A VEGETATIONAL INVENTORY OF BIG GAME WINTER RANGE IN THE SALMON RIVER CANYON

A Thesis

Presented in Partial Fulfillment of the Requirement for the

DEGREE OF MASTER OF SCIENCE

Major in Wildlife Management

in the

UNIVERSITY OF IDAHO GRADUATE SCHOOL

by

JERRY LYNN LAUER

September 1973

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AUTHORIZATION TO PROCEED WITH THE FINAL DRAFT:

This thesis of Jerry L. Lauer for the Master of Science degree with major in Wildlife Management and titled "A Vegetational Inventory of Big Game Winter Range in the Salmon River Canyon" was reviewed in rough draft form by each Committee member as indicated by the signatures and dates given below and permission was granted to prepare the final copy incorporating suggestions of the Committee; permission was also given to schedule the final examination upon submission of two final copies to the Graduate School Office:

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ABSTRACT

Big game winter ranges in the Salmon River Canyon were described in terms of species composition and forage production. I sampled vegetation on 39 permanently located macroplots in nine vegetational types.

The presence of young curl-leaf mountain mahogany plants indicates reproduction has occurred despite a history of heavy use. Low precipitation, shallow, infertile soils and big game use have produced a predominantly cheatgrass understory in some stands.

The environment of the Salmon River Canyon represents marginal habitat for climax antelope bitterbrush communities. The steep, loose granitic soils do not produce highly vigorous plants. Seedling establishment may not be adequate to replace losses.

The major impact of animals on grassland communities is displacement of the loose soil. The breakup of litter coverage allows cheatgrass brome and annuals to be conspicuous but does not represent deterioration of the community.

Availability is not a major problem on the burn vegetational type since most shrubs are a low or medium growth form. However, as tree size and density increase, the amount of available forage will decrease.

Despite a history of heavy use on the winter ranges of the Salmon River Canyon ungulate populations still exist, browse plants are still present and there is no evidence of severe erosion on most areas.

INTRODUCTION

Interacting factors must be considered in big game management: animal behavior, habitat requirements, and population structure. In mountainous terrain adverse climatic conditions dictate that winter range is a critical habitat requirement (Robinette et al. 1952). Herbivore populations and vegetation upon which they depend are constantly changing through time. Vegetation is continually altered by natural succession and disturbance which in turn may cause changes in herbivore populations (Cole 1971). Herbivores themselves are capable of altering vegetation (Klein 1965, 1968). A primary requisite for any big game management program is an inventory of range resources to establish a base upon which range trend can be followed.

The objective of this paper is to describe important vegetational types of big game winter ranges in the Salmon River Canyon of central Idaho. Basic ecological facts are needed not only for proper management of big game in wilderness areas but for a better understanding of ecological cause and effect. This research supplements previous studies (Wood 1962, Presby 1963, Wing 1969, Hornocker 1969, 1970, Seidensticker 1973, Claar 1973) and contributes to knowledge of the ecology of the area. The data upon which my description is based were gathered from May through September 1972.

STUDY AREA

Location and Physiography

The Salmon River Canyon covers portions of four national forests in central Idaho: Bitterroot, Nezperce, Payette and Salmon. Part of the canyon forms the boundary between the Salmon River Breaks Primitive Area, encompassing 340 sq mi, and the Idaho Primitive Area, encompassing 2000 sq mi. Roadless areas exist outside the boundaries of the primitive areas in many places.

Extreme topography of the canyons of the Salmon River and its tributaries strongly influences vegetation distribution. The narrow canyons are characterized by steep hillsides, cliffs, and talus slopes and are rimmed with sharp ridges, subalpine valleys, and glaciated basins. Major exceptions are Chamberlain Basin in the northern portion of the Idaho Primitive Area and basin lands in the western portion of the Salmon River Breaks Primitive Area. Both areas have gentler topography, broader stream courses, and mountain meadows.

This project was conducted along a 54-mi section of the Salmon River Canyon (Fig. 1). I selected nine drainages for intensive sampling.

Soils

Soils, derived from granitic bedrock, are predominantly coarsely textured and at low elevations are light colored and shallow approaching 6 to 12 inches in depth. Texture ranges from loamy sand or sandy loam for the surface to loamy sand or sand for the subsoil. Rock outcrops are common. Higher elevation soils are dark colored, have sandy loam or loamy sand textures throughout the profile, and are deeper than lower elevation

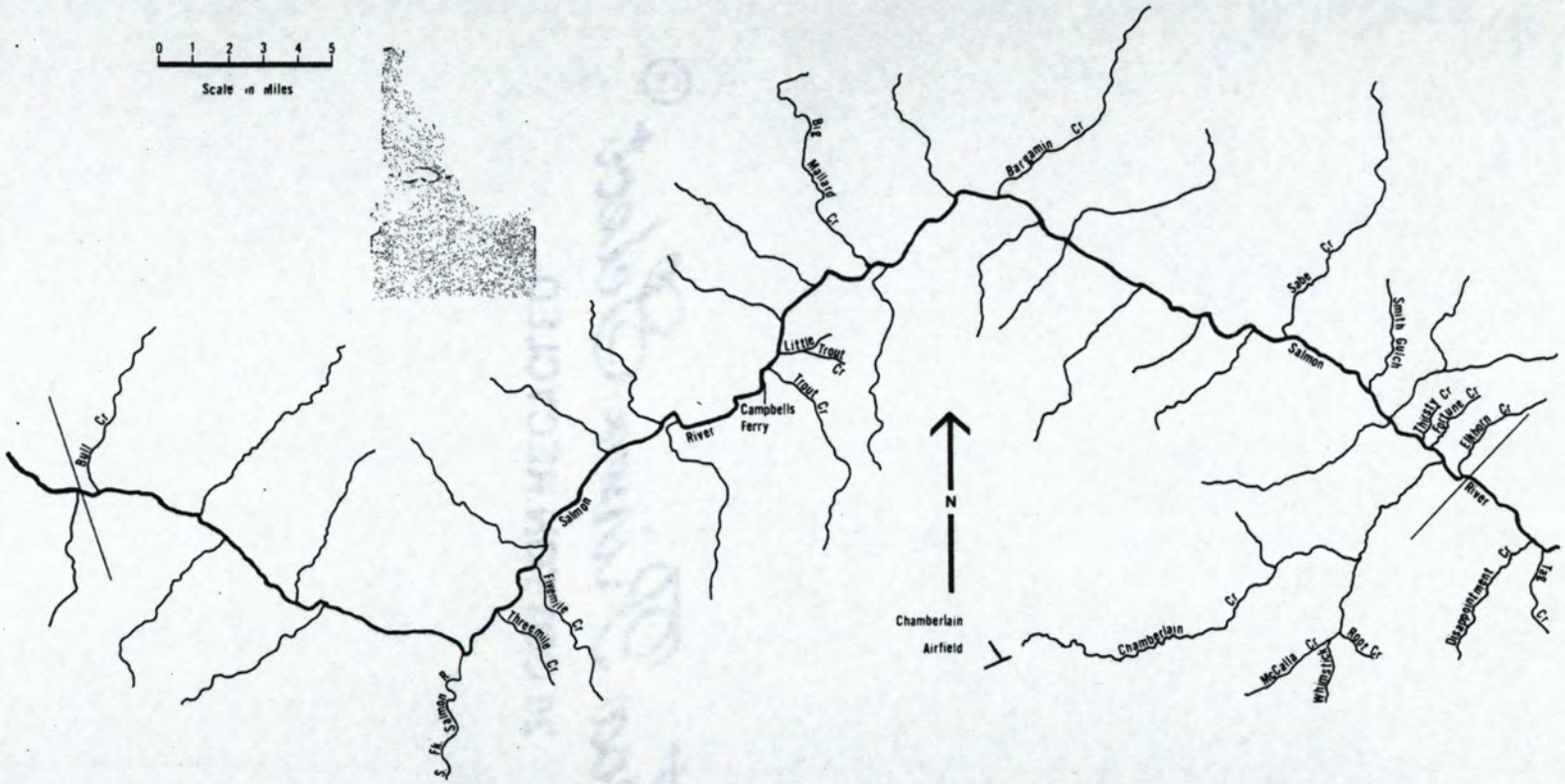

Fig. 1. Approximate study area in the Salmon River Canyon.

soils; depths approach 10 to 40 inches (Alvis and Wheeler 1970).

Climate

A diverse climate characterizes the drainage. Air temperature extremes range from over 100° F to below -32° F. Temperatures of more than 100° F are common during July and August. Subzero temperatures can be expected during December and January.

Most precipitation occurs from late fall to early spring. Mean annual precipitation at Campbell's Ferry (2330 ft) in the study area is 21.70 inches (Alvis and Wheeler 1970) while at Dixie (5610 ft), north of the study area, it is 31.96 inches (U.S. Weather Bureau 1956-1965). Snow accumulates on most winter ranges from late December through February. Southern exposures are often bare while greater amounts of snow accumulate on northern expcsures and at higher elevations.

History

Domestic livestock grazed in the canyon as early as the late 1890's. Attracted by mining booms and the possibility of large profits, several men ran livestock in the Chamberlain country. Severe winters coupled with distances to markets eliminated many operations (Hockaday 1968), although some use continued to the late 1940's. Evidence of range abuse is present near many old ranches. Domestic sheep grazed in the Salmon River Breaks Primitive Area as early as 1917. There was no grazing between 1920 and 1930 but grazing resumed in 1932, then ceased in 1940 (Schumaker and Dewey 1970). Present use in both primitive areas is limited to horse grazing by recreationists and outfitters.

Big game animal numbers have changed since the late 1800's.

Bighorn sheep (*Ovis canadensis* Shaw) were abundant at that time with numbers reported in the thousands but they declined around 1880 and have never returned to previous levels (Smith 1954). Elk (*Cervus canadensis* Erxleben) were apparently confined to local populations in Chamberlain Basin but are now numerous throughout the canyon. The area was noted for large mule deer (*Odocoileus hemionus* Rafinesque) and mountain goat (*Oreamnos americanus* Allen) populations prior to 1927 before elk appeared in the area.

