID c.t. and FEID/DECA h.t., but was present in large amounts in the FEID/AGCA h.t.

Both above and below ground standing crop estimates are minimum figures because samples were collected in the fall after some deterioration and utilization by ungulates, rodents, bears and insects.

Soil Moisture

Seasonal soil moisture trends at depths of 10, 30 and 60 cm were determined at nine sites (Figure 9 and Table 17) representing three vegetation types. Two sites were located at the Violet Springs area of Hayden Valley, the remainder were in Pelican Valley. All but site B in Hayden Valley were sites of intensive grizzly bear digs.

Soil parent material of sites A and B in Hayden Valley are lacustrine. Parent material of sites C and D in Pelican Valley is glacial till. Parent material for other Pelican Valley sites is either alluvium or lacustrine.

Soil moisture remained at 0.5 ATM stress for all soils and depths until late June. At 10 cm soils at four sites exceeded 15 ATM stress during August. Sites E and H in Pelican Valley did not reach 15 ATM at 10 cm. Site H was subirrigated and remained relatively moist throughout the season. Moisture trend at 10 cm was not obtained for Site B, a non-bear use site in Hayden Valley.

Soil moisture at 30 cm at sites G, H, and I remained at 0.5 ATM or less for nearly the entire season and never exceeded 1 ATM at any time. Soils at 30 cm at sites B, C, and D experienced moisture stress of 15 ATM about mid-August or early September.

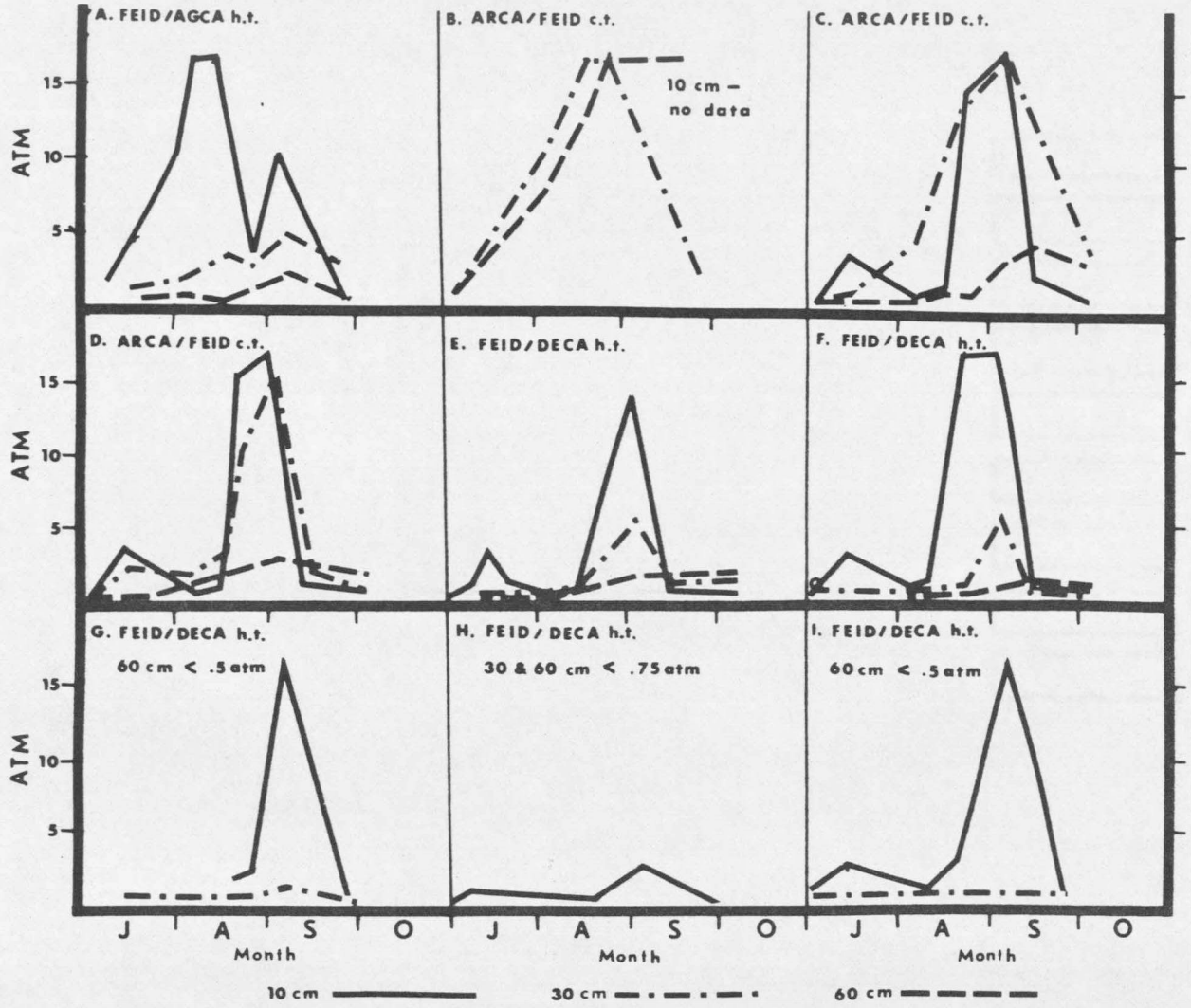


Figure 9. Seasonal soil moisture trends on nine sites at depths of 10, 30, and 60 cm in Pelican and Hayden Valleys, 1976.

Table 17. Soil moisture trend site location, topography and vegetation type.

Soil Site	Location	Topography		Vegetation Type
		Aspect	Slope(°)	
A	Hayden	NW	11	FEID/AGCA h.t.
B	Hayden	SE	11	ARCA/FEID c.t.
C	Pelican	NW	4	ARCA/FEID c.t.
D	Pelican	NE	2	ARCA/FEID c.t.
E	Pelican	NW	5	FEID/DECA h.t.
F	Pelican	N	3	FEID/DECA h.t.
G	Pelican	NW	3	FEID/DECA h.t.
H	Pelican	NE	6	FEID/DECA h.t.
I	Pelican	W	6	FEID/DECA h.t.

Soils moisture at 60 cm at sites G, H, and I remained about 0.5 ATM throughout the season. Soil moisture at all other sites remained below 4 ATM throughout the season except at site B where soil moisture reached 15 ATM during the fourth week in August. Fifteen ATM was reached during the first week in August and was maintained at least until the third week in September.

The Hayden Valley sites (A and B) are opposite each other on adjacent east-west parallel ridges. Soil moisture stress at north facing site A never exceeded 5 ATM at lower depths whereas at south facing site B soil moisture experienced 15 ATM stress about mid-August. Soils at the lower depths at site A are clay or clay loam. It is

suspected that they are the same at site B. The clayey texture combined with the south exposure probably accounts for the severe stress conditions on site B. Soil moisture at site B reached 15 ATM at the 30 cm depth about one week earlier than at the 60 cm depth. This agrees with Mueggler (1971) who showed that moisture became limiting for plants one to two weeks earlier at the 20 cm depth than it did at 50 cm on a southwest exposure at 2164 meters. He also showed that at 50 cm moisture became limiting about a week earlier on southwest exposures than they did on northeast exposures. My data showed that moisture at 60 cm was never limiting on the north exposure, site A.

Based on two adjacent soil moisture sampling sites soils in Hayden Valley which reached 15 ATM did so 2 to 2-1/2 weeks prior to any soils in Pelican Valley at corresponding depths. Hayden Valley soils generally maintained severe moisture stress (15 ATM or greater) about two weeks longer than soils at corresponding depths in Pelican Valley. A possible difference of 26 cm precipitation between the two valleys may explain the relative lengths of the drought periods. According to a zonal precipitation map prepared by Farnes (1975), most of Hayden Valley falls within a 30 in. (76 cm) precipitation zone and most of Pelican Valley falls within a 40 in. (102 cm) zone.

DISCUSSION

Bears were predictably present in Hayden and Pelican Valleys in the spring until the end of the first week in June. They arrived back in the valleys about the second week in August. During both 1975 and 1976 bears dug for gopher caches in the spring along the southern edge of Pelican Valley and in the northwest corner of Hayden Valley. Bears returned to the valleys in late summer and fall to forage in the clover patches in the north central portion of Pelican Valley, to dig yampa roots throughout the edges of the entire valley and to occasionally dig for gopher caches. Similar seasonal changes in habitat and elevation in response to food availability have been reported for grizzly bears by Pearson (1975), Martinka (1972,1974), Berns and Hensel (1972), and Mundy and Flook (1973).

The type of feeding activity and place of use in Pelican and Hayden Valleys remained the same both years. Weather and plant phenology may influence intensity of bear use of the valleys in successive years. The valleys in 1975 were characterized by low bear use, greater snow fall and late phenology. In 1976 they were characterized by high bear use, lesser snow fall, and earlier more normal phenology. Intensity of grizzly bear use of the valleys was much lower in 1975 than in 1976. Sixty-five observation sites were recorded in 1975 compared to 185 in 1976. Three instances of bears grubbing for yampa roots were observed in 1975 as opposed to 24 in 1976. About 4.4 more inches of precipitation in the form of snow fell at the Lake weather station in the

winter 1974-75 than in the winter 1975-76 (U.S. Department of Commerce, 1969-76). Snow was abundant in Pelican Valley as late as July 21, 1975 but was virtually melted by mid-June 1976. *Erythronium grandiflorum*, an early spring plant, was in bloom throughout the valleys in late July 1975 but was gone by late June 1976. Plant phenology in general appeared to be at least one month behind normal years in 1975 (Cole, 1975, Personal Communication).

Perhaps fluctuations in microtine numbers as well as availability of forage determined by weather patterns influence bear use of the valleys in a given year. In 1975 I found little evidence of an abundance of microtines. In 1976, however, I noted several microtine trails and nests. Some digs in 1976 indicated bears were seeking microtines for food where as no such evidence was found in 1975. Mealey (1975) observed that bears readily sought microtines for food in Hayden Valley in 1974.

Grizzlies appeared to be grubbing exclusively for yampa roots in the fall of the year. Mealey (1975) reported both spring beauty and grasses to be the most important food items in the grizzlies' diet during June, July and August in the mountainous areas in Yellowstone. Yampa is nutritionally superior to the other species. Its high sugar content may be of value in the deposition of fat prior to denning. The use of *Melica* or spring beauty, should it occur, may be related to the

lack of availability of alternate food sources or to the exploration of alternate food sources.

Competition as well as environmental factors influence seasonal abundance of food. Bison and elk appeared to compete heavily with bears for succulent grasses and forbs. In Pelican Valley domestic horses probably were more competitive with grizzlies for clover than were wild ungulates. A series of small clover patches along the north central edge of the valley provide a readily available source of succulent forage. In both years, horses of outfitters eliminated clover as a grizzly food source at these sites after the opening of the fishing season in August.

Both the quality and the quantity of food changes from year to year and season to season. As was hypothesized for black bears (Amstrup and Beecham, 1976), the patch feeding strategy which I observed may be an evolutionary adaptation by grizzlies to insure that all potentially available food sources would be explored. Amstrup and Beecham concluded that "familiarity gained by exploration should result in greater long-term efficiency in exploiting the environment."

My data indicates grizzlies prefer feeding sites in close proximity to timber because timber serves as escape cover and because in late summer and fall quality forage determined by moisture and protein content is restricted to forest types or adjacent stream side locations. These observations suggest that grizzlies will emphasize foraging in

forest types or on streams immediately adjacent to timber edge, if the need by grizzlies for escape cover is a valid assumption. This forest edge foraging strategy would also tend to bring them into closer contact with rutting elk in the fall which are an additional potential food source as the rutting season progresses.

