

VEGETATION MONITORING PROGRAM

FINAL REPORT

for the

East Kootenay Trench

Agriculture/Wildlife Committee

Cranbrook, B.C.

by

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ABSTRACT

This study was designed to assist in resolving long-standing disagreements in the Rocky Mountain Trench of southeastern British Columbia regarding appropriate allocation of forage among cattle, elk and deer. The research focused on the contribution that cattle and wildlife make toward trends in range condition. A habitat monitoring program was initiated on four important deer and elk winter ranges to study dietary overlap, forage and browse use, and the impacts of wildlife and cattle grazing on the range resource. This report provides a summary of data collected from 1991 to 1995.

Cattle, deer, and elk diets were quite broad with elk and deer eating between 31 to 63 species during the year, and 18 to 25 species seasonally. Approximately one dozen key forage species, however, are major contributors to all grazers diets. Deer diet composition was dominated by browse species in all periods in this study. Elk were primarily grazers, with grass and grass-like species ranging to >90% of diet composition in some months. Cattle diets were dominated by grasses, with diet composition ranging between 60% and >90%. Although cattle and elk used wheatgrass species, smooth brome grass, Idaho fescue, rough fescue, bluegrass species, and needlegrass species in common, elk diet composition was dominated by rough fescue, while cattle diet was more evenly distributed among the grasses listed above. In the East Kootenay, bitterbrush is likely a more important browse species for deer, than for elk and cattle. Generally, spring elk diets were similar to cattle diets at all sites whether cattle were grazed in spring or fall. Elk and deer diets were similar in winter and spring. Elk diets consistently overlapped between foraging periods. Diet overlap between deer and elk occurs on some sites and in some years.

Except for the wildlife exclusion area at Skookumchuck Prairie where the highest standing crop occurred in 1994, all sites produced the maximum standing crop in 1993. The lowest standing crop at all sites except Peckhams Lake (1994), was produced in 1992. These maxima coincided with growing season precipitation in 1993 that was 70% higher than the long term average.

Total forage used by cattle and wildlife varied between approximately 55% and 65% at Skookumchuck Prairie. The proportion of the total forage eaten by wildlife and cattle appears to be relatively consistent in all years at Peckhams Lake, however, total use ranged between approximately 50% and >90%. Total forage eaten by wildlife and cattle combined was almost identical at Premier Ridge in 1992 and 1994, but in 1993 total forage eaten was more than 70% higher. Total use varied between approximately 50% and 65%. Total forage eaten by wildlife and cattle at Pickering Hills was between 55% and 75%. TSC was lower in 1992, where total use exceeded 70% of TSC, than TSC in 1993 and 1994.

Saskatoon and bitterbrush production estimates in 1993 indicate that available browse may exceed available herbaceous forage in some years. Saskatoon was used more consistently, and to a higher degree, than bitterbrush in all grazing periods by wildlife and cattle. However, available bitterbrush exceeded Saskatoon production by more than ten times. At all sites, the plant community was generally similar at the end of the sampling period to the plant community at the beginning of the study. Recommendations include:

1. recognize the production capabilities and limitations of a site, and manage lands with the Desired Plant Community (DPC) concept which integrates social, economic, and biological information;

2. recognize that in the East Kootenay "range condition" is not influenced solely by grazing; DPC's also include timber stocking levels in low-elevation forests. Range and wildlife managers must work with silviculture and timber harvesting proponents to define levels which are suited to integrated resource management;
3. base forage allocation on seasonal diets and standing crop to provide a sustainable environment which meets management objectives;
4. improve range condition on key winter/spring ranges by improving wildlife distribution - conducting range enhancements (e.g. lure crops, restoration logging), and introducing rest into cattle rotations; and,
5. incorporate wildlife numbers, distribution, and time on the winter range into range use plans, involve resource user groups in wildlife monitoring.

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1.0 Introduction

This investigation was initiated to provide information that will assist in resolving long-standing disagreements in the Rocky Mountain Trench of southeastern British Columbia regarding appropriate allocation of forage among cattle, elk and deer. Accounts describing the landscape of the Trench vary from "dense forest with few large ungulate species present" (Pitt 1982) to "open woods and grassy meadows" (Nisbet 1994). A considerable portion of the open range in the Rocky Mountain Trench was derived from fires in the low elevation forests during the 1920s and 1930s. These openings provided ideal habitat for whitetail deer, mule deer, elk and Rocky Mountain bighorn sheep. Moreover, they provided excellent forage for domestic livestock. The last major forest fires occurred in 1931 (Demarchi 1971) and, since then, forest encroachment has continued into these open areas restricting forage abundance for both wildlife and cattle. Wildlife populations peaked in the early 1950s but declined between 1960 to 1970 in response to over harvesting, forest regeneration, land alienation and competition with livestock (Pitt 1982). In contrast, livestock Animal Unit Months (AUMs) reached their maximum by 1964 (72,896 AUMs) but by 1980 they were down to 41,198 AUMs. Between the beginning of Coordinated Planning in 1975, and 1982, most resource managers in the East Kootenay believed that forage availability had improved (Pitt 1982). Since 1982 however, the elk population has increased from approximately 10,000 in the Cranbrook and Invermere Forest Districts (Churchill 1981; Pitt 1982) to perhaps more than 28,000 animals post-winter in 1986 (Demarchi et al. 1987), while cattle numbers have remained relatively constant. Despite Coordinated Planning and range improvements, many resource managers believe that increased grazing pressure, combined with forest encroachment and land alienation, continues to produce localized downward trends in plant vigor, forage production and range condition (Pitt and Simpson 1989).