Much of the area was in the Salmon River Game Preserve established in 1925 by the Idaho Legislature and was closed to hunting to increase big game herds. In 1952 the game preserve was abolished and elk kills rapidly increased when outfitters became established and transportation by power boats came into use (Schumaker and Dewey 1970).

In addition to mule deer, elk, bighorn sheep, and mountain goats, white-tailed deer (*O. virginianus* Bailey) are common in parts of the canyon. Important carnivores include mountain lions (*Felis concolor* L.), black bears (*Ursus americanus* Audubon), coyotes (*Canis latrans* Say), and bobcats (*Lynx rufus* Schreber).

Wildfires in the 20th century have played a major role in determining vegetational patterns within the canyon. Fires during the late 1920's, 1930's and early 1940's burned many drainages. Since then wildfires have decreased as a result of fire suppression techniques.

METHODS AND TECHNIQUES

Species Composition and Cover Typing

The vegetational type is the interpretive unit used in this inventory. Vegetational types are based on dominant species in the tree, shrub, and herb layers. Vegetational type describes present vegetation on a site and is not synonymous with habitat type defined by Daubenmire and Daubenmire (1968).

I patterned sampling procedures after Poulton and Tisdale (1961). I sampled each vegetational type by one or more 100 X 100 ft macroplots within which four 50-ft transects were located in a restricted random pattern. Restrictions were that two of four transects start within the first 25 ft and two within the second 25 ft of the macroplot. Along the transects 6-ft belts and 8 X 20 inch plots were located (Fig. 2). Sampling was limited to southern exposures due to their importance as big game winter ranges.

I recorded canopy coverage and frequency of occurrence of all herbs as well as plot leg hits on bare ground, rock, litter, and live vegetation (Daubenmire 1959). For shrubs, foliage intercept was measured along each transect line (Canfield 1941). A frequency of contact value established by dividing the line transects into 5-ft segments replaced frequency of occurrence as a measure of plant dispersion. Density (number per unit area) was recorded for large shrubs in each 6-ft belt.

Vegetation data were analyzed by computer programs designed for this study. Computerized range plant symbols (Asherin 1973a) were used to code data on field forms suitable for automatic data processing. Scientific plant names follow Hitchcock et al. (1955-1969).

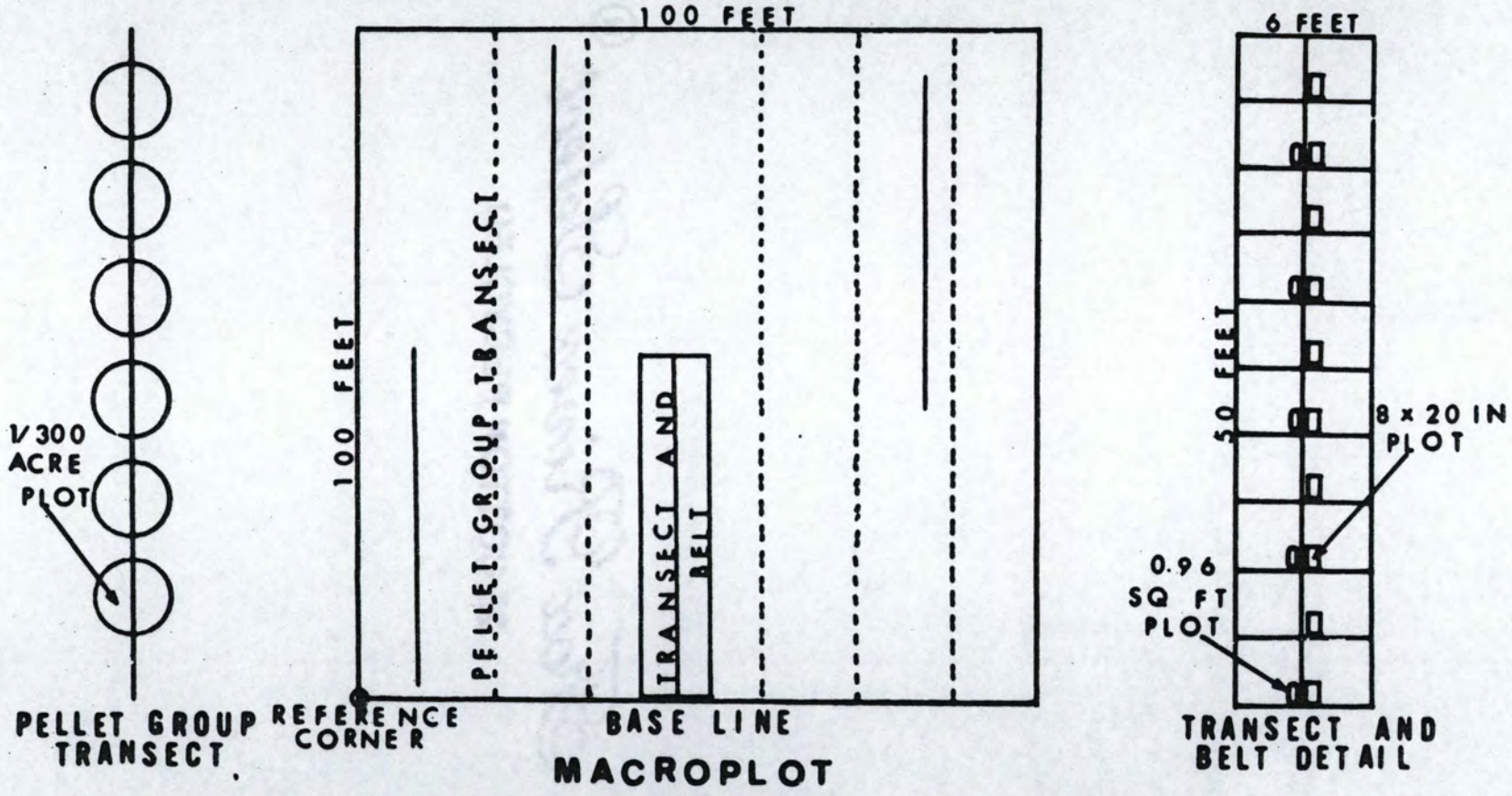

Fig. 2. The macroplot and its subsampling design.

Browse Condition

Condition of curl-leaf mountain mahogany and antelope bitterbrush was determined by classifying plants to age and form classes (Cole 1963). All plants within 6-ft belts located along the four 50-ft transects were classified (Fig. 2). Transects were extended to sample a minimum of 25 plants per site.

Forage Production

I obtained yields of standing live herbage of the grass-sedge and forb vegetation classes by clipping twenty 0.96 circular sq ft plots spaced at 10-ft intervals along 50-ft transects (Fig. 2).

Yields of current annual growth were obtained for each shrub species on a site. Yields of low-growing shrubs were obtained in the same manner as the grass-sedge and forb vegetation classes. For larger shrubs 20 twigs were clipped from each of 20 plants at each site and stratified into length classes. A weighting factor was then determined by dividing number of twigs in each length class by total twig numbers. This percentage multiplied by the class mean twig weight gave a weighted average. Stand mean twig weight was obtained by adding the weighted average twig weights. Production (grams/plant) was obtained by multiplying a total count of available twigs per plant by the stand mean twig weight (Hickey 1971). Leaves of snowbrush since they are persistent through the winter were stratified into four size classes and treated in the same manner as twigs. A basic assumption of the method is that twigs or leaves collected on a site are representative numberwise of the species. All forage samples were oven dried at 70° C before weighing.

Animal Use

Thirty 1/300-acre circular plots were located at 15-ft intervals along five randomly located lines to measure relative animal use (Fig. 2). Mule deer and bighorn sheep pellet groups were combined for all analyses as they are indistinguishable (Smith 1954).

RESULTS

Species Composition and Cover Typing

General vegetational zones roughly follow an altitudinal sequence with a transition from curl-leaf mountain mahogany to bluebunch wheatgrass to ponderosa pine to Douglas fir. Zones are not rigidly defined with vegetation of higher zones extending downslope in protected draws and on northern exposures while vegetation characteristic of lower zones extends upslope on southern exposures (Fig. 3). This interfingering provides great neterogeneity and greatly affects distribution of animals on the range.

Bluebunch Wheatgrass Zone. This zone achieves its best development on the lower section of the study area with bunchgrass-dominated open areas occurring between the river and the ponderosa pine zone. Most grassland communities are intermingled with forested areas dominated by ponderosa pine on the upper section of the study area (Fig. 3). Two types of vegetational composition are recognized.

Bluebunch Wheatgrass Vegetational Type. At low elevations on areas without a forest canopy bluebunch wheatgrass dominated the vegetation. The most characteristic associated species was cheatgrass brome. The major exceptions were the Fortune Creek area where cheatgrass brome formed a large percentage (11 percent canopy coverage) of grasses and in Little Trout Creek where a sedge was prominent throughout the type.

Dogbane, yarrow, knotweed, arrowleaf balsamroot and cushion buckwheat were characteristic forbs (Table 1). Low forb production in the Fortune Creek area reflected the scarcity of forbs in that area. Forage production averaged 365 pounds per acre (Table 2).