Eighty-two percent of the grizzly observation sites were located in Pelican Valley compared with only 18 percent in Hayden Valley. The difference in use of the two valleys may be due to the interaction of several factors. First, Pelican Valley has only one-third the non-forest land that Hayden Valley has. Secondly, Pelican Valley (primarily the southern edge) provides 4.7 km of timber/grassland edge per square kilometer of non-forest land, whereas Hayden Valley provides only 1.0 km of edge per square kilometer of non-forest land. The much greater timber/grassland edge in Pelican Valley effectively divides Pelican Valley's land mass into smaller ecological units than are found in Hayden Valley. Third, the *Artemesia tridentata/Festuca idahoensis* h.t. is unimportant for grizzlies in both valleys. Only two percent of all grizzly observation sites were found in the big sage type. Twenty-one percent of the vegetation in Hayden Valley is the ARTR/FEID type, whereas this type comprises only 0.2 percent of the vegetation types in Pelican Valley. The great number of grizzlies observed in the past in Hayden Valley (Cole, 1971; Hornocker, 1962; Craighead and Craighead, 1971) was probably more related to the presence of garbage

dumps at Trout Creek and Canyon Village rather than to the inherent quality of Hayden Valley as grizzly habitat. Summer distribution of a large number of grizzlies in Glacier National Park, Canada was also apparently related to the distribution of garbage dumps (Mundy and Flook, 1973).

Soils may be a valuable tool used with vegetation for determining potential grizzly bear habitat in valley habitats. Because of their relatively stable features, soils are a reliable criterion by which areas whose vegetation has been altered by man's influence or by succession can be compared in terms of potential.

Low lying, poorly drained sites, whose parent material is most likely humic alluvium, appear unsuitable gopher habitat. Gopher activity is found on upland well drained sites. The three soil profiles suggest that these upland sites have relatively thick, loose surface layers whose texture and consistencies make them suitable for soil moisture retention and production of preferred gopher foods. Perhaps the significant import of soils for grizzlies lies in the relationship between soils, vegetation and pocket gophers.

Plant available soil water was about the same in all three classified soils. Both taxonomic units, alboll and aquic boroll are indicators of significant quantities of soil water in the profile (L. Munn and C. Montagne, 1976, Personal Communication). Soil moisture also indicated a high degree of available water throughout most of the

summer at depths of 30 and 60 cm. Additionally, digging site selectivity was apparent on east-west ridges in the northwest corner of Hayden Valley. All bear digs were found on north aspects or ridge tops. Based on one set of soil moisture blocks (Figure 4,B), the south aspects were depleted of plant available moisture by the second week in August. The tendency of bears to select dig sites with ample plant available water suggests a hypothesis of an indirect relation between soil water storage capacity and bear use.

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APPENDICES

APPENDIX A

VEGETATION SUMMARY DATA

Table 18. Frequency of occurrence (percent) and average canopy cover (percent) of important plants in the following vegetation types within Pelican and Hayden Valleys summarized from general reconnaissance data: *Festuca idahoensis/Agropyron smithii-A. dasystachyum, Festuca idahoensis/Agropyron caninum, Artemesia tridentata/Festuca idahoensis, Artemesia cana/Festuca idahoensis, Potentilla fruticosa/Festuca idahoensis, Festuca idahoensis/Deschampsia caespitosa, Deschampsia caespitosa/Carex* spp., *Carex* spp. Numbers in parentheses indicate number of stands sampled.[1]

Taxa	Vegetation Type							
	FEID/ AGSM-AGDA (6)	FEID/ AGCA (12)	ARTR/ FEID (28)	ARCA/ FEID (52)	POFR/ FEID (13)	FEID/ DECA (41)	DECA/ CAREX (60)	CAREX (28)
Shrubs			100/45	100/34	100/35	7/1	17/5	21/5
Artemesia cana				100/34	38/4			
A. tridentata			100/44		15/6			
Chrysothamnus parryi			18/.8					
Lonicera caerula					8/3	5/.5	7/.3	
Potentilla fruticosa					100/25			
Rosa woodsii						2/4	13/2	18/2
Salix scouleriana					8/1	5/.5	7/3	11/3
S. wolfii					8/3			
Vaccinium myrtillus								
Graminoids	100/28	100/44	100/42	100/63	100/73	100/59	100/85	100/96
Agropyron caninum		100/7	64/4	79/7	92/23	63/7	37/2	
A. dasystachyum	100/5	8/.3	7/.2	10/.7		10/.6		
Agrostis exarata								7/.7
A. scabra			4/T	4/.4			12/.7	
Alopecurus alpinus							27/3	
Bromus spp.	33/.6							
B. carinatus		50/10	39/4	48/6	15/.5	41/4	10/2	
Calamagrostis canadensis		8/.3		6/.8	62/17	22/2	38/23	35/22

Table 18 (cont.)

Taxa	Vegetation Type							
	FEID/ AGSM-AGDA (6)	FEID/ AGCA (12)	ARTR/ FEID (28)	ARCA/ FEID (52)	POFR/ FEID (13)	FEID/ DECA (41)	DECA/ CAREX (60)	CAREX (28)
Graminoids (cont.)								
Carex spp.		8/1	29.2	4/.1	38/4	17/2	14/4	4/2
C. anthrostachya							34/6	7/3
C. aquatilis							36/12	65/36
C. geyeri		8/.3	21/3			2/.9		
C. hoodii				4/.1				
C. microptera		25/.6	4/.1	8/.2		22/4	47/12	25/6
C. neurophora								7/4
C. paysonis						7/.6		
C. platyepsis	67/2	25/2	14/2	46/4		66/5	20/19	
C. praegracilis							2/2	
C. raynoldsii		8/1	11/.7	33/2	23/.3	41/3	7/.1	
C. rossii			4/1					
C. rostrata							13/3	68/35
C. stenoptila				4/.1	23/.7			
Danthonia californica							2/.7	
D. intermedia	33/1	25/8	46/8	37/4	54/4	37/6	3/.3	
Deschampsia caespitosa				65/13	100/26	100/25	100/29	
Festuca idahoensis	100/11	100/22	100/18	100/31	100/22	100/19		
Glyceria elata								9/4
Hierochloe odorata					15/.1	5/.1	3/.2	
Hordeum brachyantherum						2/4	32/8	4/2
Juncus spp.	33/1			2/.1	15/1	7/.2	7/.4	
J. balticus			7/.1	2/.1	8/2	10/1	3/.5	
J. ensifolius							2/.1	7/.7
J. mertensianus								7/.2
Koeleria cristata	33/3	8/1	29/1	8/.2	23/.1	7/.2		
Luzula campestris					31/2	24/3	7/.1	4/1

Table 18 (cont.)

Taxa	Vegetation Type							
	FEID/ AGSM-AGDA (6)	FEID/ AGCA (12)	ARTR/ FEID (28)	ARCA/ FEID (52)	POFR/ FEID (13)	FEID/ DECA (41)	DECA/ CAREX (60)	CAREX (28)
Graminoids (cont.)								
Luzula glabrata							5/.1	
Melica spectabilis		42/4	21/2	48/3		56/4	14/.5	
Phleum alpinum		17/5	4/.1	27/2	15/1	46/3	55/5	7/.7
Poa spp.		8/1	14/.3	2/.1				
P. cusickii	50/4	25/3	18/1	13/.5	38/2	27/1		
P. fendleriana			19/.8					
P. palustris							23/1	4/.1
P. interior	17/.1							
P. nervosa		8/.3		2/.1				
P. nevadensis				19/2		5/T		
P. reflexa		8/T						
P. sandbergii	100/13	42/9	43/3	40/3	40/.6	15/1		
P. scabrella		33/.4	29/5	27/3		34/3	8/.6	
Stipa occidentalis		75.9	39/1	68/8	8/1	46/3	3/.3	
Trisetum spicatum							2/.3	4/.6
T. wolfii		8/.3		8/.4		17/2	45/8	4/.1
Forbs	100/34	100/53	100/41	98/60	100/59	100/62	100/64	68/31
Achillea millefolium	50/2	83/12	64/4	96/14	100/10	88/12	30/4	
Aconitum columbianum					15/1		3/.5	11/.3
Agoseris aurantica				4/.4	8/T	7/T	5/.1	
A. glauca	50/2	50/4	61/7	71/9	69/6	76/9	37/3	
Allium brevistylum							2/.1	7/.7
A. geyeri						12/.9	7/.4	
Androsace septentrionalis					8/T	7/.1		
Angelica pinnata							7/.4	11/.6
Antennaria corymbosa			7/1	8/.7	8/.2		23/4	7/.7

Table 18 (cont.)

Taxa	Vegetation Type							
	FEID/ AGSM-AGDA (6)	FEID/ AGCA (12)	ARTR/ FEID (28)	ARCA/ FEID (52)	POFR/ FEID (13)	FEID/ DECA (41)	DECA/ CAREX (60)	CAREX (28)
Forbs (cont.)								
Antennaria microphylla	100/11	67/10	79/8	62/11	46/10	88/17		
Arabis drummondi	17/.1	25/.1	43/.2	38/.4	8/.2	20/.2	9/.1	
Arenaria congesta	17/.1	8/T	32/1					
Arnica chamissonis							5/.4	
A. mollis							5/.4	7/1
Aster spp.			18/4	67/15		37/4	32/9	
A. campestris	50/3	33/5	18/1	17/11		17/1		
A. foliaceus		58/19	7/.1	21/5	77/11	49/11	57/15	29/3
A. occidentalis				10/.3				
Astragalus miser	33/1		25/.7	19/.7	23/1			
A. tegetarius	50/6	8/1	21/2					
Barbarea orthoceras		8/T				10/.1		
Besseya wyomingensis			4/.1			2/.1	5/.6	
Campanula rotundifolia			4/T			7/.5		
Castilleja pallescens	17/5		25/.1	10/.1				
C. rhexifolia							5/.3	7/2
Cerastium arvense		42/2	57/2	40/3	77/2	41/1		
Cirsium foliosum		67/1	39/1	81/2	46/1	66/1	18/.5	7/.1
Claytonia lanceolata		8/.3			31/2	10/1		
Collomia linearis				2/.3	23/.1	5/.2		
Cruciferae			7/.2	6/.3	8/T			
Delphinium bicolor			11/.3	13/1	8/1	5/T		
D. occidentale	17/.1		21/.4	37/2	31/4	10/.4		
Descurainia richardsonii				8/.1				
Dodecatheon pulchellum	17/.5	8/T	7/.2		8/1	7/.2	3/.1	
Draba stenoloba	17/.1	25/.1			31/1	20/.1		
Epilobium glandulosum		17/.3		12/.7	38/2	37/1	57/4	36/2

Table 18 (cont.)