The principal source of controversy in the East Kootenay focuses on the relative contribution that cattle and wildlife make regarding downward trends in range condition (Pitt 1982). Wildlife supporters argue that high cattle stocking rates and improper seasons of use have altered species composition in plant communities and reduced both forage production capability and forage availability on critical wildlife winter ranges. In contrast, ranching advocates argue that grazing programs implemented under Coordinated Resource Management Planning were primarily responsible for the initial improvements in range condition and that current overgrazing likely results from increased wildlife populations using low-elevation rangelands when cattle are not present (Pitt and Simpson 1989).

Virtually no site-specific information is available to resource managers regarding optimal spring turnout dates for cattle, optimal season and intensity of forage use, or the combined effects of cattle and wildlife grazing. Similarly, few data are available documenting dietary overlap between cattle and wildlife in the East Kootenay. This information is essential to plan reliable grazing management prescriptions (Pitt 1982).

The East Kootenay Trench Agriculture/Wildlife Committee was formed in August 1990 to address these resource management conflicts in the East Kootenay. A nine point strategy was developed by the Steering Committee to mitigate conflict in the region through improved inventory and monitoring of the wildlife and range resources, better public education, and through habitat and range enhancement.

Two Steering Committee objectives directed the activities of the habitat research and monitoring program:

1. Create an on-going program to collect data on populations of both wild and domestic ungulates, plus the extent and impact of their use of Crown range vegetation,
2. Recommend an equitable forage allocation process that protects Crown range resources and recognizes the legitimate interests of both the livestock and wildlife industries.

The Vegetation Monitoring Program was initiated in 1991 at four locations (Table 1). Working plans were prepared for four projects and the infra-structure for sampling and controlling animal distribution were established in 1991. Baseline data were collected in 1991 as well. Data collection was initiated at the four locations in 1992. This report summarizes data collected 1991 to 1995 from all aspects of the monitoring program.

Table 1. Summary of site locations and projects.

Project	Skookumchuck Prairie	Premier Ridge	Peckhams Lake	Pickering Hills
Three-Way Exclosure	x			
Clipping Trial	x			
Cattle/Wildlife Diet	x	x	x	x
Grazing Impacts	x	x	x	x

1.1 Objectives

Vegetation Monitoring objectives were:

- 1) At all sites, determine cattle, deer, and elk diets during all respective grazing periods on low-elevation range plant communities,
- 2) At Skookumchuck Prairie; determine the long-term differential impacts of cattle, wildlife, and cattle and wildlife combined on range plant communities,
- 3) At Premier Ridge, Peckhams Lake, and Pickering Hills, document actual forage use by cattle and wildlife,
- 4) At Premier Ridge, Peckhams Lake, and Pickering Hills, document the relative temporal forage demands of cattle and wildlife.

2.0 Description of Study Area

2.1 Location and Physical Features of Study Sites

All four sites are located in the Rocky Mountain Trench within 60 km of Cranbrook, British Columbia (Figure 1). Each site is an important winter range for deer and elk, and all are rotationally grazed by cattle. Skookumchuck Prairie, however, had been under non-use from cattle grazing for five years before the study began.

2.2 Topography and Soils

Skookumchuck Prairie occurs on flat river terrace deposits in the Ponderosa Pine Zone while the Pickering Hills, Peckhams Lake and Premier Ridge are all located above the flood plain in the Interior Douglas-fir Zone (Table 2). Topography at Skookumchuck Prairie and Peckhams Lake is mostly flat. Both Premier Ridge and Pickering Hills are located on steep, undulating south and southwest facing slopes.

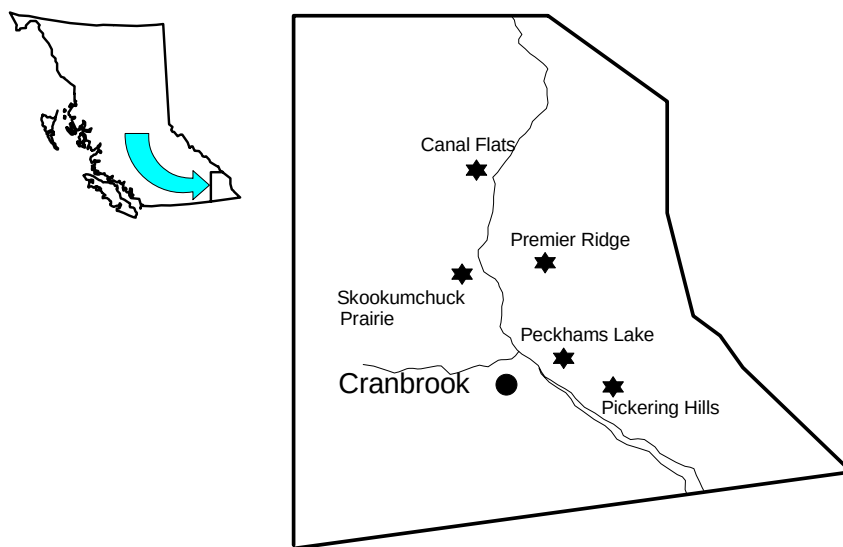


Figure 1. Location of study sites in the Rocky Mountain Trench of southeast British Columbia.

Table 2. Elevations and biogeoclimatic classification of study sites.

Site Name	Elevation (m)	Biogeoclimatic Unit
Skookumchuck Prairie	825	PPdh2 ¹
Premier Ridge	1035	IDFdm2 ²
Pickering Hills	1025	IDFdm2
Peckhams Lake	915	IDFdm2

¹ PPdh2 - Kootenay Dry Hot Ponderosa Pine Variant (Braumandl and Curran 1992)

² IDFdm2 - Kootenay Dry Mild Interior Douglas-fir Variant (Braumandl and Curran 1992)

Virtually all soils in the Rocky Mountain Trench were derived from glacial deposits (Kelley and Sprout 1956; Lacelle 1990). Soils on the glacial flood plains and upland terraces were developed on strongly calcareous gravelly river deposits which were overlain with deposits of silty and very fine sandy materials (Kelley and Sprout 1956).