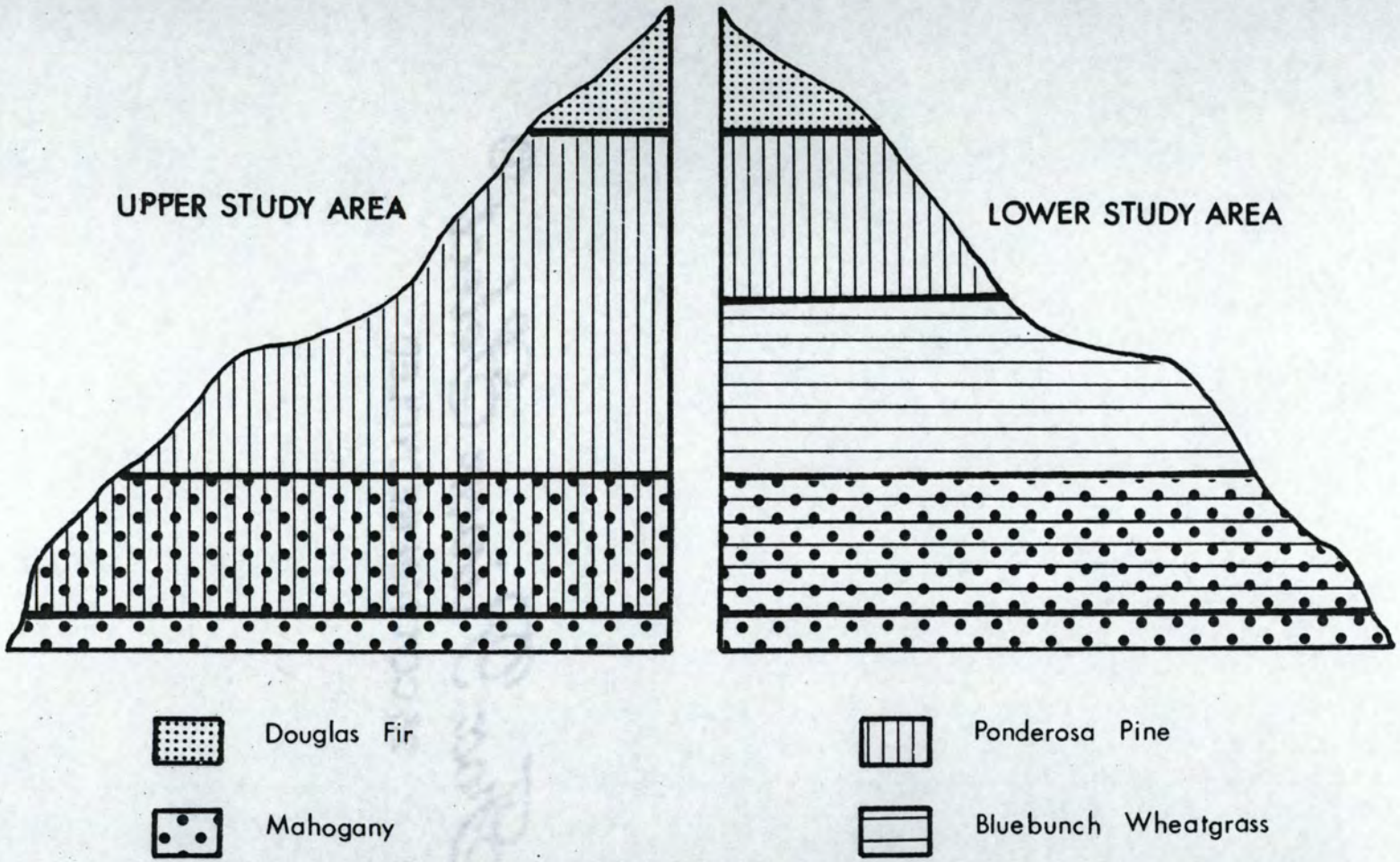

Fig. 3. Vegetational zones in the Salmon River Canyon.

Table 1. Major components of the bluebunch wheatgrass vegetational type. The number in parentheses is the site number. The data are presented as follows: percent canopy coverage/frequency of occurrence. Trace (T) amounts are less than 1 percent. A plus (+) denotes occurrence on the site but not in any plot. Ground cover leg hits are expressed as percentages.

Species	Fortune-Thirsty Creeks		Little Trout Creek		Bull Creek	
	(2)	(3)	(1)	(6)	(2)	(3)
Agropyron spicatum	29/80	17/50	20/65	19/52	16/60	6/17
Bromus brizaeformis					1/38	
B. tectorum	17/95	6/65	7/72	8/72	2/70	16/100
Festuca idahoensis		1/10			T/2	
Poa sandbergii		1/7	+			
Poa spp.			+			
Carex spp.			3/15	2/17	T/2	T/2
Achillea millefolium lanulosa	+	1/10	3/22	+	5/55	+
Amsinckia spp.				1/25	1/13	T/2
Apocynum spp.			T/2		14/75	
Arabis spp.			+	+		
Astragalus spp.			+	1/7		
Balsamorhiza sagittata	T/2	+	3/5	2/5	T/2	1/5
Cryptantha spp.		T/2				
Cirsium foliosum					T/2	
Erigeron spp.				+	T/5	+
Eriogonum ovalifolium	1/5	1/7	+	+	3/13	6/27
Hackelia deflexa						T/2
Hieracium albertinum			T/2	1/2	+	
Hypericum perforatum				T/2		
Lithospermum ruderale	+		+	+	T/5	
Lomatium spp.			T/2	2/15		
Lupinus spp.	+			T/2		
Penstemon spp.			T/5	1/7	+	+

Table 1 (continued).

Species	Fortune-Thirsty Creeks (2)	Fortune-Thirsty Creeks (3)	Little Trout Creek (1)	Little Trout Creek (6)	Bull Creek (2)	Bull Creek (3)
Phacelia spp.		T/2	+			2/25
Phlox austromontana					T/2	
Plantago patagonica						T/2
Polygonum spp.		1/10	3/45	2/4	2/4	6/67
Tragopogon pratensis	+	+	1/7	+	1/25	T/2
Berberis repens			5/22			
Ceanothus sanguineus			+			
Cercocarpus ledifolius		7/15				
Chrysothamnus nauseosus			+			
Eriogonum heracleoides		+		+	+	
Philadelphus lewisii		+		1/10		
Phlox longifolia		T/2		T/5		
Ribes cereum		+				
Sambucus cerulea						1/5
Symphoricarpos albus			T/2			
Annual Forb					1/17	T/10
Unknown Forb			1/7	4/10	T/2	T/2
Unknown Grass						T/5
Ground Cover-Leg Hits						
Bare Ground	27.5	23.7	33.7	43.8	50.0	22.5
Litter	43.1	18.8	25.6	35.6	29.4	51.9
Live Vegetation	21.2	25.0	11.9	11.2	11.9	19.3
Rock	8.2	32.5	28.8	9.4	8.7	6.3

Table 2. Average forage production in pounds per acre on the bluebunch wheatgrass vegetational type.

Class	Elkhorn-Fortune-Thirsty Creeks	Little Trout Creek	Bull Creek
Grasses	205	200	180
Forbs	80	205	175
Shrubs	--	--	--

Common Snowberry-Bluebunch Wheatgrass Vegetational Type. On more mesic sites this type supplants the bluebunch wheatgrass vegetational type. Recognition is afforded by the presence of several low-growing shrubs. Common snowberry dominated the vegetation with Oregon grape and spirea characteristic associates on moist sites. Young common chokecherry plants were invading moist sites occurring in stands of 50-300 plants. Better moisture conditions during the past few years may be responsible.

The dominant grass was bluebunch wheatgrass. Associated grasses were cheatgrass brome, Idaho fescue, and rattle brome. Presence of rattle brome in the area from the South Fork of the Salmon River to Fivemile Creek reflected the higher mean annual air temperatures in the lower canyon. Perennial forbs including arrowleaf balsamroot, yarrow, lupine, and desert phlox were well represented. Ground cover is typically greater than on the bluebunch wheatgrass vegetational type (Table 3).

Forage production averaged 696 pounds per acre but large differences existed among different drainages. In Chamberlain Creek and the area from the South Fork of the Salmon River to Fivemile Creek this type produced

Table 3. Major components of the common snowberry-bluebunch wheatgrass vegetational type. The number in parentheses is the macroplot identification number. The data are presented as follows: percent canopy coverage/frequency of occurrence. Trace (T) amounts are less than 1 percent. A plus (+) denotes occurrence on the site but not in any plot. Ground cover leg hits are expressed as percentages.

Species	Chamberlain Creek				Smith Gulch			Trout Cr.		South Fork Salmon Fivemile Creek		
	(3)	(7)	(8)	(10)	(1)	(3)	(5)	(2)	(3)	(7)	(1)	(4)
Agropyron spicatum	24/75	27/67	33/85	29/85	30/75	16/50	20/63	43/88	12/40	23/82	15/60	49/42
Bromus brizaeformis								T/10		4/80	4/15	T/5
B. tectorum	2/60	4/65	5/35	10/80	11/77	7/75	11/100	1/7	4/45	1/20	3/25	6/57
Festuca spp.								+				
F. idahoensis	1/2		5/25		T/2			5/27			7/30	1/7
Poa spp.			2/17					8/42	T/2			
Achillea millefolium lanulosa	4/30	22/67	22/72	1/2	7/35	16/57	5/30	1/10	5/35	2/13	4/27	2/7
Agoseris spp.									T/7	+		
Amsinkia spp.						2/15	T/13					
Anaphalis margaritacea						1/5						
Apocynum spp.						11/32	1/5		3/17			
Astragalus spp.				+			3/25			+	1/13	
Aster spp.									1/7			
Balsamorhiza sagittata	46/77	19/38	42/82	+	8/27	5/13	12/42	8/30		16/45	10/25	+
Castilleja spp.			1/7									
Cirsium utahensis												2/10
Clarkia pulchella		1/25						+		1/22	9/52	2/17
Erigeron spp.									T/5			2/7
Eriogonum ovalifolium			+									1/5
Hieracium albertinum			+		1/5	1/7		+		+	T/2	
Hypericum perforatum									3/10			
Lithospermum ruderale	+	2/2	1/2		1/2	1/5	2/10	+	1/7	+	+	+

Table 3 (continued).