Taxa	Vegetation Type							
	FEID/ AGSM-AGDA (6)	FEID/ AGCA (12)	ARTR/ FEID (28)	ARCA/ FEID (52)	POFR/ FEID (13)	FEID/ DECA (41)	DECA/ CAREX (60)	CAREX (28)
Forbs (cont.)								
Epilobium paniculatum			18/.8	10/.4				
Equisetum arvense							2/1	
E. laevigatum								11/1
Erigeron compositus	17/.5							
E. gracilis	50/1	33/.9	18/.8	13/1		10/1		
E. peregrinus							2/.1	
E. ursinus			4/.1	13/.6	15/.1	5/.1		
Eriogonum flavum			7/.1					
E. umbellatum	33/7	67/6	71/9	35/3		10/3		
Eriophyllum lanatum	17/3	42/3	14/.8	29/2	8/T	5/.1		
Erythronium grandiflorum		8/.3						
Floerkea prosperpinacoides				4/.1	8/1	18/2		4/.6
Fragaria virginiana		25/.6	14/.9	27/4	8/.2	39/6	18/3	11/2
Frasera speciosa	17/.1	17/.6	14/2	13/1	23/.1	7/.1		
Fritillaria pudica						12/.2		
Galium boreale		17/2	4/.5	6/.1	38/7	5/.2	2/.1	
Gentiana affinis		8/T					9/.1	
G. amarella						5/.1		4/.1
G. detonsa							23/2	15/3
G. viscosissimum				2/.1		2/.1		
Geum macrophyllum					8/.2	7/1	15/.5	18/2
G. triflorum	17/.5		50/6	44/6	54/7	24/1		
Habenaria dilatata								18/3
Heracleum lanatum								7/.7
Hesperochiron pumilus						5/.1		
Hydrophyllum capitatum						2/.1		
Linanthus septentrionalis		25/5	11/.6	8/.3		10/.6		

Table 18 (cont.)

Taxa	Vegetation Type							
	FEID/ AGSM-AGDA (6)	FEID/ AGCA (12)	ARTR/ FEID (28)	ARCA/ FEID (52)	POFR/ FEID (13)	FEID/ DECA (41)	DECA/ CAREX (60)	CAREX (28)
Forbs (cont.)								
Lepidium spp.								
Linum perenne	50/.7	58/1	29/2	48/2	38/5	10/.3		
Lithophragma tenella		8/T				7/T		
Lomatium ambiguum			7/.6					
L. cous				4/.3	8/.2	2/.4		
Lupinus caudatus		25/2	32/3	13/2	8/T	17/4		
L. lepidus	17/.5	33/2	21/.7	8/.3	31/.5	7/.8		
Madia glomerata		8/.3		2/.3		2/.1	3/.3	
Mertensia ciliata								11/3
Microsteris gracilis		58/7	32/5	71/7	15/3	49.5	15/1	
Mimulus moschatus							2/.1	7/.7
Montia chamissoi					15/.3			
Nemophila breviflora						2/.1		
Oenothera heterantha				10/.1		5/.1		
Oxytropis spp.		25/2	21/2					
O. deflexa	17/3							
O. lagopus	67/6		21/2	6/.4	8/.2			
Pedicularis bracteosa					8/.2			
P. groenlandica					23/1	10/.6	20/2	7/.6
P. parryi	17/.5	25/4	25/.8	8/.2	8/1	22/2		
Penstemon procerus	67/2	25/2	25/.3	31/2	31/1	20/.5	3/.1	
Perideridia gairdneri		58/15	25/2	69/10	8/T	56/13	44/.8	
Phlox hoodii	67/14	17/3	50/8	12/1		5/1		
P. multiflora		8/1	25/1		8/.2			
Plagiobothrys scouleri				17/.1				
Polygonum bistortoides		17/.1	14/.2	19/.9	92/9	37/3	37/2	7/.T
P. douglasii		50/11	21/4	79/13	46/2	54/10	7/2	

Table 18 (cont.)

Taxa	Vegetation Type							
	FEID/ AGSM-AGDA (6)	FEID/ AGCA (12)	ARTR/ FEID (28)	ARCA/ FEID (52)	POFR/ FEID (13)	FEID/ DECA (41)	DECA/ CAREX (60)	CAREX (28)
Forbs (cont.)								
Polygonum viviparum							2/.3	4/.1
Potentilla anserina							7/3	7/2
P. gracilis		75/11	46/5	85/13	77/7	78/13	62/10	4/.6
Prunella vulgaris								4/.1
Ranunculus spp.			4/T		8/.2	2/.1		4/3
R. alismaefolius						2/.1	7/.2	11/.7
R. inamoenus								4/.1
R. orthorhyncus								4/.6
Rorippa curvisiliqua				2/7				
Rumex paucifolius		17/1	4/.1	10/.1	54/.3	34/.4	5/.1	
Saxifraga arguta								11/1
S. oregana				4/.1	46/3	20/1	5/.4	
Sedum lanceolatum	17/1		32/1	6/.4				
S. rosea							2/.1	
Senecio spp.				25/1		10/1		
S. crassulus	17/1		7/.6	2/.7	23/2			
S. hydrophilus							2/.3	11/.3
S. lugens		17/.3		6/.4	46/4	20/4	60/8	7/.6
S. pseudaureus								4/.6
S. triangularis							3/.9	25/7
Solidego spp.			11/.6					
S. canadensis								4/.6
S. multiradiata						5/.5		
Spiranthes romanzoffiana								7/7
Spraguea umbellata			11/.6					
Stellaria longipes				8/.1	39/.4	10/3	15/.2	4/.6
Taraxacum officionale	50/2	50/4	21/2	71/5	23/.3	51/5	27/3	

Table 18 (cont.)

Taxa	Vegetation Type							
	FEID/ AGSM-AGDA (6)	FEID/ AGCA (12)	ARTR/ FEID (28)	ARCA/ FEID (52)	POFR/ FEID (13)	FEID/ DECA (41)	DECA/ CAREX (60)	CAREX (28)
Forbs (cont.)								
Thalictrum occidentale				8/.9	8/1	5/.1	7/.7	
Thlaspi parviflorum			7/T	4/.1				
Trifolium spp.	50/1	50/4	18/1	29/3	8/1	32/3	14/1	7/.6
T. longipes		17/1	7/.6	31/1	69/9	41/3	20/2	7/.6
T. repens					8/1		3/2	
Trollius laxus								11/2
Valeriana dioica				8/.2		2/.1		
V. edulis				13/.2	46/.4	7/.2	17/1	
Veronica americana								32/3
V. serpyllifolia							2/.3	
V. wormskjoldii					15/.3	10/.1		4/.6
Viola adunca	17/.1	50/3	36/3	31/2	31/.5	34/3		
V. nuttallii		25/.4	14/1	25/8		12/.1		
Zizia aptera					15/1	5/.5	3/.5	
Bare ground	100/30	100/21	100/18	100/11	100/3	100/6	63/2	14/.1
Litter	100/11	100/22	100/20	100/39	100/62	100/38	100/60	100/59

[1]Only those species that either occur on 5 percent or more of the stands within a vegetation type or those that have an average canopy cover of at least 0.1 percent are included. T - trace, canopy cover <0.05 percent.

APPENDIX B

SOILS

Table 19. Horizon fertility data for one soil classification site in Hayden Valley (A) and two soil classification sites in Pelican Valley (D,F).

Soil Site	Horizon	Thickness (cm)	Bray P (ppm)	Extractable K (ppm)	Organic Matter (%)	Extractable Ca (meq/100 g)	Mg	Na
A	A1	22	49	293	5.9	5.7	2.2	0.1
	A21	16	45	153	0.8	5.7	3.4	0.1
	A22	9	25	125	1.3	5.4	3.5	0.2
	B21t	25	11	236	0.6	12.5	9.9	0.3
	B22t	23	--	246	0.2	14.4	11.9	0.3
	B3	85	18	265	0.2	12.5	10.3	0.3
D	A11	17	26	144	2.3	5.0	1.4	0.1
	A12	19	25	80	3.6	5.0	1.6	0.2
	A2	39	17	62	0.8	5.0	2.5	0.2
	B2t	35	6	107	0.4	8.7	5.3	0.2
	IIC	70	5	89	0.5	6.8	4.5	0.2
F	A1	32	18	218	3.0	5.0	1.4	0.1
	B21	38	21	107	0.4	5.0	2.0	0.1
	B22	62	7	125	<0.2	4.7	2.5	0.1
	C	48	5	116	<0.2	3.6	2.2	0.1

Table 20. Horizon physical characteristics for one soil classification site in Hayden Valley (A) and two soil classification sites in Pelican Valley (D,F).

Soil Site	Horizon	Depth (cm)	Sand	Silt	Clay	Soil Water 1/3 Bar (%)	Soil Water 15 Bar (%)	Cation Exchange Capacity (me/100 g)	CEC / % Clay	15 Bar H_2O / % Clay	Andic Properties
A	A1	0- 22	28	52	20	34	14	26	130	0.7	No
	A21	22- 38	21	42	37	29	11	20	54	0.3	
	A22	38- 47	20	41	39	27	11	19	49	0.3	
	B21t	47- 72	14	31	55	38	22	32	59	0.4	
	B22t	72- 95	16	35	49	38	22	35	72	0.5	
	B3	95-180	17	37	46	39	22	34	75	0.8	
D	A11	0- 17	43	44	13	39	19	29	223	1.5	Yes
	A12	17- 36	41	41	18	29	11	21	117	0.6	
	A2	36- 75	43	33	24	24	10	15	63	0.5	
	B2t	75-110	38	31	31	29	14	21	68	0.5	
	IIC	110-180	41	28	31	29	13	20	65	0.5	
F	A1	0- 32	60	33	7	21	11	20	286	1.6	Yes
	B21	32- 70	66	25	9	12	5	12	134	0.6	
	B22	70-132	77	15	8	9	5	10	125	0.7	
	C	132-180	90	5	5	5	3	--	--	1.0	

Table 21. Mineralogy for one soil classification site in Hayden Valley (A) and two soil classification sites in Pelican Valley (D,F).

Soil Site	Vegetation Type	Soil Classification	Soil Horizon	Depth (cm)	Feldspars	Quartz	Smectite	Vermiculite	Chlorite	Illite	Kaolinite	Interstratified material	Amorphous material
A	FeId/AgCa	Typic Argialbolls, Cryic	A1	0- 22	+[2]	++[2]	++	+	+	+	+		
			A21	22- 38	+	++	++	+	+	+	+		
			A22	38- 47	+	++	+++[3]	+	+	+	+		
			B21t	47- 72	+	++	+++	+	+	+	+		
			B22t	72- 95	+	++	+++	+	+	+	+		
			B3	95-180	+	++	+++	+	+	+	+		
D	ArCa/FeId	Argiaquic Argialbolls, Cryic	A11	0- 17	+	+++	T[4]	++	++	++	++	+	
			A12	17- 36	+	+++	T	++	++	++	++	+	
			A2	36- 75	+	+++	T	++	++	++	++	+	
			B2t	75-110	+	++	T	++	++	++	++	+	
			IIC	110-180	+	++	T	+++	+++	++	++		
F	FeId/DeCa	Aquic Cryoborolls	A	0- 32	+	++	T	++	++	+	+	++	P[5]
			B21	32- 70	+	++	T	+	+	+	+	++	P
			B22	70-132	+	++	+++	+	+	+	+		P
			C	132-180	+	++	+++	+	+	+	+		P

[1] + - weak pattern

[2] ++ - moderate pattern

[3] +++ - strong pattern

[4] T - pattern barely discernable

[5] P - possible presence

Table 22. Soil fertility data and physical characteristics obtained from five soil sites at depths of 0-10, 10-30, and 30-60 cm. All are intensive grizzly bear dig sites.