Soils at Skookumchuck Prairie and Peckhams Lake are classified as Orthic Eutric Brunisols. Inclusions of Elko, Fishertown, and Saha Associations occur on both sites (Lacelle 1990). The solum is typically dark gray brown to brown gravelly or fine sandy loam. The soil depth may extend below 70 cm. The lower part of the solum consists of a matrix of stratified medium gravel and scattered stones which is often overlain with a layer of whitish gray lime-cemented gravel and scattered stones (Kelley and Sprout 1956).

Soils at Premier Ridge and Pickering Hills are also classified as Orthic Eutric Brunisols with a mix of soils in the Flatbow and Wycliffe Associations (Lacelle 1990). Soils on both sites are derived from strongly calcareous glacial till (Kelley and Sprout 1956). Soil textures vary from gravelly silt loams and silt loams but in some areas very fine sandy loams occur (Kelley and Sprout 1956). These soils are generally well-drained and may exceed 90 cm in depth.

2.3 Climate

Climate throughout the Rocky Mountain Trench is variable depending on elevation with upland areas receiving slightly more precipitation and cooler temperatures than on the flood plain (Chapman 1952). Chapman (1952) described the climate throughout the flood plain as Humid Continental-Cool Summer (Dfb) and Humid Continental-Cool, Short Summer (Dfc) for the uplands in the Trench.

Kelley and Sprout (1956) characterized the climate near Cranbrook as semi-arid with weather patterns being influenced by cold continental air masses from the north in winter, and from heated air masses from the southern interior plateau of the United States in summer. Normal mean annual precipitation from 1955-1992 at Cranbrook airport, which is approximately centrally located among the four research sites, is 366 mm (Table 3).

Precipitation is bi-modally distributed with peaks in November - January (mostly snow) and in May-June (rain) (Table 4).

Table 3. Precipitation and temperature during the growing season at Cranbrook Airport in 1992, 1993, and 1994 as compared to climatic normals 1955-1992.

Year	Temperature			Precipitation		Sunshine Hours	
	Max	Min	Mean	Annual	Growing Season*	Annual	Growing Season*
				(mm)	(mm)	(hr)	(hr)
1955-92	11.5	-0.3	5.6	366.0	221.8	2206.7	1736.2
1992	12.7	0.9	6.8	360.2	251.6	2196.9	1742.0
1993	10.4	-0.7	4.8	487.2	378.1	2005.3	1569.0
1994	13.1	1.1	7.1	328.0	220.2	2381.9	1842.0

* April 1 - October 31

Table 4. Precipitation and temperature at Cranbrook Airport in 1992, 1993, and 1994 as compared to climatic normals 1955 - 1992.

Year	Month	Temperature (°C)			Precipitation (mm)	Sunshine (hrs)
		Max	Min	Mean		
1955-1992	Jan	-3.8	-12.6	-8.2	32.2	71.5
	Feb	1.6	-8.5	-3.5	22.8	107.2
	Mar	7.1	-3.9	1.6	18.9	165.2
	Apr	12.6	0.0	6.3	24.3	220.9
	May	17.6	4.4	11.0	39.4	253.8
	Jun	21.9	8.4	15.2	49.4	281.4
	Jul	25.7	10.7	18.2	30.6	320.1
	Aug	25.3	10.1	17.7	30.5	288.0
	Sep	19.1	4.9	12.0	28.7	215.1
	Oct	11.6	-0.5	5.6	18.9	156.9
	Nov	2.4	-5.4	-1.5	36.0	75.0
	Dec	-3.4	-11.3	-7.4	36.4	55.2
TOTAL		11.5	-0.3	5.6	366.0	2206.7
1992	Jan	0.8	-6.2	-2.7	18.0	46.2
	Feb	5.1	-4.0	0.5	15.5	105.7
	Mar	12.5	-2.3	5.1	10.1	212.8
	Apr	14.2	1.2	7.7	28.4	206.8
	May	19.8	4.6	12.2	34.7	298.2
	Jun	25.4	10.9	18.2	59.3	281.5
	Jul	23.6	10.8	17.2	77.0	292.5
	Aug	24.8	9.5	17.2	9.3	304.1
	Sep	18.0	3.9	11.0	19.3	208.2
	Oct	13.4	1.7	7.6	23.6	150.8
	Nov	1.7	-3.9	-1.1	34.8	40.1
	Dec	-6.6	-14.9	-10.8	30.2	50.0
TOTAL		12.7	0.9	6.8	360.2	2196.9

Table 4. (continued)