Species	Chamberlain Creek (3)	Chamberlain Creek (7)	Chamberlain Creek (8)	Chamberlain Creek (10)	Smith Gulch (1)	Smith Gulch (3)	Smith Gulch (5)	Trout Cr. (2)	Trout Cr. (3)	South Fk. Salmon Fivemile Creek (7)	South Fk. Salmon Fivemile Creek (1)	South Fk. Salmon Fivemile Creek (4)
Lomatium spp.				T/5	1/7	11/27		+	1/2	T/5	1/7	+
Lupinus spp.	5/65	10/32	11/45	T/2			4/7	3/13	3/5	10/47	3/25	+
Mentzelia albicaulis			2/25									
Orthocarpus spp.		4/32			1/15	2/32	T/5	T/2	T/2			
Penstemon spp.							+		1/20			
Pedicularis spp.								T/7				
Phacelia spp.							1/17					
Phlox austromontana								6/38				
Phoenicaulis cheiranthoides					2/5					+	T/2	2/17
Polygonum spp.	2/65	2/25	1/10	1/7	2/30	3/42	4/57		3/27			
Senecio integerrimus											1/15	
Tragopogon pratensis		6/45	T/5	T/2	T/5	2/17	+	1/15	T/2	T/7	T/2	+
Berberis repens						9/27						
Eriogonum heracleoides	+	1/5	+		2/15			2/7		+	1/5	4/20
Holodiscus discolor						+						
Phlox longifolia	+		T/5									
Prunus virginiana		1/5							+			
Spiraea spp.						6/22				+	1/5	
Symphoricarpos albus	+	21/50	+		1/10	1/7		6/30		7/57	6/38	2/13
Annual Forb		1/22										
Unknown Forb								+	2/15			2/5
Ground Cover-Leg Hits												
Bare Ground	47.5	32.5	29.4	25.6	28.1	17.5	33.1	31.3	43.8	27.5	36.9	9.4
Litter	41.9	45.6	53.1	53.1	37.5	46.9	40.6	53.1	28.7	55.0	35.0	81.9
Live Vegetation	5.6	11.2	13.1	16.9	10.6	13.7	8.7	11.9	7.5	16.9	23.1	8.7
Rock	5.0	10.6	4.4	4.4	23.7	21.9	17.5	3.1	20.0	0.6	5.0	0.0

820 and 1080 pounds per acre, respectively, while in Smith Gulch and Trout Creek it produced 410 pounds per acre (Table 4).

Table 4. Average forage production in pounds per acre on the common snowberry-bluebunch wheatgrass vegetational type.

Class	Chamberlain Cr.	Smith Gulch	Trout Cr.	South Fork Salmon-Fivemile Cr.
Grasses	400	200	200	595
Forbs	405	205	200	475
Shrubs	15	5	10	15

Curl-leaf Mountain Mahogany Zone. This zone is confined to cliffs and talus slopes bordering the river and larger drainages. Small curl-leaf mountain mahogany stands may be found on exposed ridges (Fig. 3). One vegetational type was recognized.

Curl-leaf Mountain Mahogany-Bluebunch Wheatgrass Vegetational Type. This type is confined to shallow, rocky sites along the river and larger drainages. Curl-leaf mountain mahogany dominated the vegetation and occurred as either highlined or low hedged "pincushion" plants. Seedlings generally occurred in small stands of 20-30 plants but were more infrequently distributed in larger stands. The low coverage of curl-leaf mountain mahogany in Chamberlain Creek reflected the small plants on the sites sampled (Table 5). Fifty-eight percent of the browse plants classified in Chamberlain Creek were severely hedged. Of these, 48 percent were wholly available and 10 percent were partially available. Twenty-four percent were

Table 5. Major components of the curl-leaf mountain mahogany-bluebunch wheatgrass vegetational type. The number in parentheses is the macroplot identification number. The data are presented as follows: percent canopy coverage/frequency of occurrence. Trace (T) amounts are less than 1 percent. A plus (+) denotes occurrence on the site but not in any plot. Ground cover leg hits are expressed as percentages.

Species	Chamberlain Cr.		Elkhorn-Fortune-Thirsty Crs.			South Fork Salmon Fivemile Cr.
	(1)	(5)	(1)	(4)	(5)	(5)
Agropyron spicatum	9/30	30/75	23/67	41/88	28/65	17/67
Bromus brizaeformis						T/2
B. tectorum	+	5/57	15/85	15/72	6/57	3/52
Festuca idahoensis	6/42	3/5		5/15	T/2	1/2
Poa spp.		1/7				
Achillea millefolium lanulosa	+	3/15		+	+	T/7
Agoseris spp.						+
Amsinkia spp.			+		T/7	
Arabis spp.						T/2
Astragalus spp.		+				
Balsamorhiza sagittata	3/13	3/15		6/10		2/10
Cirsium utahensis						+
Clarkia pulchella						1/17
Erigeron spp.						+
Eriogonum ovalifolium	+	1/2	+	+	+	+
Frasera spp.		T/2			+	
Gilia aggregata	T/2					
Hieracium albertinum	T/5		+		+	+
Lithospermum ruderale	+	+			+	+
Lomatium spp.	+					
Lupinus spp.	+	1/2				
Penstemon spp.	+	T/2				
Polygonum spp.	+	T/2				
Senecio integerrimus						T/2

Table 5 (continued).

Species	Chamberlain Cr.		Elkhorn-Fortune-Thirsty Crs.			South Fork Salmon Fivemile Cr.
	(1)	(5)	(1)	(4)	(5)	(5)
Tragopogon pratensis	+					+
Amelanchier alnifolia	T/3					T/3
Cercocarpus ledifolius	3/15	2/3	13/30	32/40	14/18	7/13
Chrysothamnus nauseosus			+			+
Eriogonum heracleoides	T/7			+	3/5	+
Glossopetalon nevadense						+
Phlox longifolia		1/5		T/7	T/5	
Philadelphus lewisii				+	+	
Purshia tridentata		3/8				
Ribes cereum		+		+	+	
R. velutinum gooddingii		+	2/13	+	+	
Symphoricarpos albus	+					
Unknown Forb	+		+		+	
Unknown Grass	2/17					
Ground Cover-Leg Hits						
Bare Ground	15.0	48.1	14.4	7.5	12.5	25.6
Litter	25.6	26.9	31.3	46.9	33.1	15.6
Live Vegetation	17.5	6.9	21.9	26.9	14.4	23.7
Rock	41.9	18.1	32.5	18.8	40.0	34.4

in the decadent age class. Eighty percent of the browse plants classified in the Fortune Creek area were severely hedged. Of these, 70 percent were wholly available and 10 percent were partially available. Only 4 percent of the plants classified were in the decadent age class (Table 6).

Bluebunch wheatgrass and cheatgrass brome were dominant grasses. Cheatgrass brome formed almost pure stands underneath patchy clumps of old curl-leaf mountain mahogany. Concentration of big game animals in the type is responsible. Common forbs included arrowleaf balsamroot, yarrow, and knotweed. Forbs were not common on more disturbed sites (Table 5).

Forage production averaged 452 pounds per acre with curl-leaf mountain mahogany contributing a small percentage of total production (Table 7).

Ponderosa Pine Zone. The ponderosa pine zone comprises the bulk of the big game winter range. The zone is relatively dry and ponderosa pine forms open stands when mature (Fig. 3). Six vegetational types are recognized in this zone. I did not attempt to separate the wide variety of seral vegetation on burns into different types. The vegetation typically changes in a short distance even within a drainage.

Ponderosa Pine-Bluebunch Wheatgrass Vegetational Type. This type occurred mainly on the lower section of the study area and occasionally as small stands on the upper section. Ponderosa pine was the only coniferous tree present. Bluebunch wheatgrass and cheatgrass brome were dominant grasses. Dogbane, yarrow, and knotweed were common forbs. Annual forbs and cheatgrass brome were common on areas that showed evidence of range abuse (Table 8). Forage production totaled 405 pounds per acre (Table 9).

Table 6. Results of age and form class transects in the curl-leaf mountain mahogany-bluebunch wheatgrass vegetational type.

Drainage	Density (Plants per Acre)	No. of Plants	No. of Unavailable Plants	No. of Dead Plants	Form Class Percent						Age Class Percent			
					1	2	3	4	5	6	S	Y	M	D
Chamberlain Cr.	407	125	4	11	10	31	48		1	10	8	16	52	24
Elkhorn-Fortune-Thirsty Crs.	334	50	3	--		20	70			10		18	78	4

Table 7. Average forage production in pounds per acre on the curl-leaf mountain mahogany-bluebunch wheatgrass vegetational type.

Class	Chamberlain Cr.	Elkhorn-Fortune-Thirsty Crs.	South Fork Salmon-Fivemile Cr.
Grasses	302	200	200
Forbs	300	100	200
Shrubs	16	23	10

Table 8. Major components of the ponderosa pine-bluebunch wheatgrass and ponderosa pine-common snowberry-bluebunch wheatgrass vegetational types. The number in parentheses is the macroplot identification number. The data are presented as follows: percent canopy coverage/frequency of occurrence. Trace (T) amounts are less than 1 percent. A plus (+) denotes occurrence on the site but not in any plot. Ground cover leg hits are expressed as percentages.

Species	Ponderosa Pine-Bluebunch Wheatgrass	Ponderosa Pine-Common Snowberry-Bluebunch Wheatgrass				
	Bull Cr.	Chamberlain Cr.	Smith Gulch		South Fork Salmon Fivemile Cr.	
	(4)	(2)	(2)	(4)	(2)	(3)
Agropyron spicatum	13/35	36/85	20/85	24/72	13/60	29/63
Bromus brizaeformis	2/32				4/42	5/70
B. tectorum	4/63	3/30	1/27	8/75	2/25	2/27
Festuca idahoensis	1/13	11/38	3/27	T/5	7/35	8/32
Poa spp.		T/5	1/7	T/2		
Carex geyeri	T/2		1/7			
Achillea millefolium lanulosa	T/7	2/13	1/7	3/22	1/5	
Agoseris spp.		T/2				
Amsinkia spp.				T/5		
Anaphalis margaritacea				2/10		
Apocynum spp.		19/67		1/7		
Balsamorhiza sagittata	7/35	9/35	14/50	18/45	13/35	29/63
Centaurium muhlenbergii	+					
Clarkia pulchella					1/7	1/7
Epilobium minutum		+				
Erigeron spp.	1/5					
Eriogonum ovalifolium			+			
Frasera spp.				T/5		
Hieracium albertinum	T/2	2/7	2/13	+	T/2	
Lathyrus spp.		7/25				

Table 8 (continued).