Soil Site	Vegetation Type	Depth (cm)	pH	Parts per Million (rating)[1]						meq/100 g			Millimhos	Percent (rating)				Soil Class-Texture[2]
				Zn	Fe	Cu	Mn	P	K	Ca	Mg	Na	Salt	O.M.	Sand	Silt	Clay	
A	FEID/ AGCA	0-10	5.4	3.7	98	2.0	21.3	52 (M)	360 (H)	6.0	2.7	.4	.5	5.5 (M)	30.7	43.6	25.7	loam
		10-30	5.5	1.7	92	1.4	5.7	46 (L)	270 (H)	5.6	3.0	.3	.4	3.6 (L)	26.7	43.6	29.72	clay loam
		30-60	5.8	1.2	59	2.9	10.2	49 (L)	260 (H)	7.9	6.2	.4	.2	1.4 (VL)	18.7	36.6	44.7	clay
D	ARCA/ FEID	0-10	5.5	3.3	157	1.5	18.9	96 (H)	280 (H)	5.6	1.5	.2	.5	132 (H)	46.4	35.9	17.7	loam
		10-30	5.5	1.3	130	.9	7.5	107 (H)	200 (M)	4.0	1.3	.2	.3	5.1 (M)	26.0	34.6	22.7	loam
		30-60	5.5	.8	98	1.3	2.3	96 (H)	140 (M)	4.0	1.9	.3	.2	2.1 (VL)	40.7	29.6	29.7	clay loam
E	FEID/ DECA	0-10	5.2	3.2	164	2.1	16.1	52 (M)	240 (M)	4.8	1.3	.2	.8	6.7 (M)	33.3	45.0	21.7	loam
		10-30	5.4	1.4	150	1.8	16.5	43 (L)	210 (M)	5.6	2.0	.2	.5	6.0 (M)	34.6	41.6	23.7	loam
		30-60	5.6	1.4	117	2.6	7.3	71 (M)	140 (M)	4.8	1.9	.3	.3	3.5 (L)	35.6	39.6	24.7	loam
F	FEID/ DECA	0-10	5.6	2.7	92	1.0	11.0	29 (VL)	210 (M)	3.2	.9	.2	.6	5.2 (M)	58.4	28.9	12.7	silt loam
		10-30	5.8	1.5	59	.8	14.7	35 (L)	200 (M)	4.0	1.3	.3	.3	3.2 (L)	57.4	29.9	12.7	silt loam
		30-60	5.9	.7	65	1.0	6.2	32 (L)	160 (M)	4.8	2.2	.3	.2	1.3 (VL)	62.4	23.9	13.7	silt loam
I	FEID/ DECA	0-10	5.6	2.6	130	1.0	21.3	43 (L)	220 (M)	4.0	1.2	.2	.5	5.8 (M)	35.4	51.9	12.7	silt loam
		10-30	5.8	1.2	78	.8	12.1	46 (L)	190 (M)	4.4	1.6	.3	.3	3.2 (L)	36.4	47.9	15.7	loam
		30-60	6.2	.7	52	.9	6.2	35 (L)	170 (M)	4.8	2.2	.3	.2	1.4 (VL)	37.4	47.9	14.7	loam

[1] From Plant and Soil Science ST-Form 3, 1975: H - high, M - medium, L - low, VL - very low.

[2] From Buckman and Brady, 1969.

APPENDIX C

GENERAL RECONNAISSANCE FIELD DATA

General reconnaissance field data is available in Appendix C (pp. 90-124) in the following copies: Copies 1 and 2, Montana State University Library, Bozeman, Montana; Department of Biology, Montana State University, Bozeman, Montana; Yellowstone National Park Library, Yellowstone National Park, Wyoming.

Table 23. General reconnaissance data of canopy cover classes[1] in the *Festuca idahoensis/Agropyron smithii-A. dasystachyum* habitat type.

Stand No.	1	2	3	4	5	6
Aspect	SW	W		NW		N
Slope(°)	30	15		17		20
Graminoids	2	5	4	4	3	3
Agropyron dasystachyum	2	3	2	2	2	1
Bromus spp.		2	1			
Carex platylepsis	2	2		2	1	
Danthonia intermedia	2				2	
Festuca idahoensis	3	3	2	3	2	3
Juncus spp.	2	2				
Koeleria cristata		3	2			
Poa cusickii	2		2			3
P. interior		2				
P. sandbergii	2	4	3	3	2	2
Forbs	4	4	3	5	3	4
Achillea millefolium	2		2	2		
Agoseris glauca	2	2	2			
Antennaria microphylla	2	3	3	3	2	3
Arabis drummondi					1	
Arenaria congesta					1	
Aster campestris	2		3	1		
Astraglus miser	2	2				
A. tegetarius			3	3	2	
Castilleja pallescens					2	
Delphinium occidentale					1	
Dodecatheon pulchellum					2	
Draba stenoloba		1				
Erigeron compositus		2				
E. gracilis		2		2		1
Eriogonum umbellatum	4				2	
Eriophyllum lanatum	3					
Frasera speciosa					1	
Geum triflorum					2	
Linum perenne		2	1		1	
Lupinus lepidus				2		
Oxytropis deflexa				3		
O. lagopus		3	2		2	3

Table 23 (cont.)

Stand No.	1	2	3	4	5	6
Forbs (cont.)						
Pedicularis parryi					2	
Penstemon procerus	2	2		1	2	
Phlox hoodii		2		4	2	4
Sedum lanceolatum					1	
Senecio crassulus					1	
Taraxacum officionale		2	2	2		
Trifolium spp.		2		2	1	
Viola adunca						1
Bare ground	5	3	4	3	3	4
Litter	2	4	2	3	2	2
Pocket gopher sign[2]			2	1		

[1]Cover classes: 1 = 0-1%, 2 = 2-5%, 3 = 6-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-95%, 7 = 96-100%.

[2]Percent ground disturbance: 1 = 1-5%, 2 = 6-25%, 3 = 26-50%, 4 = >50%.

Table 24. General reconnaissance data of canopy cover classes[1] in the *Festuca idahoensis/Agropyron caninum* habitat type.

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12
Aspect	NE		N		S	SW	W	NE			E	NW
Slope(°)	12		2		7	12	10	23			20	11
Graminoids	5	5	5	5	5	5	3	5	4	2	3	3
Agropyron caninum	3	2	2	2	3	3	2	3	1	2	2	2
A. dasystachyum			2									
Bromus carinatus		3	4	4		3				2		2
Calamagrostis canadensis		2										
Carex spp.	3											
C. geyeri					2							
C. microptera		2	2									2
C. platylepsis				2	3				1			
C. raynoldsi												3
Danthonia intermedia					4			4	3			
Festuca idahoensis	3	1	4	4	3	4	3	4	4	2	3	2
Koeleria cristata								3				
Melica spectabilis		2	2	2		3						3
Phleum alpinum		5										1
Poa spp.						3						
P. cusickii	3							3			2	
P. nervosa			2									
P. reflexa												1
P. sandbergii			3	2	4		4				3	
P. scabrella		2	1							1		1
Stipa occidentalis	3	3	3	2		3		3	2		2	3
Trisetum wolfii		2										
Forbs	6	6	5	5	5	5	4	4	5	3	3	4
Achillea millefollium	3	4	3	2	4	3	2		2	1		3
Agoseris glauca		2	2	2	3	2						3
Antennaria microphylla	4	2	2	2	2			3	4			3
Arabis drummondi		1							1			1
Arenaria congesta									1			
Aster campestris					1	2	4	3				
A. foliaceus	5	5	4	4		2			3			1
Astragalus tegetarius											3	
Barbarea orthoceras	1											
Cerastium arvense				2	2		2	2	2			
Cirsium foliosum	1	1	1	1	1	2					2	1
Claytonia lanceolata												2

Table 24 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12
Forbs (cont.)												
Dodecatheon pulchellum	1											
Draba stenoloba	1					1		1				
Epilobium glandulosum		2										1
Erigeron gracilis					2			2	1			2
Eriogonum umbellatum		1	2		3	3		3	3	2	2	
Eriophyllum lanatum		1	3	2				3		1		
Erythronium grandiflorum												2
Fragaria virginiana			2							1		2
Frasera speciosa									2		2	
Galium boreale						2	3					
Gentiana affinis									1			
Lepidium spp.			2									
Linanthus septentrionalis		3	4									1
Linum perenne			1	1	1	2	2		1		2	
Lithophragma tenella	1											
Lupinus caudatus		2								1		3
L. lepidus					2				3	1	2	
Madia glomerata										2		
Microsteris gracilis	1	3	2	4	3						3	1
Oxytropis spp.					2		3				2	
Pedicularis parryi					2			2	4			
Penstemon procerus	1						2		3			
Perideridia gairdneri		5	4	4		3		1		3		2
Phlox hoodii					3				3			
P. multiflora					3							
Polygonum bistortoides	1											1
P. douglasii	3	3	3	4		4						2
Potentilla gracilis	3	4	3	2	1	4	3			1		2
Rumex paucifolius	3	1										
Senecio legens	2								1			
Taraxacum officionale		2			2	3	1				2	3
Trifolium spp.		3	3	2	3		1			1		
T. longipes	1											3
Viola adunca	1				3			3	2		2	1
V. nuttallii			2	1								1

Table 24 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12
Bare ground	3	3	4	5	1	2	3	2	2	4	3	4
Litter	4	4	4	2	4	1	3	4	2	3	3	3
Bear Sign[2]		+		+						+		
Pocket Gopher Sign[3]	2	2	2	3	1	2	1			2	1	2

[1]Cover classes: 1 = 0-1%, 2 = 2-5%, 3 = 6-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-95%, 7 = 96-100%.

[2]+ indicates presence of grizzly sign.

[3]Percent ground disturbance: 1 = 1-5%, 2 = 6-25%, 3 = 26-50%, 4 = >50%.

Table 25. General reconnaissance data of canopy cover classes[1] in the *Artemesia tridentata/ Festuca idahoensis* habitat type.

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Aspect	W	S	S	N	E	E	NW	SE	W			NW		E	N	N	W	N		S	SW			NW	S	S	SW	NW
Slope(°)	13	14	11	14	14	5	2	15	7			4		13	14	12	10	12		4	10			20	20	20	20	3
Shrubs	5	4	6	2	2	5	3	5	6	4	3	4	2	3	4	2	4	5	4	5	4	4	3	4	6	4	6	6
Artemesia tridentata	5	4	6	2	2	5	3	5	6	4	3	4	2	3	4	2	4	5	4	5	3	4	3	2	6	4	6	6
Chrysothamnus parryi														2		2					2			3	2	1		
Graminoids	5	2	5	5	4	5	4	5	4	5	4	5	5	4	4	5	4	5	4	4	3	4	4	3	4	3	3	3
Agropyron caninum	2	1	1			3	2				1	1				4	2	3		2	2	2	2	1	3	2		2
A. dasystachyum						2	2																					
Agrostris scabra																												1
Bromus carinatus	4	2	3					2	3			1					1			3	1						2	3
Carex spp.				3						2	2		2		2	2	2				3							
C. geyeri			2					2			3	3	4			3												
C. microptera	2																											
C. platylepsis			4									1							2	1								
C. raynoldsii	3								2											1								
C. rossii					4																							
Danthonia intermedia				4	2			3		4		1	5		1	1		2	4			2	2					
Festuca idahoensis	5	2	3	3	2	3	3	3	3	4	3	5	3	3	4	4	4	4	3	3	2	3	3	3	3	2	2	2
Juncus balticus											2	1																
Koeleria cristata										1				3	1	1						2	2		2	2		
Melica spectabilis	4	1	1						2											1								1
Phleum alpinum	2																											
Poa spp.								1	2						2		1											
P. cusickii										2				2									2		2	3		
P. fendleriana		1	1	2	2																			3				
P. sandbergii						2	3				1		3	3	3		3	2		2	2	2		2				
P. scabrella	3															4	3	3							3	3	3	2
Stipa occidentalis		1	2			3		1			2	2					1		1	2	2							