Year	Month	Temperature (°C)			Precipitation (mm)	Sunshine (hrs)
		Max	Min	Mean		
1993	Jan	-7.1	-15.7	-11.4	29.3	51.0
	Feb	-2.6	-13.0	-7.8	18.2	92.9
	Mar	7.7	-3.2	2.3	4.9	162.1
	Apr	12.1	1.5	6.8	14.8	157.6
	May	22.4	7.5	15.0	36.3	306.7
	Jun	19.6	8.1	13.9	127.3	223.9
	Jul	19.1	9.0	14.1	101.6	189.4
	Aug	22.2	9.1	15.7	42.7	275.6
	Sep	19.4	4.5	12.0	44.5	224.3
	Oct	13.1	0.5	6.8	11.2	191.6
	Nov	-0.4	-10.1	-5.3	25.8	89.4
	Dec	-1.3	-7.1	-4.2	30.6	40.8
TOTAL		10.3	-0.7	4.8	487.2	2005.3
1994	Jan	3.1	-4.5	-0.7	11.4	101.7
	Feb	-1.5	-10.4	-6.0	30.2	91.2
	Mar	9.8	-2.6	3.6	11.6	213.4
	Apr	14.2	2.0	8.1	39.5	197.6
	May	18.9	5.9	12.4	47.7	279.8
	Jun	21.1	8.0	14.6	68.6	264.0
	Jul	28.7	12.7	20.7	4.6	357.6
	Aug	27.2	11.1	19.2	12.6	328.2
	Sep	24.0	6.5	15.3	3.0	257.9
	Oct	11.8	0.3	6.1	44.2	157.6
	Nov	0.8	-6.7	-2.9	23.1	57.8
	Dec	-1.5	-9.4	-5.5	31.5	75.1
TOTAL		13.1	1.1	7.1	328.0	2381.9

Maximum precipitation falls in June (Average = 49.4 mm). March and October are typically the driest months with normal mean monthly totals of 18.9 mm in both months (Table 4).

Mean maximums for the hottest months, July and August, are 31.8 and 32.2° C respectively. The mean monthly minimum for the coldest months, December and January, are -25.4 and -26.3° C. The absolute extremes on record are a high of 37.2 C in July, 1960 and August 1961, and a low of -43.9° C in December, 1968 (Cranbrook Airport 1992). The Rocky Mountain Trench enjoys an average of 2206.7 hours of sunshine (Table 4) and 110 frost-free days annually (Atmospheric Environment Service 1990).

2.4 Vegetation

Vegetation at Skookumchuck Prairie is predominantly open grassland interspersed with groves of ponderosa pine and trembling aspen. Grassland vegetation is dominated by bitterbrush but other shrubs such as Saskatoon, common chokecherry, mock orange, rose, and soopolallie are also present. Herbaceous cover consists of a mix of grasses and forbs including Kentucky bluegrass, needle-and-thread, Richardson's needlegrass, bluebunch wheatgrass, rough fescue, bitterroot, death camas, spiny phlox, low pussytoes, and rosy pussytoes.

Vegetation at Premier Ridge and Pickering Hills are relatively similar. Like Skookumchuck Prairie, both sites comprise open grass/shrub land interspersed with groves of Douglas-fir mixed with ponderosa pine and trembling aspen. Open areas are dominated by bitterbrush but Saskatoon, common chokecherry, mock orange, rose and soopolallie are also present. Herbaceous cover consists of a mix of grasses and forbs with the principle grasses including Kentucky bluegrass, western needlegrass, bluebunch wheatgrass, and rough fescue. Bluebunch wheatgrass and rough fescue occur infrequently on both sites.

Peckhams Lake has been seeded to domestic forages including alfalfa, clovers, orchardgrass, crested wheatgrass, and smooth brome. This site, however, is mixed with native species such as pinegrass, Idaho fescue, prairie Junegrass, common yarrow, rosy pussytoes, Nuttall's pussytoes, timber milkvetch, strawberry, small-flowered penstemon and early blue violet. Bluebunch wheatgrass and rough fescue occur infrequently and shrubs are poorly represented on the site.

3.0 Methods

The following data were collected on all four locations but sampling intensity varied between Skookumchuck Prairie and the other three locations at Premier Ridge, Peckhams Lake and Pickering Hills:

- 1) Monthly elk, deer and cattle diets for months where each ungulate species was present on each site;
- 2) Percent cover and frequency of herbaceous and shrubby vegetation;
- 3) Annual forage standing crop and percent forage use by cattle and wildlife; and
- 4) Annual production and percent use of Saskatoon and bitterbrush.

3.1 Layout

Skookumchuck Prairie

This site was the most extensively sampled of the four locations. A "3-way exclosure" was constructed to allow differential access to cattle, wildlife, and cattle and wildlife together (Figure 2). The Cattle Only Area (65 ha) was fenced with 2.8 m (9 ft) ungulate fence and serves as an enclosure for cattle while excluding all other ungulate grazing.

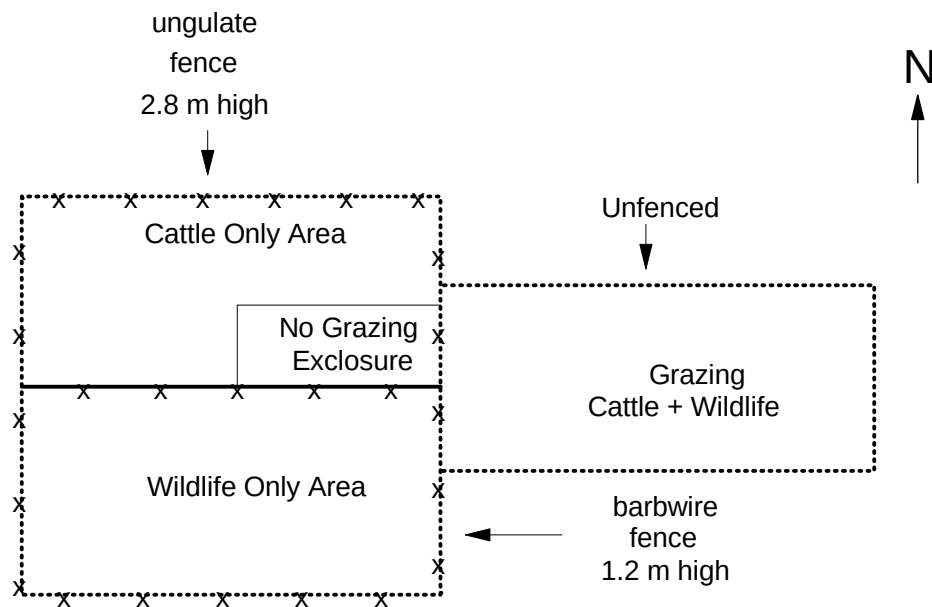


Figure 2. Schematic diagram of exclosure arrangement at Skookumchuck Prairie.