Species	Ponderosa Pine-Bluebunch Wheatgrass	Ponderosa Pine-Common Snowberry-Bluebunch Wheatgrass				
	Bull Cr.	Chamberlain Cr.	Smith Gulch		South Fork Salmon Fivemile Cr.	
	(4)	(2)	(2)	(4)	(2)	(3)
Lithospermum ruderale	+	4/25	+	T/2	+	+
Lomatium spp.	+					T/5
Lupinus spp.			10/25	1/5	6/25	1/2
Orthocarpus spp.		T/2		T/2		
Penstemon spp.	+		+			
Phlox austromontana	+				3/30	
Polygonum spp.	1/30	1/30	1/32	5/50		T/13
Sedum stenopetalum		1/5				
Senecio integerrimus			+		T/2	
Tragopogon pratensis		T/5			1/7	+
Berberis repens		T/10				
Chrysothamnus nauseosus					T/2	+
Eriogonum heracleoides	+				T/2	
Holodiscus discolor	+					
Spiraea spp.	T/2	+	T/13	T/2	2/10	
Symphoricarpos albus	1/15	2/17		9/45	5/50	
Unknown Forb		5/20				1/7
Ground Cover-Leg Hits						
Bare Ground	28.7	48.1	56.9	17.5	24.4	26.2
Litter	45.0	45.6	38.7	66.9	38.7	55.0
Live Vegetation	8.7	5.3	4.4	8.1	31.3	18.1
Rock	17.5	1.2	0.0	7.5	5.0	1.2

Table 9. Average forage production in pounds per acre on the ponderosa pine-bluebunch wheatgrass and ponderosa pine-common snowberry-bluebunch wheatgrass vegetational types.

Class	Ponderosa Pine-Bluebunch Wheatgrass	Ponderosa Pine-Common Snowberry-Bluebunch Wheatgrass		
	Bull Cr.	Smith Gulch	Chamberlain Cr.	S. Fork of Salmon Fivemile Cr.
Grasses	205	200	400	410
Forbs	200	203	400	393
Shrubs	--	30	10	35

Ponderosa Pine-Common Snowberry-Bluebunch Wheatgrass Vegetational Type. On more mesic sites this type supplants the ponderosa pine-bluebunch wheatgrass vegetational type. Ponderosa pine is again the only coniferous tree present. Common snowberry dominated the shrub layer with Oregon grape and spirea characteristic associates on moist sites. Bluebunch wheatgrass and cheatgrass brome were common grasses with Idaho fescue abundant on moist sites and rattle brome common in the area from the South Fork of the Salmon River to Fivemile Creek. Dogbane, arrowleaf balsamroot, western hawkweed, yarrow, and lupine were the major forbs (Table 8).

Forage production averaged 694 pounds per acre but large differences existed among the drainages. Chamberlain Creek and the area from the South Fork of the Salmon River to Fivemile Creek produced 810 and 837 pounds per acre, respectively, while in Smith Gulch it produced 433 pounds per acre (Table 9).

Ponderosa Pine-Idaho Fescue Vegetational Type. Limited areas on east-facing slopes throughout the study area supported this composition. Ponderosa pine is the only coniferous tree present. Idaho fescue dominated the understory reflecting the mesic conditions. Commonly associated with it is bluebunch wheatgrass. A variety of forbs including arrowleaf balsamroot, lupine, and western hawkweed were common. I did not sample any stands due to the type's limited distribution.

Ponderosa Pine-Antelope Bitterbrush-Idaho Fescue Vegetational Type. This type was found only on east-facing slopes above 3000 ft in Chamberlain Creek but may exist on similar aspects in other large drainages. Mature ponderosa pine dominated the vegetation. Antelope bitterbrush dominated the shrub layer. Twenty-four percent of the browse plants examined

were severely hedged. Light use of the type was further reflected in the low percent of plants in the decadent age class (Table 10). Seedlings were scattered infrequently throughout the stand.

Idaho fescue and bluebunch wheatgrass were codominant grasses; pinegrass and elk sedge were also present. Lupine, heartleaf arnica, and western hawkweed were common forbs (Table 11). Forage production totaled 945 pounds per acre but antelope bitterbrush contributed only a small percentage of the total (Table 12).

Ponderosa Pine-Antelope Bitterbrush-*Agropyron spicatum* Vegetational Type. This type replaced the ponderosa pine-antelope bitterbrush-bluebunch wheatgrass vegetational type on south-facing slopes in Chamberlain Creek. Antelope bitterbrush under an overstory of ponderosa pine again dominated the shrub layer. Fifty percent of the browse plants examined were severely hedged and the same percentage were classified as decadent (Table 10). Seedlings were infrequently scattered through adjacent bunchgrass stands.

Bluebunch wheatgrass and cheatgrass brome were the major grasses. Idaho fescue was not common, reflecting the drier conditions. The most common forb was arrowleaf balsamroot (Table 11). Forage production averaged 853 pounds per acre (Table 12).

Burns. Dominants included reproduction of Douglas fir and more commonly ponderosa pine. Several species of shrubs including willow, serviceberry, redstem ceanothus, snowbrush, oceanspray, ninebark, and rose were present in the understory. The prominence of any one species varied greatly between sites. Shrub production and density data for the six sites sampled are presented in Table 13.

Table 10. Results of age and form class transects in the ponderosa pine-antelope bitterbrush-Idaho fescue and ponderosa pine-antelope bitterbrush-bluebunch wheatgrass vegetational types in Chamberlain Creek.

Vegetational Type	Density (Plants per Acre)	No. of Plants	No. of Unavailable Plants	No. of Dead Plants	Form Class Percent						Age Class Percent			
					1	2	3	4	5	6	S	Y	M	D
Ponderosa Pine-Antelope Bitterbrush-Idaho Fescue	552	25	--	--	8	68	24				8	20	60	12
Ponderosa Pine-Antelope Bitterbrush-Bluebunch Wheatgrass	624	50	--	4		50	50					8	42	50

Table 11. Major components of the ponderosa pine-antelope bitterbrush-Idaho fescue and ponderosa pine-antelope bitterbrush-bluebunch wheatgrass vegetational types. The number in parentheses is the macroplot identification number. The data are presented as follows: percent canopy coverage/frequency of occurrence. Trace (T) amounts are less than 1 percent. A plus (+) denotes occurrence on the site but not in any plot. Ground cover leg hits are expressed as percentages.

Species	Ponderosa Pine-Antelope Bitterbrush-Idaho Fescue Vegetational Type (4)	Ponderosa Pine-Antelope Bitterbrush-Bluebunch Wheatgrass Vegetational Type (6)	(9)
Agropyron spicatum	9/35	5/27	21/80
Bromus tectorum	T/2	15/92	6/72
Calamagrostis rubescens	T/2		
Festuca idahoensis	14/40		1/7
Carex geyeri	2/10		
Achillea millefolium lanulosa	2/10		
Agoseris spp.	+		
Antennaria spp.	2/2		
Arnica cordifolia	4/25		
Astragalus spp.			T/7
Balsamorhiza sagittata	+	+	5/25
Clarkia pulchella		T/7	
Epilobium minutum		+	
Eriogonum ovalifolium			T/5
Fragaria vesca bracteata	T/5		
Hieracium albertinum	2/15		
Linnaea borealis longiflora	1/14		
Lithospermum ruderale			+
Lupinus spp.	10/32		
Mentzelia albicaulis		3/17	

Table 11 (continued).

Species	Ponderosa Pine-Antelope Bitterbrush-Idaho Fescue Vegetational Type (4)	Ponderosa Pine-Antelope Bitterbrush-Bluebunch Wheatgrass Vegetational Type (6)	(9)
Penstemon spp.		T/2	1/17
Phacelia spp.		+	
Phoenicaulis cheiranthoides	+		+
Polygonum spp.	T/2	T/7	T/2
Sedum stenopetalum	+		
Tragopogon pratensis	+	+	+
Viola adunca	T/15		
Amelanchier alnifolia	2/8	1/3	
Berberis repens	+	+	
Eriogonum heracleoides			+
Phlox longifolia		+	+
Prunus virginiana		2/13	
Purshia tridentata	30/45	23/58	10/40
Ribes cereum	+		
Symphoricarpos albus	+	+	
Unknown Forb		T/7	
Ground Cover-Leg Hits			
Bare Ground	6.3	71.9	48.1
Litter	81.9	27.5	33.7
Live Vegetation	11.9	0.6	10.0
Rock	0.0	0.0	8.1

Table 12. Average forage production in pounds per acre on the ponderosa pine-antelope bitterbrush-Idaho fescue and ponderosa pine-antelope bitterbrush-bluebunch wheatgrass vegetational types in Chamberlain Creek.

Class	Ponderosa Pine-Antelope Bitterbrush-Bluebunch Wheatgrass	Ponderosa Pine-Antelope Bitterbrush-Idaho Fescue
Grasses	400	450
Forbs	405	450
Shrubs	48	45

Grasses present included bluebunch wheatgrass and Idaho fescue on the drier sites to elk sedge, pinegrass, and Kentucky bluegrass on moist sites. Forbs included yarrow, pussytoes, and heartleaf arnica (Table 14). Forage production averaged 890 pounds per acre (Table 15).

Douglas Fir Zone. The downward extensions of this zone represent the upper limits of big game winter range on south-facing slopes (Fig. 3). The seral vegetation discussed previously is present on many burned areas. Climax vegetation is probably similar to the Douglas fir/pinegrass or Douglas fir/ninebark habitat types described by Daubenmire (1952). This zone provides much of the spring and fall range for elk.

Animal Use

I obtained pellet group counts to provide information on relative use of different vegetational types. Julander (1958) and Loveless (1967) have found pellet group counts reliable indicators of use intensity.

I erected a chi-square contingency table to test the hypothesis that

Table 13. Shrub production and density on six sites in the burn vegetational type. The number in parentheses is the site number.