Table 25 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Forbs	5	3	5	4	4	4	4	4	4	4	4	5	5	4	5	4	4	4	4	5	3	4	3	4	4	4	4	4
Achillea millefolium	3	1	3	2		2	2		1	1		2	3		2		2	2	3	3	2	1					2	
Agoseris glauca	3		2	3	3	3	2	1	3	3	3	1	4							2	1	2	3					3
Antennaria corymbosa											4	1																
A. microphylla	3	1		3	3	3	3	3	3	3		2		3	2	3	3		2	1	1	3	2	3	2	3		
Arabis drummondi	1	1	1					1			1		1		1	1	1	1	1	1								
Arenaria congesta								2			1	3				2	1	1				2	2		2			
Aster spp.	2				4	3							4							3								
A. campestris								1	1	1									3						3			
A. foliaceus										2																		1
Astragalus miser						2	2					1		2		2	2	2										
A. tegetarius												2	2	2						1			3			4		
Besseya wyomingensis											2																	
Campanula rotundifolia																												1
Castilleja pallescens						1					1	1		1			1	1	1									
Cerastium arvense			2	3		2			3	2	2	2	1		2	2	2	1		2			1	1			2	
Cirsium foliosum	2		1							2		1	1	1	3					1		1	1		2			
Cruciferae							1					1											1					
Delphinium bicolor		2	2			2																						
D. occidentale	2					2			1						2		1			1								
Dodecatheon pulchellum												2	2															
Epilobium paniculatum		2	3		1		2																					1
Erigeron gracilis															3	2							1	1			2	
E. ursinus																		2										
Eriogonum flavum								2		1																		
E. umbellatum		2	2	4	2	2	3	2	3		4	3				3	3	3	4	2	1	3	3				3	3

Table 25 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Forbs (cont.)																												
Eriophyllum lanatum			3				2				1						1								2			
Fragaria virginiana	2		2																	2								3
Frasera speciosa				3								3		1	1			2										
Galium boreale																												3
Geum triflorum						3	2			2	1	4	3	2	4		2	3	3	2		3	2					
Linanthus septentrionalis	1	1																										3
Linum perenne							1			3			1		3	2	1	2		2								
Lomatium ambiguum		2	3																									
Lupinus caudatus	2		4		1	1											3	2	2	1					3			
L. lepidus								1		3	1				2		1					1						
Microsteris gracilis	3	3	3	2		3			4											3							2	3
Oxytropis spp.		2	3				3																		3	2	3	
O. lagopus															3	3	2	2				3		3				
Pedicularis parryi				3						1	1	1	1									3		3				
Penstemon procerus				2							1	1	1		1							1	2					
Perideridia gairdneri	2	1	2						2											2							3	4
Phlox hoodii				3			3	2			2	2	4	2	3	3	4					3	3	4		2		
P. multiflora								2		2							1	3	2			2	2					
Polygonum douglasii		2		2		2			4											4								3
P. bistortoides				2									1		1			1										
Potentilla gracilis	3	3	4	3		2	1		3			1	1		1					2					3		3	
Ranunculus spp.																					1							
Rumex paucifolius				2																								
Sedum lancelatum				3			2				2	1	2			2	1		2			2	1					
Senecio crassulus						3													2									3
Solidego spp.			1																		1							
Spraquea umbellatum										1												3	1					
Stellaria longipes			1												1													

Table 25 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Forbs (cont.)																												
Taraxacum officionale	2			2			2					1								1					4			
Thalspi parviflorum				1		1																						
Trifolium spp.						3										2			2	2		2						
T. longipes	2														3													
Viola adunca	2		3	3					2				3		2			4		2		1		1				
V. nuttalii	3	3	2																									2
Bare ground	2	5	2	4	5	3	3	2	2	2	3	2	3	4	4	2	2	1	4	4	2	2	3	3	3	3	2	3
Litter	4	2	3	4	3	4	2	3	4	3	2	3	3	2	2	3	4	5	4	4	2	3	3	2	2	1	4	3
Bear Sign[2]	+		+																									
Pocket gopher sign[3]	2		2	1		2			2	1									2	1		1					1	2

[1]Cover classes: 1 = 0-1%, 2 = 2-5%, 3 = 6-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-95%, 7 = 96-100%.

[2]+ indicates presence of grizzly sign.

[3]Percent ground disturbance: 1 = 1-5%, 2 = 6-25%, 3 = 26-50%, 4 = >50%.

Table 26. General reconnaissance data of canopy cover classes[1] in the *Artemesia cana/ Festuca idahoensis* community type.

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Aspect	SE	SE			E	E		SW						N			S		W			E		S	
Slope(°)	6	6			17	10		2						10			5		15			8		4	
Shrubs	5	4	3	5	3	4	6	4	5	4	4	5	5	3	2	4	3	5	5	2	5	3	4	4	4
Artemesia cana	5	4	3	5	3	4	6	4	5	4	4	4	4	3	2	4	3	5	5	2	5	3	4	4	4
Graminoids	6	5	6	4	3	4	6	5	5	6	6	5	5	4	6	5	5	5	5	5	5	3	6	5	4
Agropyron caninum	2	3	3	3	2	3	4		1		3	2	3	2	2	2	2	2	2	2	2		1	2	2
A. dasystachyum																								2	
Agrostis scabra	2											3													
Bromus carinatus	2	2					2	3	2				2	3		3	2		2		2	2	2	3	
Calamagrostis canadensis												4				2									1
Carex spp.										2	2														
C. hoodii																								2	
C. microptera		1											2												
C. playtlepsis			2				3		1			2	2		2			2					2	2	2
C. raynoldsii													2										2	2	1
C. stenoptila						1										2									
Danthonia intermedia	4		3	2		2					3				4	2	2	2					3		
Deschampsia caespitosa			2	4	2	3	3		1	3	4	3	3	1	4	3		3	2				3		2
Festuca idahoensis	5	4	5	3	3	3	5	3	4	3	4	3	3	2	4	3	4	3	4	4	4	2	4	4	3
Juncus spp.							2																		
Koeleria cristata									2	2															
Melica spectabilis		3								2			2	2			2	1			2		1	2	
Phleum alpinum		2		2				3				2	3												3
Poa spp.																					2				
P. cusickii						2																	1		

Table 26 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Graminoids (cont.)																									
P. nervosa															2										
P. nevadensis										2										2				1	1
P. sandbergii	2	1						2									2						2	2	
P. scabrella				2						2			2						2						2
Stipa occidentalis	2	2					4		3	3			2			2	2	2			2	2	3	2	
Trisetum wolfii												2	3										1		
Forbs	6	6	6	5	5	4	5	5	5	6	6	5	6	4	6	5	5	5	5	5	5	4	5	4	6
Achillea millefolium	3	3	2	3	2	3	3	3	3	4	3	4	3	1	4	4	2	3	3	2	2	2	3	3	3
Agoseris aurantica														2											
A. glauca	2	3	2	2	2			2	2	3	2	2	2	2		2		2	2	1	2	2		3	4
Angelica pinnata								1																	
Antennaria corymbosa			4																				3		
A. microphylla	4			5	2	3	3			4	3	3	2		3	2	3	3		3	2			3	
Arabis drummondi					1	1		1		1	1					1	1				1	1			
Aster spp.	1			3	4	4		4	4	4	2	4	5	2	4	3	4	4	3	3	3	3		3	
A. campestris		3																							
A. foliaceus		3																					4	1	5
A. occidentalis										2		1					2			2	2				
Astragalus miser				2				1									1		2			1			
Cerastium arvense	2	2		1	1	2				1					1		2		3					2	
Cirisium foliosum	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	2	1	1	2	2	1	1	2	1	2
Collinsia parviflora												1													
Collomia linearis		3																							
Cruciferae							3																	1	
Delphinium bicolor				2	4	2																			
D. occidentale								2									1	1	1				1	2	

Table 26 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Forbs (cont.)																									
Descurainia richardsonii								1																	
Dodecatheon pulchellum			1																						
Epilobium glandulosum			1								1		1												
E. paniculatum						1																			
Erigeron ursinus								2	2	2														1	
Eriogonum umbellatum	3							2				2		1		2				3		2		3	
Eriophyllum lanatum		1						2						2		2	2						1		
Floerkea proserpinacoides					2	1																			
Fragaria virginiana							4	3			3	4	4			2			2				2		1
Frasera speciosa							4	1	1	1															
Galium boreale		1								1														2	
Gentiana affinis										1															1
Geranium viscosissimum								2																	
Geum triflorum	4	3	1	2		1	4				4		2			3	3	2			2		3	3	
Heracleum lanatum								1																	
Linum perenne	2				1			1	1		2					2	2	1	3	2	2		3	2	
Lomatium cous					3	1																			
Lupinus caudatus		2						3																	
L. lepidus	1				3	1																			
Microsteris gracilis			1			1		2	1	2		3	2	2	2	3	2	2	2		3	4	3	3	3
Pedicularis groenlandica				2																					
P. parryi			2																						

Table 26 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Forbs (cont.)																									
Penstemon procerus			2	2		2	3				1	2													2
Perideridia gairdneri	3	4						3	2				4	2	4	2	3	3			3	2	3	1	3
Phlox hoodii					1	1																			
Plagiobothrys scouleri									1												1	1			
Polygonum bistortoides			3	2											1										1
P. douglasii	2	2		2	2	4		4	3	4	2	3	3	4	2	4	3	5	4		4	2	4	3	3
Potentilla gracilis	4	4	3	3	1		2	4	3	2		3	4	2	1	2	2	2	2	2	3	2	3	4	3
Rorippa curvisiliqua				4																					
Rumex paucifolius			1	2		1						1													
Saxifraga oregana			1	2																					
Sedum lanceolatum	2																					3			
Senecio spp.		2			1					2		1	2			1		2			2		2		
S. crassulus						4																			
S. lugens			1	2																					3
Solidego canadensis								1																	
Stellaria longipes				1																					
Taraxacum officionale	2	3		2		1		1	3	2				1	1	2	1	2	2	2	1	1	2	2	4
Thalictrum occidentale								1							4										2
Trifolium spp.	2					2			2	3	4		3		3	2	2	·						3	
T. longipes	2		2	2	1																				1
Valeriana edulis							2				1												2		
Viola adunca	2	3					3												1						2
V. nuttallii		2																						1	

Table 26 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Bare ground	1	2	1	1	3	3	1	3	2	3	3	1	3	4	3	3	4	4	3	3	3	4	3	3	1
Litter	5	4	5	6	2	4	5	3	2	4	4	5	6	3	5	4	4	4	4	3	4	2	4	4	5
Bear sign[2]																		+			+		+		
Pocket gopher sign[3]	1	1		1		1		2	1	2	2		1	2	3	2	2	2	1	1	3	1	3	2	

[1]Cover classes: 1 = 0-1%, 2 = 2-5%, 3 = 6-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-95%, 7 = 96-100%.

[2]+ indicates presence of grizzly sign.

[3]Percent ground disturbance: 1 = 1-5%, 2 = 6-25%, 3 = 26-50%, 4 = >50%.

Table 26 (cont.)