An exclosure, measuring 100 m X 70 m (0.7 ha), was constructed inside the Cattle Only Area on the fence line separating the Cattle Only Area from the Combined Use Area. This exclosure was constructed with 2.8 m ungulate fence to exclude all ungulate grazing and to act as a control (Figure 2).

The Wildlife Only Area (65 ha) was fenced with 1.2 m (4 ft) barbed wire to exclude cattle yet permit deer and elk access. This site is located immediately south of the Cattle Only Area (Figure 2). An unfenced area of approximately 65 ha was defined east of these exclosures to assess combined use by cattle and wildlife (Figure 2).

Secondary Locations

Only small exclosures (0.7 ha) were constructed at Premier Ridge, Peckhams Lake, and Pickering Hills to serve as controls for no ungulate grazing. Transects were located both within and outside each exclosure to monitor plant species cover and frequency, forage standing crop, and forage use from 1991 to 1995. A more detailed description of sampling methods occurs in the section discussing these measurements.

3.2 Livestock and Wildlife Grazing

At Skookumchuck Prairie, the operational prescription for the Pulp Pasture called for a one month grazing period on a spring/fall rotation. Periods of use, cattle numbers and the actual animal unit months (AUMs) used during the study are summarized in Table 5. Water was hauled daily to troughs located in the southern end of the Cattle Only Area in 1992. In 1993, water was pumped from a spring on the west side of the Cattle Only Area, to water troughs located in the center of the area. In 1994, a windmill was installed on a newly drilled well in the center of the Cattle Only Area. Tanks capable of storing 36,000 liters were located on the windmill site.

Deer and elk were left to follow normal distribution patterns on all sites where they had access. In fall 1991, 50% of the over-wintering elk population had reached the Trench by November 21. By May 25, 1992, 50% of these elk had left the site for summer range. In fall 1992, 50% of the over-wintering herd arrived by October 23, and departed by June 2, a period more than one month longer than in 1991/92 (Jamieson and Hebert 1993).

Periods of use, cattle numbers and the actual animal unit months (AUMs) used at the secondary sites are summarized in Table 5. Wildlife have equal access to all parts of the pastures at Premier Ridge, Peckhams Lake and Pickering Hills. The number of deer and elk using the portions of these locations that were sampled are not available. Jamieson and Hebert (1993), however, reported that wintering elk spent an average of 20 days longer on the winter range at Premier Ridge than they did at Peckhams Lake or Pickering Hills. In 1991/92, 50% of the elk population wintering on Premier Ridge had reached the Trench by November 15 and 50% of the population had left by May 5, 1992 (Jamieson and Hebert 1993). In 1992/93 50% of the herd reached Premier Ridge on November 3, and departed on the same date as in 1992. The Bull River herd, wintering at Peckhams Lake and Pickering Hills, arrived in the Trench up to 3 weeks later, on November 23 and November 25 in 1991 and 1992, respectively, but departed at about the same time as the Premier Ridge herd.

3.3 Assessment of Plant Cover and Frequency

At all sites, plant species cover and frequency were assessed using the canopy coverage method (Daubenmire 1959) with nested plots (Figure 3). At Skookumchuck Prairie, ten 20 cm X 50 cm plots (0.1 m²) were systematically located along each of 10 - 50 m transects in the ungulate exclosure, Wildlife Only, Cattle Only, and Combined Use Areas to estimate grass and forb cover and frequency (Figure 4). Cover and frequency for trees and shrubs were sampled in 1 m X 2 m plots. Cover, or the vertical projection of foliar material to the ground, was estimated for each species within six cover classes (Table 6). Cover of soil, litter, rock, bryophytes, and cattle, deer and elk feces were recorded. Species that occur within 3m on each side of the transect, but not in the plot, were also recorded as trace. All transects were sampled at the end of June on all sites.

Table 5. Cattle grazing rotations in the Cranbrook and Invermere Forest Districts 1992-1994.

	Site	Dates	Cattle Numbers	Actual #AUM
1992	Skookumchuck Prairie			
	Cattle Only	Jun 15 - Jul 15	35 cows 2 bulls	38
	Combined Use	Jun 15 - Jul 15	65 heifers 2 bulls	48
	Premier Ridge	May 1 - Jun 15	80	104
	Peckhams Lake	May 23 - Jun 15	207	152
		Sep 1 - Sep 15	207	104
	Pickering Hills	Aug 11 - Sep 4	270	199
1993	Skookumchuck Prairie			
	Cattle Only	Sep 1 - Sep 30	24 cows 17 yearlings	38
	Combined Use	Sep 1 - Sep 30	35 cows 2 bulls	38
	Premier Ridge	Aug 1 - Aug 22	80	60
	Peckhams Lake	Aug 15 - Sep 15	207	207
	Pickering Hills	Jul 10 - Aug 10	270	270
1994	Skookumchuck Prairie			
	Cattle Only	Jul 10 - Aug 10	37 cows 2 bulls	43
	Combined Use	Jul 10 - Aug 30	40 cows 2 bulls	72
	Premier Ridge	May 15 - Jun 19	80	91
	Peckhams Lake	Jun 25 - Jul 10	207	110
	Pickering Hills	Jul 26 - Aug 25	270	270

Percent cover for each species was calculated by averaging the cover estimates over all 100 plots at each location. Percent frequency for each species was calculated with the following formula:

$$\text{Frequency} = \frac{\text{Number of plots with species A}}{\text{Total number of plots sampled}} \times 100.$$

At Premier Ridge, Peckhams Lake and Pickering Hills, five 50 m transects were located systematically within exclosures and in the area grazed by elk, deer and cattle. Transects were installed parallel to slope contours where terrain was undulating and they were sampled the same way as Skookumchuck Prairie.