Species	Smith Gulch (6)	Little Trout Cr. (4)	(5)	S. Fk. Salmon Fivemile Cr. (6)	Bull Cr. (1)	(5)
	Production (Pounds per Acre)					
Amelanchier alnifolia	--	14	26	--	--	--
Berberis repens	10	30	2	--	--	--
Ceanothus sanguineus	--	18	--	--	125	356
C. velutinus	260	62	--	--	--	--
Holodiscus discolor	6	--	--	173	--	--
Physocarpus malvaceus	279	--	--	--	130	175
Salix spp.	--	12	4	178	--	--
Spiraea spp.	10	20	--	--	10	--
Symphoricarpos albus	10	20	10	10	8	--
	Density (Plants per Acre)					
Amelanchier alnifolia	--	145	258	--	--	--
Berberis repens	--	--	--	--	--	--
Ceanothus sanguineus	--	145	--	--	300	683
C. velutinus	1278	145	--	--	--	--
Holodiscus discolor	--	--	--	383	--	--
Physocarpus malvaceus	1423	--	--	--	320	350
Salix spp.	--	174	--	552	--	--
Spiraea spp.	--	--	--	--	--	--
Symphoricarpos albus	--	--	--	--	--	--

Table 14. Major components of the burn vegetational type. The number in parentheses is the macroplot identification number. The data are presented as follows: percent canopy coverage/frequency of occurrence. Trace (T) amounts are less than 1 percent. A plus (+) denotes occurrence on the site but not in any plot. Ground cover leg hits are expressed as percentages.

Species	Smith Gulch (6)	Little Trout Cr. (4)	Little Trout Cr. (5)	South Fork Salmon Fivemile Creek (6)	Bull Cr. (1)	Bull Cr. (5)
Agropyron spicatum		24/52	25/65	+	1/7	26/63
Bromus brizaeformis			+		T/2	
B. tectorum	1/10		2/22	8/35		5/35
Calamagrostis rubescens	3/10			4/22	6/13	
Festuca idahoensis					12/72	T/2
Phleum pratense			2/7			
Poa bulbosa		1/5	T/7	+		
P. pratensis				10/27		
Poa spp.		4/13	+		T/2	1/10
Carex geyeri	18/57	4/10	5/17	5/13	8/45	8/20
Achillea millefolium lanulosa	3/30	3/30	4/35	2/7	2/27	4/35
Agoseris spp.			T/2			
Amsinkia spp.			+			
Antennaria spp.				6/30		
Apocynum spp.		4/35	7/42			
Arabis spp.		2/13				
Aster spp.					T/7	
Balsamorhiza sagittata			6/22			T/2
Castilleja spp.				+		
Collomia linearis					T/5	
Epilobium alpinum						+
E. angustifolium				T/5		
Fragaria vesca bracteata	T/5				T/5	T/5

Table 14 (continued).

Species	Smith Gulch (6)	Little Trout Cr. (4)	Little Trout Cr. (5)	South Fork Salmon Fivemile Creek (6)	Bull Cr. (1)	Bull Cr. (5)
Frasera spp.		T/2				
Hieracium albertinum	T/5	T/2	T/2	1/13	11/25	T/2
Lithospermum ruderale					+	
Lupinus spp.		6/20	2/7			
Mertensia campanulata		4/17				
Orthocarpus spp.	1/7					
Penstemon spp.	T/2					
Phacelia spp.	T/2	+	+			
Phlox austromontana			5/32	1/15	13/70	
Polygonum spp.	7/35			T/2	1/17	2/27
Sedum stenopetalum	+	1/7	T/2		1/27	3/38
Tragopogon pratensis	+	T/2	T/7	T/13	1/10	+
Trifolium spp.	19/27	+				
Viola adunca		T/2			1/13	
Amelanchier alnifolia	2/5	6/10	8/15	T/3	T/3	1/3
Berberis repens	6/27	5/15	+			1/5
Ceanothus sanguineus		4/5		+	1/10	39/60
C. velutinus	20/50	6/8				
Eriogonum heracleoides		3/5	+			
Holodiscus discolor	4/8			15/30		
Lonicera utahensis	T/2					
Phlox longifolia			2/10		T/2	
Philadelphus lewisii				+		
Potentilla fruticosa			T/2		4/27	+
Physocarpus malvaceus	22/60	2/3		+	3/8	8/23
Prunus virginiana			+			
Rosa spp.	T/3				5/40	T/2
Salix spp.	+	11/13	5/10	26/43	+	+

Table 14 (continued).

Species	Smith Gulch (6)	Little Trout Cr. (4)	Little Trout Cr. (5)	South Fork Salmon Fivemile Creek (6)	Bull Cr. (1)	Bull Cr. (5)
Spiraea spp.	3/13	6/25	2/7		4/38	3/20
Symphoricarpos albus	3/15	4/25	14/42	5/10		4/30
Vaccinium membranaceum		T/2				
Unknown Forb			T/13		T/2	
Unknown Grass				5/20		
Ground Cover-Leg Hits						
Bare Ground	27.5	33.1	16.9	1.9	43.1	38.7
Litter	51.2	57.5	66.9	88.1	43.8	48.1
Live Vegetation	18.1	8.7	15.6	9.4	12.5	13.1
Rock	2.5	0.6	0.6	0.0	0.6	0.0

Table 15. Average forage production in pounds per acre on the burn vegetational type.

Class	Smith Gulch	Little Trout Creek	S. Fork Salmon Fivemile Cr.	Bull Cr.
Grasses	205	198	205	210
Forbs	185	205	200	203
Shrubs	575	108	361	390

there is no difference between mean number of pellet groups per vegetational type within each drainage. I did not make comparisons between types for deer in Smith Gulch, Little Trout and Trout creeks, and the area from the South Fork of the Salmon River to Fivemile Creek because of the low number of pellet groups counted (Table 16).

There were no significant differences between the mean number of elk pellet groups in shrub and grass types but there were significant differences between types on different exposures and slope positions. Types on south-facing slopes had a significantly greater ($P<.05$) number of pellet groups than did types on east-facing slopes. This probably reflects the greater snow depth and cooler temperatures on east-facing slopes. Types on the upper part of the slope had a significantly greater ($P<.05$) number of pellet groups than did types on the lower part of the slope.

A significantly greater ($P<.05$) number of deer pellet groups were located in shrub communities than in grass communities. Low counts of deer pellet groups in the drainages where types were not compared further confirm the dependence of deer on browse as the available browse in these

Table 16. Chi-square test of significance for differences in observed and expected values for mean number of pellet groups per vegetational type.

Species	Expected	Bluebunch Wheatgrass	Curl-leaf Mountain Mahogany	Ponderosa Pine-Bluebunch Wheatgrass	Common Snowberry-Bluebunch Wheatgrass
Elk					
Chamberlain Cr.	86	--	140	--	118
Elkhorn-Fortune-Thirsty Crs.	84	78	90	--	--
Smith Gulch	94	--	--	--	87
Little Trout-Trout Crs.	65.66	69	--	--	66
S. Fk. Salmon R. Fivemile Cr.	86.75	--	69	--	72
Bull Cr.	68	69	--	60	--
Deer					
Chamberlain Cr.	33.2	--	44	--	21
Elkhorn-Fortune-Thirsty Crs.	43	45	41	--	--
Bull Cr.	29.66	36	--	23	--

Table 16 (continued).

Species	Ponderosa Pine-Common Snowberry-Bluebunch Wheatgrass	Ponderosa Pine-Antelope Bitterbrush-Idaho Fescue	Ponderosa Pine-Antelope Bitterbrush-Bluebunch Wheatgrass	Burn	$\frac{\Sigma(O-E)^2}{E}$
Elk					
Chamberlain Cr.	61	36	75	--	83.561*
Elkhorn-Fortune-Thirsty Crs.	--	--	--	--	.8570
Smith Gulch	81	--	--	114	6.5743*
Little Trout-Trout Crs.	--	--	--	62	.3739
S. Fk. Salmon R. Fivemile Cr.	107	--	--	99	12.61*
Bull Cr.	--	--	--	75	1.6763
Deer					
Chamberlain Cr.	17	38	46	--	21.5299*
Elkhorn-Fortune-Thirsty Crs.	--	--	--	--	.1860
Bull Cr.	--	--	--	30	2.8500*

*Significant at the .05 level

drainages is near the upper limits of the winter range where deep snows preclude use by deer.

DISCUSSION

Winter Range Status

Curl-leaf Mountain Mahogany. The large percentage of plants in the severely hedged form class and decadent age class indicates a history of heavy use for curl-leaf mountain mahogany. However, presence of young plants, 10-50 years old, indicates reproduction has occurred despite heavy animal use. Highlined plants evidently produce an adequate seed source and opportunity for reproduction occurs most years. My observations and those of J. Dealy (pers. comm.) suggest that microsite requirements are significant factors limiting seedling establishment. Annual weather, seed predation by insects and rodents, and site competition are factors determining establishment. Seedlings likely escape detection by ungulates until they develop competitive root systems. Present reproduction appears adequate to replace losses considering the long life-span and low reproductive rate of this species.

Low precipitation, shallow, infertile soils, and big game use have produced a predominantly cheatgrass understory in some curl-leaf mountain mahogany stands. Once established this annual does not yield to reinvasion by perennial grasses and probably represents a zootic climax.

Antelope Bitterbrush. The large percentage of plants in the severely hedged form class and decadent age class indicates a history of heavy use for antelope bitterbrush. However, the environment of the Salmon River Canyon and the lower Middle Fork of the Salmon River represents marginal habitat for climax antelope bitterbrush communities. Steep, shallow granttic soils, low in nutrients, do not produce the highly vigorous plants found on deeper soils. An examination of stands on east-facing

slopes revealed that although they were not subjected to heavy use plants were still low in vigor and contained a high percentage of dead material. This should be considered when determining the effect of ungulates on the plant.

Seedlings evidently escape detection by ungulates until they are at least 6 inches tall. Plants smaller than this did not show evidence of use. Seedling establishment may not be adequate to replace losses. The absence of seedlings in stands that did not show heavy use suggests that other factors besides big game use may be responsible for the low percentage of seedlings observed.

Grasslands. The composition of the grass types, although not unaltered, gives an indication of the probable climax for the area. Absence of vegetation similar to the Idaho fescue-junegrass and bluebunch wheatgrass-Idaho fescue communities found in the lower Salmon River Canyon (Campbell 1962) probably reflects xeric conditions on the well-drained loose granitic soils.

The major animal impact on these grasslands is displacement of loose soil. Breakup of litter coverage allows cheatgrass brome and annuals to be conspicuous but does not represent deterioration of the community. Grasslands that showed severe erosion and plant community deterioration were associated with present or past domestic livestock use. Common chokecherry has established itself in these grasslands despite a history of heavy animal use. Similar stands exist in Big Creek, 30 miles south of the study area (Claar 1973).