Stand No.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Aspect	N	S			N	NE	E		NW	SW		SE	SW	S	SE	S	S		SW	NE							NE
Slope(°)	15	10			6	4	10		4	4		8	8	8	10	20	10		12	23							2
Shrubs	1	2	5	5	3	3	3	4	3	4	3	4	4	1	5	4	3	1	4	3	3	5	4	4	5	4	3
Artemesia cana	1	2	5	5	3	3	3	4	3	4	3	4	4	1	5	4	3	1	4	3	3	5	4	4	5	4	3
Graminoids	5	5	6	5	4	5	6	6	6	6	6	5	5	4	5	4	3	4	5	4	6	5	6	6	5	6	4
Agropyron caninum	2	2		3			3	3	3	3	3	3	3	1	2			2			3		3	3	2	3	3
A. dasystachyum					3	3											1		2								
Bromus carinatus	2	2						3								3	3	3	2		4			5		4	1
Carex hoodii		2																									1
C. microptera																					2						
C. platylepsis			4	3	2	2	4		2				2			2				2	4		2		2	2	2
C. raynoldsii	3		1		2	3		1	1	1	3				2	1				3	3						2
Danthonia intermedia			1	2										1						2		3	3		3	3	2
Deschampsia caespitosa	3		4	3	4	3	4		5		4				4		1	4				3	3	3	4	3	2
Festuca idahoensis	3	3	2	4	3	4	4	5	4	5	3	4	5	3	4	3	2	3	4	4	3	5	5	4	4	5	3
Hordeum brachyantherum						1																					
Juncus balticus				2																							
Koeleria cristata													1											2			
Melica spectabilis	3	3	1		2	2	3				2	1				2	3	3	3	3	2		1				2
Phleum alpinum	2	3	3			1	1									1				2	3						
Poa cusickii						1	3							2								1		2			
P. nevadensis	3	4		3	2					3																	2
P. palustris																			1								
P. sandbergii	2	3				1		2	2	2	2	3	1	3					4			2	3	3			1
P. scabrella								3	2						2		3	3	4	4	2						2

Table 26 (cont.)

Stand No.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Graminoids (cont.)																											
Stipa occentalis	2	2		3		1	3	3	2	3		3	4		2	3	2	3	3	3	3	2	3	2	2	4	1
Trisetum wolfii			1																								
Forbs	5	4	5	6	5	5	5	7	6	5	5	4	4	4	5	4	4	4	5	5	5	4	4	4	6	4	4
Achillea millefolium	3	2	3	4	3	3	2	3	3	3	3	3	4	2	3	3	2	3	3	3	2		3		3	3	2
Agoseris aurantica																						3					
A. glauca	3	3		3	3	3	4	2	4	3	4		3		3	2	3		4		3				2		
Androsace septentrionalis					1																						
Antennaria corymbosa															4	3											
A. microphylla	3		3	4	2	2	3		4		4		2	3		1		1	3			3			5		3
Arabis drummondi				1	2			2	1	1	1	1	1		1						2					2	
Aster spp.	3	4			2	2	4		3		3	2					2	3	3				4		2	3	3
A. campestris								3				2	1	3	1		2	2					2				
A. foliaceus			4	3						3					2						4	2		3			
Astragalus miser		2												3		2		1						2			
Castilleja pallescens		1						1				1		1									1				
Cerastium arvense		2		2					1	1			3				2	1			2		3			1	1
Cirisium foliosum	2		1	2	1	1		3		2		1	1				1	1	2			2	2	2	2	2	
Cruciferae																						1					
Delphinium bicolor		2										2							2								1
D. occidentale	2				2	1		3	2	3	3	3			1	1		1	1			1					
Descurainia richardsonii				1	2																					1	
Epilobium glandulosum						3														3							2
E. paniculatum					2												1	1		3							
Erigeron gracilis			1				3			4	1			1		3	2										

Table 26 (cont.)

Stand No.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Forbs (cont.)																											
Erigeron ursinus	2	3																									1
Eriogonum umbellatum		2						2		3			2			3	3	3		3				2			2
Eriophyllum lanatum		2						3				3				3	3	2		3	1						1
Floerkea proserpinacoides																											1
Fragaria virginiana	3				1	2											3				2						
Frasera speciosa								2		3														2			
Geum triflorum				3	2			3	3						2							3	2		3		1
Linanthus septentrionalis							3										1	1			1						
Linum perenne	2	2		2	2			3			2		2	1								3	2	2			
Lupinus caudatus	3	2							1							3					4						
L. lepidus																1											
Madia glomerata																					3						
Microsteris gracilis	3	3		2	3	2	3	2		2		4				2	3	2	3		2		2	3		3	2
Oenothera heterantha		1					1	1									1										1
Oxytropis lagopus														3					2					2			
Pedicularis parryi	2								1													1					
Penstemon procerus			2						2	1	1		1	1									4	1	2		
Perideridia gairdneri	3	2	4	3	2	3	4	3	1		3	2			3	2	3	3	3	4			2	2		3	2
Phlox hoodii				1				4					3	3													
Plagiobothrys scouleri		1						1					1					1		1						1
Polygonum bistortoides	3		1			2	1		2		2																
P. douglasii	3	3		2	3	3	4	1	1	2	2	2			2	1	3	3	3		3					3	3
Potentilla gracilis	3	2	4		2	3		3	3	4	4		1		3	4	3	3	3	3	4	3	2			3	1
Rumex paucifolius					1																						1
Sedum lanceolatum																						1					

Table 26 (cont.)

Stand No.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Forbs (cont.)																											
Senecio spp.	3										2	3							1								
Stellaria longipes				1	1				1																		
Taraxacum officionale		1		2	1	3		3	3	2		2	3	3	1	3	3				3	2	3	2		2	
Thalictrum occidentale	2																										
Thelypodium sagittatum				1																							
Thlaspi parviflorum	2																					2					
Trifolium spp.	2											2				1											1
T. longipes				1		2				3	2	2	1		2	2	2	2					3				
T. repens									1																		
Valeriana dioica					2										2							2					1
V. edulis						1					1											1					1
Viola adunca		2		3				2				2	2	2					2			3	2	2			2
V. nuttalii				1	2	1	2					1				2	2	2	2	3		1					
Bare ground	1	2	3	2	3	2	3	1	2	1	2	3	2	2	3	3	3	3	2	2	2	2	2	1	1	2	3
Litter	5	4	3	6	2	4	5	6	5	5	5	3	4	3	4	3	3	3	4	3	4	4	3	3	4	3	4
Bear sign[2]			+		+	+	+									+											
Pocket gopher sign[3]	2	1	2	1	3	2	3	1	1	1	1	2	1		2	2	2	1	2	2	2		1	1		1	2

[1]Cover classes: 1 = 0-1%, 2 = 2-5%, 3 = 6-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-95%, 7 = 96-100%.

[2]+ indicates presence of grizzly sign.

[3]Percent ground disturbance: 1 = 1-5%, 2 = 6-25%, 3 = 26-50%, 4 = >50%.

Table 27. General reconnaissance data of canopy cover classes[1] in the *Potentilla fruticosa/Festuca idahoensis* habitat type.

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Aspect	E	NE	N	N	N	NW	W	W	NE	W	NW	W	E
Slope (°)	12	12	12	5	3	7	3	12	2	11	5	11	8
Shrubs	4	4	5	4	4	3	3	6	1	4	5	3	3
Artemesia cana		2	3		3			3		1			
A. tridentata				4						4			
Lonicera caerula											4		
Potentilla fruticosa	4	4	4	2	4	3	2	5	1	3	4	3	3
Salix wolfii							3						
Vaccinium myrtillus											4		
Graminoids	7	6	6	5	7	6	4	5	4	5	6	6	5
Agropyron caninum	4	3	4	4	3	3		3	3	4	3	3	4
Bromus carinatus			2		2								
Calamagrostis canadensis	5	3	4		4	2	3	4				3	
Carex spp.				2		2				2	4		2
C. raynoldsii						1						1	2
C. stenoptila			2			2	2						
Danthonia intermedia			3	3		2			2	3		2	1
Deschampsia caespitosa	3	2	4	2	5	4	2	3	4	4	4	4	3
Festuca idahoensis	3	3	3	4	3	3	2	3	3	4	3	4	4
Hierochloe odorata							1				1		
Juncus spp.						2	3						
J. balticus											2		
Koeleria cristata			1	1									1
Luzula campestris					2	3	2	2					
Phleum alpinum					2						3		
Poa cusickii	2	2				2				2		3	
P. sandbergii			1	1	2			2		1			1
Stipa occidentalis										3			
Forbs	5	5	5	5	5	5	4	5	5	5	6	4	4
Achillea millefolium	2	2	3	2	3	3	2	2	4	3	1	2	3
Aconitum columbianum					3			1					
Agoseris aurantica							1						
A. glauca	3	2			3	2	1	3	3	2		2	

Table 27 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Forbs (cont.)													
Androsace septentrionalis										1			
Antennaria corymbosa				2									
A. microphylla			4	2	3	4		2	4				2
Arabis drummondi										2			
Aster foliaceus	4	3			3	3	3	1	4		2	2	1
Astragalus miser			1	1						3			
Cerastium arvense	1	1	2	2	2	1		2	1	2		2	
Cirsium foliosum				2				2	2	2	1	2	
Claytonia lanceolata			2	2	3			2					
Collomia linearis		1	1	1									
Cruciferae				1									
Delphinium bicolor				1									
D. occidentale		1	3							3			3
Dodecatheon pulchellum			2										
Draba stenoloba			1	3		1			1				
Epilobium glandulosum					2		3	1	1		1		
Erigeron ursinus										1		1	
Eriophyllum lanatum										1			
Floerkea proserpinacoides							3						
Fragaria virginiana								2					
Frasera speciosa								1		1			1
Galium boreale	4	2	3		3			3					
Geum macrophyllum											2		
G. triflorum		3	3		3	2		3		3			3
Linum perenne			3	3		1				3			3
Lomatium cous				2									
Lupinus caudatus										1			
L. lepidus				2		2			1			1	
Microsteris gracilis						4							2
Montia chamissoi					1		2						
Oxytropis lagopus										2			
Pedicularis bracteosa							2						
P. groenlandica							3	2			1		
P. parryi				3									

Table 27 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Forbs (cont.)													
Penstemon procerus			1	2						3			2
Perideridia gairdneri								1					
Phlox multiflora													2
Polygonum bistortoides	2	2	3	2	3	3	1	3	3		3	3	2
P. douglasii	1	1	3	2		2			2				
Potentilla gracilis	2	2	2		4	2	2	3	2		3	2	
Ranunculus spp.											2		
Rumex paucifolius	1	1			1	1			1		1	1	
Saxifraga oregana			2		3	2		3	1		2		
Senecio crassulus			3	1	3								
S. lugens						2	2	3	3	2	3		
Stellaria longipes				1	2	1		1		1			
Taraxacum officionale					1					2			1
Thalictrum occidentale			3										
Trifolium spp.													3
T. longipes	3	3		3	3	3	3	3	2	3			
T. repens												3	
Valeriana edulis			1	1			1	2	1			1	
Veronica wormskjoldii							2				1		
Viola adunca			1	2				1			2		
Zizia aptera							3	2					
Bare ground	1	2	1	1	2	1	2	1	2	2	1	1	3
Litter	6	6	6	4	6	5	6	5	4	4	5	5	3
Bear sign													
Pocket gopher sign[2]	1	1	1			2							

[1]Cover classes: 1 = 0-1%, 2 = 2-5%, 3 = 6-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-95%, 7 = 96-100%.

[2]Percent ground disturbance: 1 = 1-5%, 2 = 6-25%, 3 = 26-50%, 4 = >50%.

Table 28. General reconnaissance data of canopy cover classes[1] in the *Festuca idahoensis/Deschampsia caespitosa* habitat type.