Table 6. Daubenmire cover classes and midpoints.

Cover Class	Range in Percent Cover	Midpoint
1	0 - 5	2.5
2	6 -25	15.0
3	26 - 50	37.5
4	51 - 75	62.5
5	76 - 95	85.0
6	96 - 100	97.5

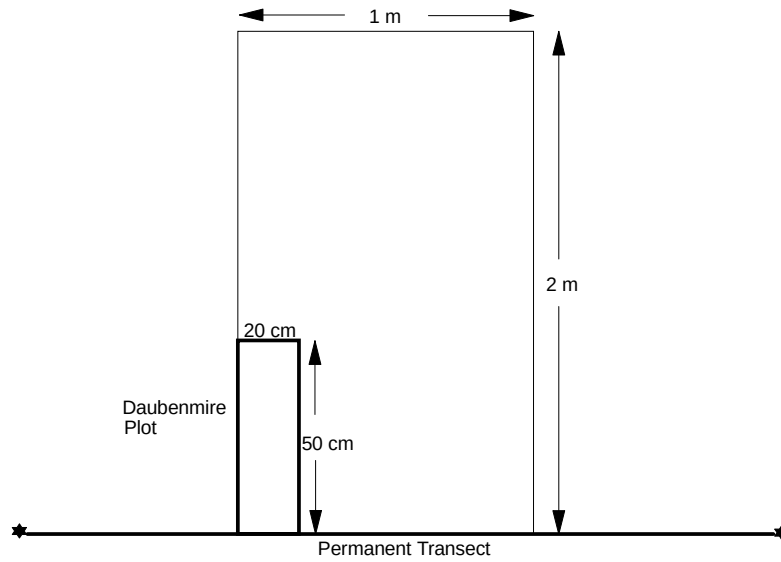


Figure 3. Schematic diagram of nested plot arrangement and sizes for herbaceous and shrub sampling.

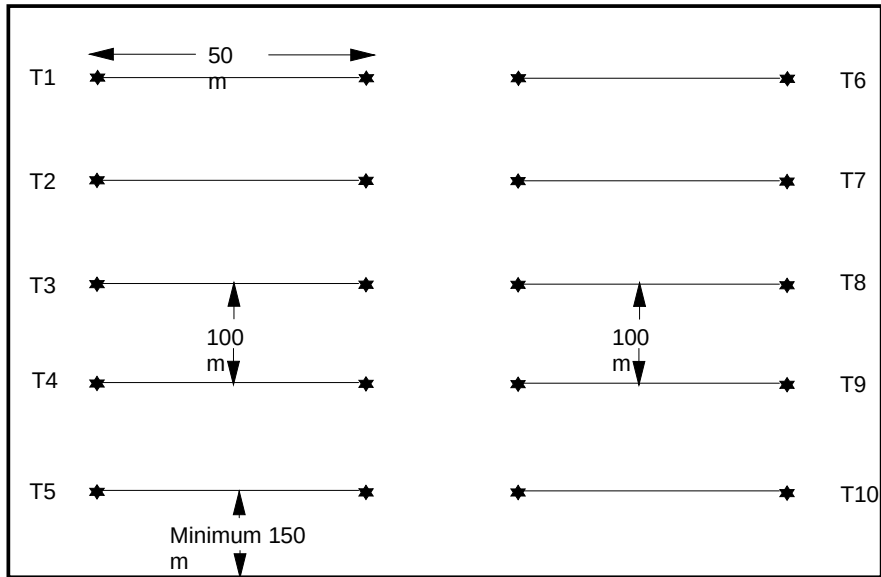


Figure 4. Schematic diagram of transect arrangement in grazed and ungrazed areas at Skookumchuck Prairie.

3.4 Plant Community Similarity

Spearman's rank correlation (Zar 1984) was used to compare plant community similarity. The procedure ranks each measurement of a variable within the two communities, then the formula listed below is applied to the ranks to provide the Spearman rank correlation coefficient, r_s , where d_i is the difference between the ranks. The Spearman rank correlation coefficient, ρ (r_s), ranges in value from -1 to +1, and has no units.

$$r_s = 1 - \frac{6 \sum d_i^2}{n^3 - n}$$

Spearman's rank correlation has been used to compare food habits among different ungulate species (Kasworm et al. 1984) and between cattle breeds (Walker et al. 1989).

3.5 Ungulate Diets

Elk, deer and cattle diets were determined for those periods where ungulates used the range in the Wildlife Only, Cattle Only, and Combined Use Areas at Skookumchuck Prairie and at Premier Ridge, Peckhams Lake, and Pickering Hills. Four periods of wildlife and cattle use were identified (Table 7) but these use patterns were not expected to occur every year because of the cattle grazing rotation. Moreover, these periods often overlap, particularly during spring when wildlife may stay on low-elevation ranges into June in some years. Winter wildlife use of low-elevation rangelands occurs between approximately November 15 and March 15. Migratory elk generally leave the Trench between April 15 and May 15 (Simpson 1992; Jamieson and Hebert 1993), but mule deer can stay longer. From July 15 to September 1, most wild ungulates are absent from the low-elevation sites. Fall regrowth often occurs in the East Kootenay in September which may result in shifts in wildlife foraging patterns. Very little plant growth occurs from November 1 to March 15, thus any changes in forage availability and wildlife diet are controlled by weather patterns, snow accumulation, and wildlife forage consumption.