Burns. Seral brushfields provided all the available browse in three areas sampled. Animal use of these burns as indicated by the pellet

group counts was heavy. Burns generally produce more available forage than curl-leaf mountain mahogany or bitterbrush communities and browse may constitute a larger percentage of the diet of elk than that reported by Claar (1973) for curl-leaf mountain mahogany and antelope bitterbrush communities in Big Creek. They may achieve additional importance as spring and fall range. Their relative nonimportance to deer may be due to deep snows typically present during the winter.

Two major problems associated with seral browse ranges are current annual growth availability and conifer encroachment (Klebenow 1965, Leege 1968). Availability is not a major problem on these ranges since most shrubs are of a low or medium growth form. Only willow has grown out of reach of elk. Ponderosa pine reproduction is present on most sites; as tree density and size increase available forage can be expected to decrease.

Management Implications

Key Species Concept. Condition and trend of big game winter ranges have typically been based on measurement of one or more "key species" considered critical to the survival of big game herds. These important species are usually measured on key or significant units of rangeland which in good condition insure that the rest of the range is also (Dasmann 1948, Cole 1963). An examination of ungulate range history in the Idaho Primitive Area reveals that present conditions are not as bad as our methods have predicted.

Winter ranges of the Salmon River Canyon, the Middle Fork of the Salmon River, and Big Creek have been termed overbrowsed since the early 1900's (Schumaker and Dewey 1970, Hockaday 1968). Yet ungulate populations still exist, browse plants are still present, and there is no evidence of severe erosion on most areas. Elk are even considered to be increasing in

Big Creek (Hornocker 1970). Perhaps our concept of key species does not take into account plant and animal interaction.

Ungulate species adjust to changes in forage quality and quantity through lower reproductive and survival rates. These low reproduction and survival rates have been termed unnatural but represent natural regulation in plant and animal communities that have evolved together. Without successional influences or habitat limitations by man, ungulate species cannot destroy their own food resource (Cole 1971).

How many or which plants should be measured cannot be easily answered. The final indicator of poor condition is the loss of the base resource - the soil. A management approach combining population dynamics with associated data on range resources appears more ideal.

Range Trend. Good management requires knowledge of population dynamics and forces affecting the past and future composition of that population. Together with data on animal movement, food habits, and population structure, this inventory can help form the basis for a management program. This inventory provides a base description upon which range trend can be followed. The macroplots should be remeasured at 3-5 year intervals when vegetation is near maximum development. The major limitation is that the measurement of forbs and grasses will not relate directly to forage availability during winter months.

Use of canopy by plot method and the line intercept method appears to be a good approach to vegetation sampling. Canopy coverage by plot method detects more plant species (Asherin 1973b) than other methods but is awkward to use in tall shrub types. Comparable data may be obtained for tall shrubs by the line intercept method. The use of the frequency

of contact value also yields a measure of shrub distribution on a site comparable to frequency of occurrence obtained with the canopy coverage by plot method.

Automatic data processing reduces time and effort required to analyze data. Coded field forms and alpha codes, for reducing field time, allow keypunching of data directly off field forms and with the use of a master type (Asherin 1973a) give the full scientific name in the output. Cost of analyses in this study averaged $1.80 per macroplot for both canopy coverage and line intercept data.

Pellet group transects should not be used for trend determination unless the data used were collected from elevations where concentrations of animals occurred in the years being compared. Variations in annual weather conditions cause different animal distribution on the range. The high inherent variation of pellet group counts further reduces their usefulness. A prohibitively large number of plots must be sampled to attain an acceptable level of accuracy.

Fire Ecology. Fire's significance in the ecosystem should be considered in developing programs of fire control. Fire is an integral part of natural ecosystems and contributes to species diversity. Elk, deer, and moose are all associated with seral browse ranges. Fire may even prove beneficial to animals such as bighorn sheep associated with climax communities (Morgan 1971).

Rehabilitation of seral browse ranges by prescribed spring or fall burning may not be the answer in this area. It is doubtful whether current annual growth availability could be improved on these ranges. The lack of good quantities of light fuels precludes a hot enough fire to set back conifer encroachment.

SUMMARY

1. A range inventory was conducted in nine drainages of the Salmon River Canyon from June 1972 through September 1972 to describe important vegetational types in terms of species composition and forage production.

2. I sampled vegetation on 39 permanently located macroplots in nine vegetational types. These were bluebunch wheatgrass, common snowberry-bluebunch wheatgrass, curl-leaf mountain mahogany-bluebunch wheatgrass, ponderosa pine-bluebunch wheatgrass, ponderosa pine-common snowberry-bluebunch wheatgrass, ponderosa pine-Idaho fescue, ponderosa pine-antelope bitterbrush-bluebunch wheatgrass, ponderosa pine-antelope bitterbrush-Idaho fescue, and burn vegetational types.

3. The presence of young curl-leaf mountain mahogany plants indicates reproduction has occurred despite a history of heavy use. Low precipitation, shallow, infertile soils and big game use have produced a predominantly cheatgrass understory in some stands.

4. The environment of the Salmon River Canyon represents marginal habitat for climax antelope bitterbrush communities. The steep, loose granitic soils do not produce highly vigorous plants. Seedling establishment may not be adequate to replace losses.

5. The major impact of animals on grasslands is displacement of loose soil. Breakup of litter coverage allows cheatgrass brome and annuals to be conspicuous but does not represent deterioration of the community.

6. Availability is not a major problem on the burn vegetational type since most shrubs are of a low or medium growth form. As tree size and density increase, the amount of available forage will decrease.

7. Winter ranges of the Salmon River Canyon, the Middle Fork of the Salmon River and Big Creek have been termed overbrowsed since the early 1900's, yet ungulate populations still exist, browse plants are still present and there is no evidence of severe erosion on most areas. This suggests that the deterioration of condition and trend based on measurement of one or more "key species" does not take into account plant and animal interaction.

8. This inventory provides a base description upon which range trend can be followed. The macroplots should be remeasured at 3-5 year intervals to help form the basis for a management program together with data on animal movement, food habits and population structure.

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APPENDIX I

SCIENTIFIC AND COMMON NAMES OF PLANT SPECIES ENCOUNTERED ON THE MACROPLOTS

Table 17. Scientific and common names of plant species encountered on the macroplots.

Grasses	
Agropyron spicatum	Bluebunch wheatgrass
Bromus spp.	Brome
B. brizaeformis	Rattle brome
B. tectorum	Cheatgrass brome
Calamagrostis rubescens	Pinegrass
Festuca spp.	Fescue
F. idahoensis	Idaho fescue
Phleum pratensis	Timothy
Poa spp.	Bluegrass
P. bulbosa	Bulbous bluegrass
P. pratensis	Kentucky bluegrass
P. sandbergii	Sandberg bluegrass
Grasslikes	
Carex spp.	Sedge
C. geyeri	Elk sedge
Forbs	
Achillea millefolium lanulosa	Yarrow
Agoseris spp.	Agoseris
Amsinckia spp.	Fiddleneck
Anaphalis margaritacea	Common pearlyeverlasting
Antennaria spp.	Pussytoes
Apocynum spp.	Dogbane
Arabis spp.	Rockcress
Artemisia ludoviciana latiloba	Louisiana sagebrush
Aster spp.	Aster
Astragalus spp.	Milkvetch
Balsamorhiza sagittata	Arrowleaf balsamroot
Castilleja spp.	Indian paintbrush
Centaurium muhlenbergii	Centaurium
Cirsium foliosum	Elk thistle
C. utahensis	Thistle
Clarkia pulchella	Elkhorn clarkia
Collomia linearis	Narrowleaf collomia
Cryptantha spp.	Cryptantha
Epilobium alpinum	Alpine willowweed
E. angustifolium	Fireweed
E. minutum	Smallflower willowweed
Erigeron spp.	Fleabane
Eriogonum ovalifolium	Cushion buckwheat
Fragaria vesca bracteata	Woods strawberry

Table 17 (continued).

Forbs	
Frasera spp.	Frasera
Gilia aggregata	Skyrocket gilia
Hackelia deflexa	Stickseed
Hieracium albertinum	Western hawkweed
Hypericum perforatum	Goatweed
Lathyrus spp.	Peavine
Linnaea borealis longiflora	Longtube twinflower
Lithospermum ruderale	Western gromwell
Lomatium spp.	Lomatium
Lupinus spp.	Lupine
Mentzelia albicaulis	Whitestem mentzelia
Mertensia campanulata	Bluebell
Mitella spp.	Miterwort
Orthocarpus spp.	Owlclover
Penstemon spp.	Penstemon
Phacelia spp.	Phacelia
P. hastata leucophylla	Whiteleaf phacelia
Phlox austromontana	Desert phlox
Phoenicaulis cheiranthoides	Daggerpod
Plantago patagonica	Indianwheat
Polygonum spp.	Knotweed
Sedum stenopetalum	Wormleaf stonecrop
Senecio integerrimus	Western groundsel
Taraxacum spp.	Dandelion
Tragopogon pratensis	Meadow salsify
Trifolium spp.	Clover
Viola adunca	Hook violet
Shrubs	
Amelanchier alnifolia	Saskatoon serviceberry
Berberis repens	Low oregongrape
Ceanothus sanguineus	Redstem ceanothus
C. velutinus	Snowbrush
Cercocarpus ledifolius	Curlleaf mountain mahogany
Chrysothamnus nauseosus	Rubber rabbitbrush
Eriogonum heracleoides	Wyeth buckwheat
Glossopetalon nevadense	Greenbush
Holodiscus discolor	Oceanspray
Lonicera utahensis	Utah honeysuckle
Philadelphus lewisii	Mockorange
Phlox longifolia	Longleaf phlox
Physocarpus malvaceus	Mallow ninebark
Potentilla fruticosa	Shrubby cinquefoil
Prunus virginiana	Common chokecherry
Purshia tridentata	Antelope bitterbrush

Table 17 (continued).