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Aspect				W				S	SE				S		E	W			SW	NE	N	N	SW	N	SW	E	N	W			W			NE	NW	S		W	N	NW	W
Slope (°)				12				11	10				2		1	2			14	14	12	12	2	20	2	6	15	5			10			20	20	20		3	3	3	5
Shrubs					3		3	3																																	
Lonicera caerula							3	2																																	
Salix scouleriana								3																																	
T. wolfii					3			2				2																													
Graminoids	5	6	5	4	5	6	6	5	6	5	4	5	4	5	4	6	5	5	4	5	6	4	6	4	5	5	5	3	4	4	5	6	6	6	5	5	5	4	4	4	4
Agropyron caninum				2		3		3		2	2	2	2	1	1	2	4		3		3		3			2			2		3	2		3	4	2	3	3	3	3	3
A. dasystachyum	2																			3					2		2														
Alopecurus alpinus							1																																		
Bromus carinatus		2									3		2	1	1		4		3						3	3	2				3			2			2	3	2	2	2
Calamagrostis canadensis						3	2	2	2			1																1	1					5			2				
Carex spp.				3	2	3	4			2		2																		1											
C. geyeri				4																																					
C. microptera	3	2										1				5	3		2	2				4		2									2		2	1	3
C. paysonis				3		2	2																																		
C. platylepsis			1		3	2	2	2			2	2		1	1		2	4	1	2	1	4	3		3	2			2		3	3	1	3	2	2		1		2	
C. raynoldsii		2												1	1					2	3			1	2	2		1	1		2			3	3	3		3	3		1
Danthonia intermedia	3	4	4	2	2		3			4	2	2				2												2		3		3	3			3				
Deschampsia caespitosa	4	4	2	2	3	5	4	3	5	3	4	5	2	3	3	5	2	4	2	3	3	2	5	3	5	4	4	3	2	2	4	4	2	2	2	3	4	3	3	3	3
Festuca idahoensis	2	4	4	4	3	3	3	3	2	3	3	2	3	3	2	2	2	2	2	2	4	2	4	3	5	2	4	3	3	4	2	2	5	2	5	4	3	3	3	3	3
Hierochloe odorata					2		1																																		
Hordeum brachyantherum															3																										
Juncus spp.	2							2				1																													
J. balticus				4	3	1	2																																		
Koeleria cristata	2																				1															2					
Luzula campestris	2	2	2		3	3	3	2	5		1																											1			
Melica spectabilis	2			2				1		2		2	3	3	2		2		2	3	2		2		2	3		2			2			3			3	2	3	2	3
Phleum alpinum	3	2			2	2	3		2			2	2	2	2	3	1			2				3					3					2			2	1			2
Poa cusickii		3	2													2					2	2			3		1		1		1		1								2
P. nevadensis																																						1		1	
P. sandbergii				3																									1						3	3		1		1
P. scabrella													2	2	2		3		3	2	3								2			1		2	3	3	2			1
Stipa occidentalis				1						2	2	3			1		3		2	2	2	2	3		2	3					3					3		2	1	1	2

Table 28 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Graminoids (cont.)																																									
Trisetum spicatum																								1																	
T. wolfii										2							2			4														2		3		3			
Forbs	5	6	5	5	5	6	6	5	5	5	5	6	6	5	6	5	6	6	4	5	5	5	6	5	6	5	5	5	6	4	5	5	4	5	4	5	3	3	4	4	3
Achillea millefolium	2	3	1	3		4	3	2	3	4	3	3	2	3	3	2	1	3		3	3		4	4	3	3	3	2	3	4	3		1	2	3	3		2	2	1	2
Agoseris aurantica						1	1																															1			
A. glauca	3	3		2			1	2	2	2	3	3	2	3	2	3	3	3	2	3	2	2	4	4		4	3		4		3		2	2	3			1	1		2
Allium geyeri	2								3								1	2												3											
Androsace septentrionalis																																			2				1	1	
Antennaria microphylla	3	4	3	3	3	5	4	4	3	3	3	4	1	1	1	5	3	5	1	3	2	4	3	2	4	2		2	3	2	3	4	4					1	2	3	2
Arabis drummondi										1	1	1	1	1	1					2			1		2																
Aster spp.	4				2				3	5	2	3	2			4				2							2										3	3	2	2	3
A. campestris			2							3									3						1			2						2	2						
A. foliaceus		5	3			2	3							4	4	2	4	2	1	3			3		1	4			5		2	3	4	3		4					
Barbarea orthoceras						1		1																														1	1		
Besseya wyomingensis																														2											
Campanula rotundifolia											1																							2	3						
Cerastium arvense			2	2				1	2	3	1	2		2	2						1				1			1		1	1		2					1		1
Cirsium foliosum	1	1	1	1				1	2	1	2	1		3	2		1	1		1	1		1	1	1	1			2	1	2		1		2	2		1		1	
Claytonia lanceolata														3	4																							1		1	
Collinsia parviflora																																							1		
Collomia linearis														2	2																											
Delphinium bicolor																																						1	1		
D. occidentale													1			1													3						1						
Dodecatheon pulchellum	2			2																																		1			
Draba stenoloba				1				1			1														1					1									1	1	1
Epilobium glandulosum	2					3	2	2	2			1				1				2			2			1				2							2	1		2	1
E. paniculatum																																							1		
Erigeron gracilis																			1		4		1		3																
E. ursinus																																									1
Eriogonum umbellatum										2																		1		2		2									
Eriophyllum lanatum															2				1																						
Erythronium grandiflorum																																						1			

Table 28 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Forbs (cont.)																																									
Floerkea proserpinacoides						6		2	2																					2	4							1	2		1
Fragaria virginiana								1	3						4		3		2	2	3			4		3	4			2	4						1	1	2	1
Frasera speciosa	1															1					2																				
Fritillaria pudica									1										1											2							1			2
Galium boreale													2										2																	
Gentiana amarella																																2	1							
Geranium viscosissimum																																			2						
Geum macrophyllum							1	4	2																																
G. triflorum	2		2						1	2	2							1					2		2	3					3						1	1	1	
Habenaria dilatata																				1																				
Heracleum lanatum																1																								
Hesperocheron pumilus																																						1		2	
Hydrophyllum capitatum															2																										
Linanthus septontrionalis												2							3																			2	1		
Linum perenne			2							2																	1								2						
Lithophragma tenella																																						1	1	1	
Lomatium cous			3																																						
Lupinus caudatus																1					3	4		4										3	4	3				
L. lepidus			3								1														3																
Madia glomerata																	2																								
Microsteris gracilis								1		3	2	3		2		2	2		3	3	3				2	2		2	3	3		3					2	3	3	2
Montia chamissoi																																							1		
Nemophila breviflora																																							2		
Oenothera heterantha																									2														1		
Pedicularis groenlandica					3		2																	2								1								
P. parryi	1		2	1												1		3			1	3						4		2									
Penstemon procerus			1	2											2			2									1		2	2				1					
Perideridia gairdneri	1	3	1								4	5	3	3	3		4		3	4			4		4	4	3		4		3	1				3	3	3	3	3
Phlox hoodii				4																										3										

Table 28 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Forbs (cont.)																																									
Polygonum bistortoides	3	1			1		2	2	3							3		1			3	4		3	1			3	1								1				
P. douglasii										3	4	4	5	3	3	2	4		2	3			4		2	3	1		3		3				2	3	3	3	3	2
Potentilla gracilis	4	5	1	1	2	3	4		4	2	2	2	2	3	2	4	4	3	3		4	4	3	2	3	2	1	3	1			4				3	2	1	2
Ranunculus spp.								2																																	
R. alismaefolius					2																																			
Rumex paucifolius	2			1		1	1	2			1	1				1					1						2		1						1			1		1
Saxifraga oregana	3	1		1		3	3	2	2							2																								
Senecio spp.	4									2	2		2																												
S. lugens		2			4	1	5	3															1						3			3								
Solidego multiradiata																																	2	3							
Stellaria longipes	2						1									2																			2						
Taraxacum officionale	1			2		1		2	1					4	3		2		2	2	2		2			1			4	1	4				3	3		1		1	1
Thalictrum occidentale																										1			2												
Trifolium spp.	3	2							3	3	2	2				4									2											2	3		1		1	2
T. longipes		1		3	3	3	2	1						1	1			2	3	3					2	2	2		1	3	3									
Valeriana dioica																				2																					
V. edulis																							2					2													1
Veronica wormskjoldii					2		1													1				1																
Viola adunca			4		3	2		1												1				2	2			2	2	3	3		3					1		1
V. nuttallii																																			2			1	1	1	1
Zizia aptera									3							2																									
Bare ground	1	1	2	1	2	1	1	2	1	3	2	2	3	3	3	1	1	1	3	2	2	2	1	2	2	3	2	3	2	2	1	1	1	1	2	2	1	3	3	3	3
Litter	5	5	4	4	4	6	5	4	5	4	2	4	2	2	2	4	5	5	3	4	4	4	6	3	3	4	3	3	5	3	4	4	3	4	4	5	3	4	4	4	3
Bear sign[2]										+	+		+	+	+				+				+			+										+					
Pocket gopher sign[3]		1	1			1				3	3	3	3	4	4		3		3	3	1	1	3	1	4	2				2				1	1	2	2	3	3	2

[1]Cover classes: 1 = 0-1%, 2 = 2-5%, 3 = 6-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-95%, 7 = 96-100%.

[2]+ indicates presence of grizzly sign.

[3]Percent ground disturbance: 1 = 1-5%, 2 = 6-25%, 3 = 26-50%, 4 = >50%.

Table 29. General reconnaissance data of canopy cover classes[1] in the *Deschampsia caespitosa/ Carex* spp. habitat type

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Aspect	E				SW									N										N			E	SE		SE
Slope (°)	5				2									20										2			2	2		2
Shrubs		5		1								6														4	1			
Lonicera caerula		1		1																							1			
Salix scouleriana		4																								4	1			
S. wolfii		4										6																		
Graminoids	6	6	7	6	6	6	7	6	7	6	7	6	5	6	7	7	6	7	7	7	6	7	6	7	6	7	7	6	7	6
Agropyron caninum								2		2	2	2	2	3	2		3		2						3			1		3
Agrostis scabra				1							2							2								3				
Alopecurus alpinus																					3	4	3	3	2	2	1	3	2	
Bromus carinatus								3						3			2													
Calamagrostis canadensis										4	6	6	5			5	4	6	6	6					2	4	7			
Carex spp.	2	2										4		2																
C. anthrostachya	2	3																			4	3			3	3	4	2	4	4
C. aquitilis			2	6	3	6		3	7	5						4								4			2		3	
C. microptera					2	2	5	3			2	1	2			2	2		3	2	3			4	3	3	3	4		4
C. platylepsis													2		3										3			5	3	
C. raynoldsii																	2											2		
Danthonia intermedia	3													2																
Deschampsia caespitosa	4	3	4	2	4	6	5	3	6	5	2	2	2	4	6	3	3	3	2	3	4	4	5	5	4	4	3	4	5	3
Hierochloe odorata																							1							
Hordeum brachyantherum								5							4	2					3			4	4	2		4	4	
Juncus spp.									2												2									
J. balticus		2																												
Luzula campestris	2	2																												
Melica spectabilis											3		2	2					2										2	

Table 29 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Graminoids (cont.)																														
Phleum alpinum	1			1	2		1	4						2		4	2		2		3	2			3	1	1	1	2	2
Poa palustris	2																					3		2	2	1		2	2	1
P. scabrella											3			2			2		3											
Stipa occidentalis														3			2													
Trisetum wolfii	3				6			4	1			1	3				3		3	2	3	3		3	4	3	2		5	5
Forbs	5	6	2	5	6	4	5	5	4	6	4	4	5	6	5	2	5	3	5	4	6	5	4	4	6	6	4	5	6	7
Achillea millefolium		2						3		3	2	3	2	3			3		3						3					
Agoseris aurantica	1																										2			
A. glauca					3			3		2	2			2		2	2		1		3			1					3	2
Allium geyeri																					3	2							2	
Angelica pinnata																											2			
Antennaria corymbosa	4	4		3									1				2		2											3
Arabis drummondi														1																
Arnica chamissonis						3															3				3					
A. mollis								2									2													
Aster spp.							3	4	4	3	2	4		3	5		4		5	4									4	
A. foliaceus	4	2	2	2	4	4															5	5	4	3	3	5	4	1		5
Barbarea orthoceras		1										1																		
Besseya wyomingensis																					2									
Cirsium foliosum								1						1			1													2
Delphinium occidentale														1							1									
Epilobium glandulosum	3				3	2	2	1	1	1		1				2		2		4	2	2	3	3	2	3	2	2	2	3
Fragaria virginiana		3									3	2		2											2					
Galium boreale											2																			
Gentiana affinis						1											2													1
G. detonsa				3			3								2					1					4					
Geum macrophyllum				1																					3	2	2			
Linum perenne														1																
Lupinus caudatus														1																
Microsteris gracilis					2	1				1				2			3		2											