Table 7. Periods of wildlife and cattle use.

Season of Use	Ungulate Species	Approximate Dates
Spring	Wildlife	Mar 15 - May 15
Spring	Cattle	May 1 - Jun 15
Fall	Cattle	Sep 1 - Oct 20
Fall/Winter	Wildlife	Nov 1 - Mar 15

Mule deer and whitetail deer pellets can not be reliably separated, and were combined. Deer and elk diet data were collected monthly for the above periods of ungulate use (Table 7,8). Cattle samples were collected twice (bi-weekly) during the grazing period on each site (Table 5,7,8).

Table 8. Sampling periods for deer, elk and cattle diets.

Ungulate Use Period	J	F	M	A	M	J	J	A	S	O	N	D
Spring Deer/Elk			x	x	x							
Spring Cattle					x	x						
Fall Cattle								x	x	x		
Fall Deer/Elk										x	x	
Winter Deer/Elk	x	x										x

The same procedure was used to collect fecal samples for cattle, deer, and elk diets on all sites. To ensure a representative sample, fecal sample collections for deer, elk and were collected from five fresh, moist fecal deposits in the area around each of 10 transects, at each sampling date, at Skookumchuck Prairie. At Pickering Hills, Peckhams Lake, and Premier Ridge, 10 fecal samples were collected in the area surrounding each of the five transects. Pellet groups were individually stored in plastic bags, labeled with the site, animal species and collection date, and immediately frozen. Similarly, 2 tablespoons of fresh fecal material, taken from the centers of each cattle dropping were individually stored in plastic bags, labeled with the collection date and location, and immediately frozen. Two pellets from all 50 samples were sub-sampled for each animal species on each sampling date, and combined to make composite samples. Similarly, one teaspoon from each of the 50 cattle droppings collected for each sampling period and location were combined to make a composite sample. Diet was determined by viewing 200 microscope fields (25 views/slide for 8 slides) and diet was corrected to account for differential digestibility among forage species.

Data from seasonal cattle and wildlife diets may not represent samples from a bivariate normal population. If so, standard correlation procedures are generally inapplicable. Instead, we may operate with the ranks of the measurement for each variable. Spearman's rank correlation procedure was used to assess diet similarity (overlap) (Zar 1984). This procedure approximates the ungulate's own selection process. Preferred forages are selected for and thus given a ranking in much the same way as the rank correlation procedure. Dietary diversity of the seasonal diets of all species, at all sites, was also compared using the Shannon-Weiner diversity index (SWDI) (Zar 1984). The index is calculated based on the number of species and

their relative abundance in the diet. Each diet is assigned a numerical rating between 0.0 and 6.0.

The value of the Shannon-Weiner diversity index usually falls between 1.5 and 3.5, and only rarely exceeds 4.5 (Margurran 1988). These data were not tested for statistical differences, but rather are presented to assist in the description of dietary diversity. The index is calculated below where k is the number of categories and p_i is the number of observations in category i .

$$H' = - \sum p_i \ln p_i$$

3.6 Herbaceous Standing Crop and Forage Use at Skookumchuck Prairie

Forage use was determined by comparing standing crop on paired grazed and ungrazed plots immediately following a grazing period. Two secondary transects were located randomly, at right angles, along each of the 10 permanent transects that were established in each pasture to determine plant species cover and frequency (Figure 5).

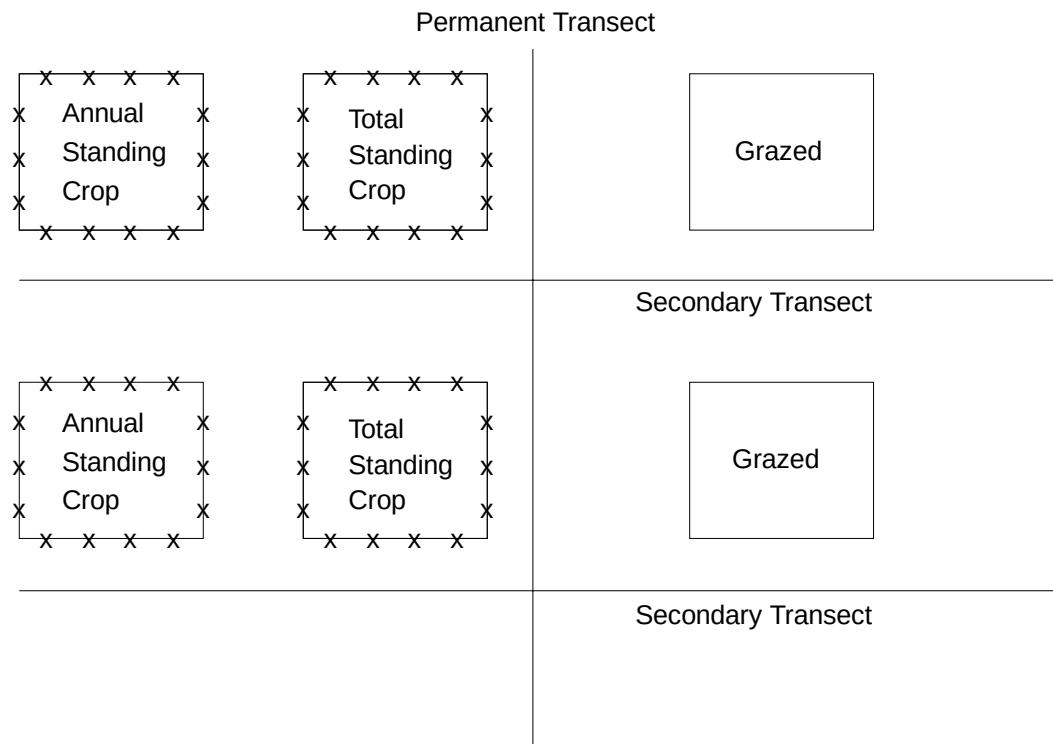


Figure 5. Schematic plot layout for herbaceous forage use in the Wildlife Only, Cattle Only, and Combined Use Areas at Skookumchuck Prairie.