Shrubs	
Ribes cereum	Wax currant
R. velutinum gooddingii	Desert gooseberry
Rosa spp.	Rose
Salix spp.	Willow
Sambucus cerulea	Blue elderberry
Spiraea spp.	Spirea
Symphoricarpos albus	Common snowberry
Vaccinium membranaceum	Big huckleberry
Trees	
Pinus ponderosa	Ponderosa pine
Pseudotsuga menziesii	Douglas fir

APPENDIX II

CANOPY COVERAGE AND LINE INTERCEPT FIELD FORMS

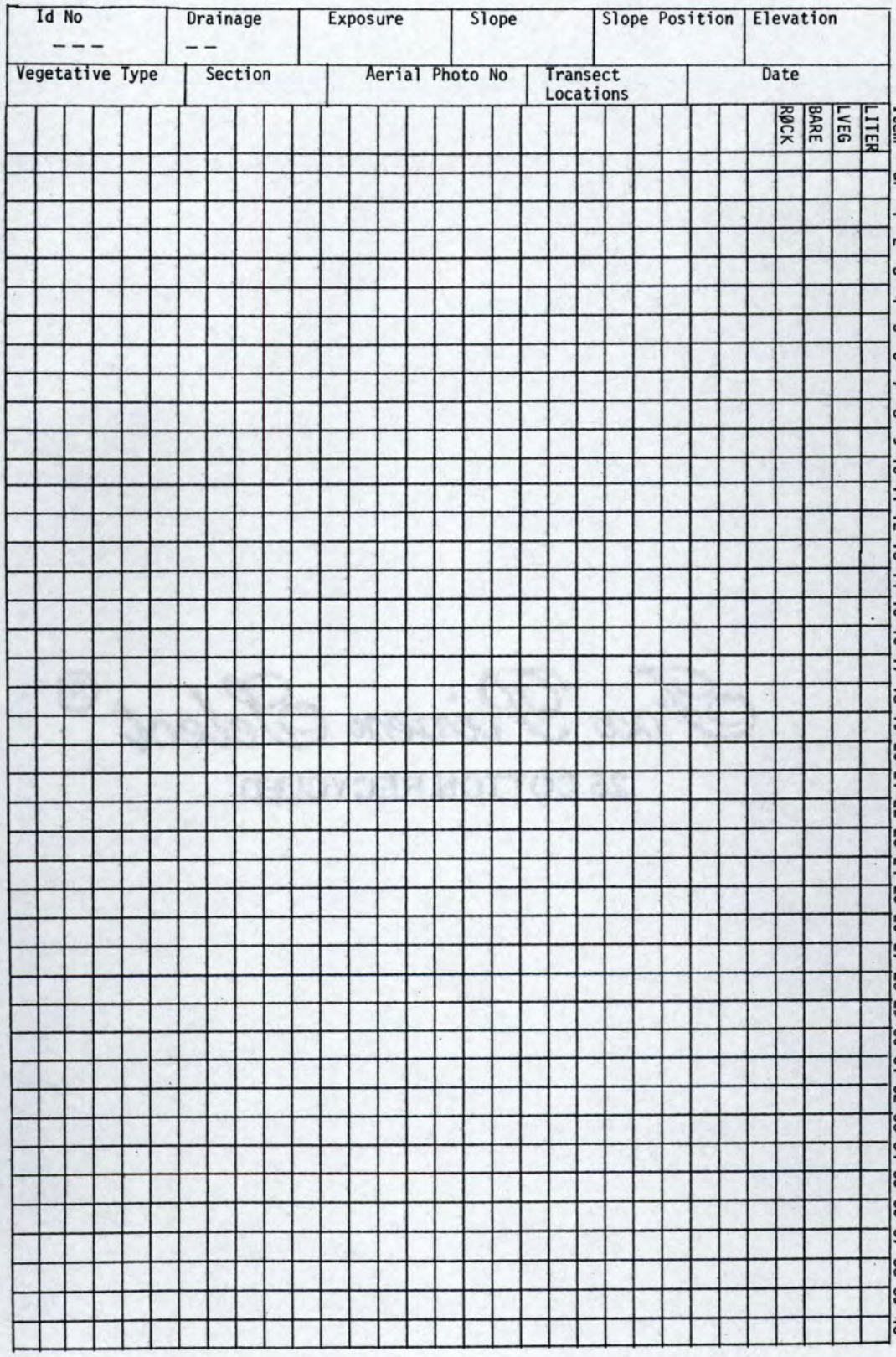

Fig. 4. Canopy coverage form.

ID NO – – –	DRAINAGE – –	SHEET OF	DATE

SP.		SP.		SP.		SP.		SP.		SP.	
INTERCEPT	FT	INTERCEPT	FT	INTERCEPT	FT	INTERCEPT	FT	INTERCEPT	FT	INTERCEPT	FT
TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL	
% INTCPT.		% INTCPT.		% INTCPT.		% INTCPT.		% INTCPT.		% INTCPT.	
SP.		SP.		SP.		SP.		SP.		SP.	
INTERCEPT	FT	INTERCEPT	FT	INTERCEPT	FT	INTERCEPT	FT	INTERCEPT	FT	INTERCEPT	FT
TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL	
% INTCPT.		% INTCPT.		% INTCPT.		% INTCPT.		% INTCPT.		% INTCPT.	

COMMENTS:

Fig. 5. Line intercept form.

APPENDIX III

VALUES OF SITE FACTORS FOR VEGETATIONAL TYPES

Table 18. Values of site factors for five vegetational types in Chamberlain Creek. The number in parentheses indicates the identification number of the macroplot.

Site Factors	Macroplot Number (1)	(5)	(4)	(6)	(9)	(2)	(3)	(7)	(8)	(10)
Township & Section	24N2	24N27	24N19	24N33	24N22	24N10	24N16	24N11	24N15	24N2
Range	12E	12E	12E	12E	12E	12E	12E	12E	12E	12E
pH	6.8	6.7	6.9	6.9	6.5	6.4	6.6	6.7	6.7	6.5
Soil depth (in)	12	18	24	12	6	28	14	16	18	9
Sand (%)	67	70	66	70	72	80	71	72	70	77
Silt (%)	22	20	23	21	20	12	19	14	17	15
Clay (%)	11	10	11	9	8	8	10	14	13	8
Slope (%)	80	66	58	62	59	60	74	72	72	74
Elevation (ft)	3200	4800	4300	4700	4500	4000	5500	4700	4800	3700
Exposure (N=0)	090	180	092	178	178	062	214	222	222	100

Table 19. Values of site factors for two vegetational types in Elkhorn, Fortune, and Thirsty Creeks. The number in parentheses indicates the identification number of the macroplot.

Site Factors	Macroplot Number (1)	(4)	(5)	(2)	(3)
Township & Section	25N36	25N35	24N1	25N36	25N36
Range	12E	12E	12E	12E	12E
pH	6.3	6.8	6.4	6.6	6.7
Soil depth (in)	12	16	12	14	18
Sand (%)	87	83	74	76	81
Silt (%)	10	14	19	19	15
Clay (%)	3	3	7	5	3
Slope (%)	82	72	80	84	90
Elevation (ft)	3500	3600	3500	3700	3700
/Exposure (N=0)	210	154	212	150	232

Table 20. Values of site factors for two vegetational types in Smith Gulch. The number in parentheses indicates the identification number of the macroplot.

Site Factors	Macroplot Number (1)	(3)	(5)	(2)	(4)	(6)
Township & Section	25N27	25N22	25N22	25N21	25N22	25N11
Range	12E	12E	12E	12E	12E	12E
pH	6.6	6.5	6.7	6.2	6.3	6.4
Soil depth (in)	16	27	20	8	12	26
Sand (%)	78	73	76	82	80	56
Silt (%)	16	19	18	14	16	35
Clay (%)	5	8	4	4	4	9
Slope (%)	72	60	60	66	74	36
Elevation (ft)	3800	4800	4100	3900	4700	5600
Exposure (N=0)	240	120	150	238	190	206

Table 21. Values of site factors for four vegetational types in Little Trout and Trout Creeks. The number in parentheses indicates the identification number of the macroplot.

Site Factors	Macroplot Number (6)	(1)	(2)	(3)	(4)	(5)
Township & Section	25N13	25N14	25N23	25N23	25N13	25N13
Range	9E	9E	9E	9E	9E	9E
pH	5.8	6.4	6.9	6.4	6.1	6.1
Soil depth (in)	12	8	34	10	26	24
Sand (%)	61	53	60	44	51	55
Silt (%)	30	34	30	41	36	34
Clay (%)	9	13	10	15	13	11
Slope (%)	76	66	80	66	60	62
Elevation (ft)	4800	3100	3800	2900	5700	4800
Exposure (N=0)	184	158	262	194	204	245

Table 22. Values of site factors for four vegetational types South Fork Salmon to Fivemile Creek. The number in parentheses indicates the identification number of the macroplot.

Site Factors	Macroplot Number (7)	(1)	(4)	(2)	(3)	(5)	(6)
Township & Section	23N5	24N33	24N21	24N33	24N28	24N28	24N33
Range	8E	8E	8E	8E	8E	8E	8E
pH	6.7	6.7	6.5	6.2	6.6	6.7	5.8
Soil depth (in)	48	36	20	34	22	10	34
Sand (%)	61	62	48	62	43	51	61
Silt (%)	28	25	35	31	42	26	29
Clay (%)	11	17	16	7	14	22	10
Slope (%)	64	83	76	72	68	68	05
Elevation (ft)	3900	4000	2400	3500	3200	2900	4700
Exposure (N=0)	268	260	238	290	262	214	302

Table 23. Values of site factors of three vegetational types in Bull Creek. The number in parentheses indicates the identification number of the macroplot.

Site Factors	Macroplot Number (5)	(1)	(2)	(3)	(4)
Township & Section	25N33	25N33	24N4	24N4	24N4
Range	6E	6E	6E	6E	6E
pH	6.3	6.0	6.2	6.3	6.0
Soil depth (in)	14	46	14	24	14
Sand (%)	71	77	74	73	65
Silt (%)	20	17	16	14	22
Clay (%)	8	6	10	13	13
Slope (%)	80	80	70	80	75
Elevation (ft)	4500	4200	3400	3000	3100
Exposure (N=0)	280	296	260	230	109