Table 29 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Forbs (cont.)																														
Pedicularis groenlandica												1						1												
Penstemon procerus											1																			
Perideridia gairdneri	2				3	1	3						4	3			4		5	1	2					4	3		3	4
Polygonum bistortoides					2			2		2			2						2	2	2	2			2		2	2	2	3
P. douglasii														5			3		2											
Potentilla gracilis				1	4		2	3	2	2	2	3	3	2			2	1	2	1	4	3	1		3	3		1	3	3
Ranunculus alismaefolius		2	2																											
Rumex paucifolius					2																									
Saxifraga oregana		3			2																									
Sedum rosea		2																												
Senecio lugens	2	3		3	2																									
Stellaria longipes					2	2	1	1				1							2		1									
Taraxacum officionale					2		2	3						1											3		4		2	
Thalictrum occidentale		4								1				1	1															
Thelypodium sagittatum										1																				
Trifolium spp.							1	3		3	2								2											
T. longipes																					2				1	3			3	
Valeriana edulis							2			1																				
Veronica serpyllifolia		3																												
Zizia aptera		3																												
Bare ground	1	1			2	2	1	2	1		1	2	1	3	1	1	3					1	1	1				1	1
Litter	4	5	5	6	5	6	6	6	6	6	6	5	6	4	6	6	4	6	6	6	6	5	5	5	6	6	6	6	6	6
Bear sign[2]																	+													
Pocket gopher sign[3]					2		1					1		3			3		1	1										

[1]Cover classes: 1 = 0-1%, 2 = 2-5%, 3 = 6-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-95%, 7 = 96-100%.
[2]+ indicates presence of grizzly sign.
[3]Percent ground disturbance: 1 = 1-5%, 2 = 6-25%, 3 = 26-50%, 4 = >50%.

Table 29 (cont.)

Stand No.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Aspect				E																		W			E	N				
Slope (°)				2																		2			3	3				
Shrubs		2				2			2										3				5							
Lonicera caerula																							3							
Salix scouleriana		2				2			2										2				3							
S. wolfii																			3				3							
Graminoids	7	6	5	7	6	6	6	7	5	7	6	4	5	7	6	6	6	5	7	6	4	7	6	6	6	5	5	6	6	4
Agropyron caninum			2	1			2	2	2	2						2				2			2			2				
Agrostis scabra												1										3			2					
Alopecurus alpinus				1										2	3	2											2	3	1	
Bromus carinatus				3		3													3											
Calamagrostis canadensis				6		2	5	7			5			5			4	3	6	5									5	
Carex spp.																						6			4	2		4		
C. anthrostachya		3		2											2	3	3	3	2			4					4			2
C. aquatilis	5	3				4								4	3		3		3					3					3	3
C. microptera				2			2	2				2				3		2	3	2	1									3
C. platylepsis							2		3				5			1				2	3					3	2			
C. praegracilis																										6				
C. raynoldsii							1													1										
C. rostrata		4	3		4	4									4											3			3	
Danthonia californica																												4		
Deschampsia caespitosa	3	3	3	3	4	2	2	2	4	4	3	2	3	3	1	5	3	4	2	2	2	5	3	5	5	4	5	5	2	3
Hierochloe odorata																													2	
Hordeum brachyantherum			4					3		4	3		2									4	3	3		3		3		
Juncus spp.	3																													2
J. balticus		2																												
J. ensifolius																									2					
Luzula campestris	2	2																												
L. glabrata					1													1	2											

Table 29 (cont.)

Stand No.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Graminoids (cont.)																														
Melica spectabilis				1				1		1																				
Phleum alpinum				1		2	2		4	3			3	3	1	3		3	2	2	3		3		3	2				
Poa palustris					2			3						1	1			1											1	
P. scabrella									1																					
Trisetum spicatum																										3				
T. wolfii	2	2				2	3		4	3				3						3	2		2							
Forbs	1	6	5	5	5	5	6	4	6	6	6	7	5	4	3	5	5	5	5	6	5	5	5	4	4	5	3	4	4	4
Achillea millefolium		3		3				1	2	4			3					3			2									
Aconitum columbianum												3							3											
Agoseris aurantica				1																										
A. glauca			2	2										2		2	2	3			2		3		3		2			
Allium brevistylum				2																										
A. geyeri														2																
Angelica pinnata										3							2	2												
Antennaria corymbosa							3									2		2		3	3	4						4		
Arabis drummondi			2										1				1						1							
Arnica mollis										3							3		2		4	3	2							
Aster spp.										3																		3		
A. foliaceus	1	5	4	4	1		4		3	4	2		4	3	2	4		3	2	4					4				3	3
Besseya wyomingensis																3		3												
Campanula rotundifolia																										1				
Castilleja rhexifolia				1	3															2										
Cirsium foliosum			1	2						2			3										1			1		1		
Dodecatheon pulcellum																														
Equisetum arvense					4																				2	2				
Epilobium glandulosum		2	3	2	3			1	2			1		2	1	3	1	2	2											
Erigeron peregrinus																	2													
Fragaria virginiana				1	3		4												3		3									

Table 29 (cont.)

Stand No.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Forbs (cont.)																														
Gentiana affinis				2																					1					
G. detonsa		2		1			3		1								2			3		3	2	3						
Geum macrophyllum		1	2			1		2									2													
Heracleum lanatum																			2											
Madia glomerata																											2	3		
Microsteris gracilis			3	2									3																	
Mimulus moschatus					2																									
Pedicularis groenlandica				3	2	2	3									2	3			3	3	4		3						
Penstemon procerus													2																	
Perideridia gairdneri			2	2			3	2		4			4			2		2		3					3	3	1			
Polygonum bistortoides		2			2			1						3	2	2		2			3	3								
P. douglasii													4																	
Polygonum viviparum																			3											
Potentilla anserina									4	4														3		5				
P. gracilis		3					4			4	3		2			4				4	4	4	4		2	3	3	2		1
Ranunculus alismaefolius								2																					1	
Rumex paucifolius																2					1									
Saxifraga arguta																			2											
S. oregana					2																									
Senecio lugens				3			1		2	5	5			2	2	3	1	1		1			3	4	3					
S. hydrophilus								3																						
S. sphaerocephalus																			1											
S. triangularis					4												3													
Stellaria lonipes				1											1															
Taraxacum officionale				2		2		4	2	3		2	2										2							
Trifolium spp.				3																						3	3			
T. hybridum												2																		
T. longipes		4		2		4	2								2				2	2										
T. repens									5			5																		
Valeriana edulis		1				3							4	2				2			2		2							3
Veronica wormskjoldii					1														2											
Zizia aptera																								3						

Table 29 (cont.)

Stand No.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Bare ground		1	1	1		2	1		1		1	2	2		2					1	1	1			1	1	1	1	2	1
Litter	6	6	5	5	6	5	4	6	5	5	5	4	5	5	4	5	5	4	5	4	3	4	5	4	3	4	3	4	4	5
Bear sign[2]													+												+	+				
Pocket gopher sign[3]							1													1	1						1			

[1]Cover classes: 1 = 0-1%, 2 = 2-5%, 3 = 6-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-95%, 7 = 96-100%.

[2]+ indicates presence of grizzly sign.

[3]Percent ground disturbance: 1 = 1-5%, 2 = 6-25%, 3 = 26-50%, 4 = >50%.

Table 30. General reconnaissance data of canopy cover classes[1] in the *Carex* spp. community type.

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Aspect	W	W		NE	NE		NW					SW															N	
Slope (°)	4	3		30	24		2					2															7	
Shrubs				3				3				2			5				1					4				
Salix scouleriana				3				2											1					4				
S. wolfii								2				2			5													
Graminoids	7	6	6	7	5	7	6	7	7	7	7	7	7	7	5	7	7	7	7	7	7	7	7	7	7	7	6	6
Agrostis exerata						2									3													
A. scabra																										1		
Alopecurus alpinus																										1		
Calamagrostis canadensis	6				3		4	7		7		6		6			5			4					3			
Carex spp.						5																						
C. anthrostachya								3				5																
C. aquitilis		6		5				4	6		5	5			5			5	5	5	5	5	5	4	5	4	5	6
C. microptera	5			2							3		3	4												4	1	
C. neurophora							5							5														
C. rostrata			6	6	1	3			3		5	6	6	5		7	4	5	4	4	5	3	6	7	4		4	
Glyceria elata							5							5														
Hordeum brachyantherum						5																						
Juncus balticus																											1	
J. ensifolius										2																3		
J. martensianus							2							2														
Luzula campestris	4																											
Phleum alpinum	3			2																								
Poa palustris					2																							
Trisetum spicatum						3																						
T. wolfii																										2		

Table 30 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Forbs	4		6	5	5	5	6	3		3		5	5	5	6	4	3						2		3	5	3	1
Aconitum columbiana							2	1						2														
Allium brevistylum												3				2												
Angelica pinnata				3								1															1	
Antennaria corymbsa				2											3													
Arnica mollis							3							3														
Aster foliaceus	3			3		3										3									2	3	3	1
Castilleja rhexifolia												2														4		
Cirsium foliosum				2																							1	
Epilobium glandulosum				3		3	2	1				3		2	2	1										2	2	
Equisetum laevigatum								3						3												2		
Floerkea proserpinacoides				3																								
Fragaria virginiana				4									2		3													
Gentiana amarella																										2		
G. detonsa						2									4											3	1	
Geum macrophyllum				3			3							3											3		2	
Habenaria dilatata												3	4				3										1	1
Heracleum lanatum										3		1																
Mertensia ciliata	3						4							4														
Mimulus moschatus																							2			3		
Pedicularis groenlandica					3																						1	
Polygonum bistortoides							1							1														
P. viviparum												2																
Potentilla anserina					5																						2	
P. gracilis				3																								
Prunella vulgaris																										2		

Table 30 (cont.)

Stand No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Forbs (cont.)																												
Ranunculus spp.			6																									
R. alismaefolius						3	2							2														
R. inamoenus										2																		
R. orthorhynchus	3																											
Rumex paucifolius						1																						
Saxifraga arguta							3						2	3														
Senecio lugens															3	1												
S. hydrophilus					2																				2		1	
S. pseudaeureus																										3		
S. triangularis	4						4	1				4	3	4												3		
Solidego canadensis																										3		
Spiranthes romanzoffiana															3											2		
Stellaria longipes					3																							
Trifolium spp.				1											3													
T. longipes															3												1	
Trollius laxus							2						4	2														
Valeriana edulis																											1	
Veronica americana						3	1					3	3	1									2			3	2	1
V. wormskjoldii				3																								
Bare ground	1						1												1								1	
Litter	6	5	3	5	4	5	5	5	6	5	6	5	5	6	6	5	5	5	4	6	5	5	5	4	5	4	3	4
Bear sign[2]																										+		

[1]Cover classes: 1 = 0-1%, 2 = 2-5%, 3 = 6-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-95%, 7 = 96-100%.

[2]+ indicates presence of grizzly sign.

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