Three plots were installed on each of the secondary transects in the Wildlife Only, Cattle Only, and Combined Use Areas to obtain two measures of ungrazed forage standing crop, and to determine wildlife, cattle, or combined wildlife/cattle forage use. The first ungrazed measure estimated annual standing crop (ASC) including fall regrowth without any ungulate grazing. This plot was not grazed at any time.

The second value estimated seasonal standing crop (SSC), the amount of forage available at the end of a grazing period, comprised of the carryover from the previous grazing period, plus any regrowth. This measurement more accurately reflects forage available during different grazing periods. Percent forage use during the spring, fall, or winter grazing periods was calculated by comparing the forage removed from the grazed plots to the ungrazed controls (SSC) in each period. This cage was moved to a new location following each grazing period.

Total standing crop (TSC) was derived by adding the spring wildlife period SSC (the amount of forage produced from greenup to the end of the spring wildlife period (Table 7) together with the regrowth produced in each subsequent grazing period. This procedure provides a better understanding of the contribution regrowth from previous grazing periods makes to available forage. Total use by wildlife, cattle, and by wildlife and cattle combined was calculated as a percentage of TSC. Sampling dates for forage use by wildlife and cattle are summarized in Table 9.

Plots (1 m²) were clipped to ground level and litter was sorted from current annual production. On all sites, clipped forage was stratified into bluebunch wheatgrass, rough fescue, Idaho fescue, other grasses, and forbs. Each sample was stored in individually labeled bags, air dried, oven dried at 70° C for 48 hours, and then weighed to the nearest 0.01 gram. Percent use was calculated with the following formula:

$$\text{Percent Use} = \frac{\text{Standing Crop Ungrazed} - \text{Standing Crop Grazed}}{\text{Standing Crop Ungrazed}} \times 100.$$

ASC and TSC production data for the three years, 1992-1994, were analyzed independently by site with paired t-tests and also compared using of Analysis of Variance (ANOVA) (SAS 1979). With ANOVA, a three-factor analysis was conducted to discern the effect of the individual year, clipping treatments (ASC vs. TSC), and grazing treatments (Cattle Only, Wildlife Only, and Combined Use). Mean separation was accomplished with Duncan's Multiple range test (Little and Hills 1978). Grazed and ungrazed standing crop production data for the three years, 1992-1994, were analyzed independently in each grazing period with paired t-tests.

3.7 Herbaceous Standing Crop and Forage Use at Secondary Sites

At Premier Ridge, Peckhams Lake and Pickering Hills, herbaceous standing crop was determined using the same methods as at Skookumchuck Prairie but the layout was slightly different. On these sites, four secondary transects were layed out perpendicular to the five permanent transects that were installed for plant cover and frequency. The five permanent transects were also extended to 100 m to distribute the plots better over each site.

Eight plots were randomly located on each secondary transect to determine Annual Standing Crop, Seasonal Standing Crop, and 1) forage use by cattle in spring, 2) combined cattle/wildlife use in spring, 3) combined season-long use, 4) spring wildlife use, 5) fall wildlife use, and 6) winter wildlife use. Cages measuring 1.2 m X 1.2 m X 0.8 m high, were located on five of the eight plots to exclude all ungulate grazing for different parts of the year. These cages provided a system to estimate standing crop and forage use in the same way as the three-way exclosure at Skookumchuck Prairie.

Plots were caged in early April before annual growth began and clipped at the end of the growing season in October. Plots were clipped 1) after spring wildlife use, 2) after spring cattle use, 3) after fall wildlife use, and 4) after winter wildlife use (Table 7). After the plots were

Table 9. Clipping schedule for calculating Annual Standing Crop, Seasonal Standing Crop and seasonal forage use with spring and fall cattle grazing .

Spring Cattle Grazing

	May 15	June 15	October 20	March 31	Total
Annual Standing Crop			X		1
Seasonal Standing Crop	X	X	X	X	4
Spring Cattle Use		X			1
Combined Spring Use		X			1
Combined Seasonal Use				X	1
Spring Wildlife Use	X				1
Fall Wildlife Use			X		1
Winter Wildlife Use				X	1
Total	2	3	3	3	11

Fall Cattle Grazing

	May 15	October 20	Nov 20	March 31	Total
Annual Standing Crop		X			1
Seasonal Standing Crop	X	X	X	X	4
Combined Fall Use			X		1
Combined Seasonal Use				X	1
Spring Wildlife Use	X				1
Fall Cattle Use		X			1
Fall Wildlife Use			X		1
Winter Wildlife Use				X	1
Total	2	3	3	3	11

clipped, the cages were moved to a new location which had been grazed in the preceding period. Seasonal Standing Crop from all clippings was totaled over the entire year so that the proportion of forage used by cattle, wildlife, and combined use could be calculated. A cattle use only plot was included on each secondary transect. This plot was caged during the spring wildlife grazing period. Just before cattle turnout, the cage was removed from this plot and the cage was replaced after the cattle were gathered.

Two uncaged plots were designated as combined wildlife and cattle use (Figure 6). The first of these plots, combined spring use, was clipped after cattle were moved from the pasture to estimate use by wildlife and cattle up to the end of the cattle grazing period. The second plot, combined seasonal use, remained uncaged for the entire year and was clipped before spring green-up late-March, 1993.

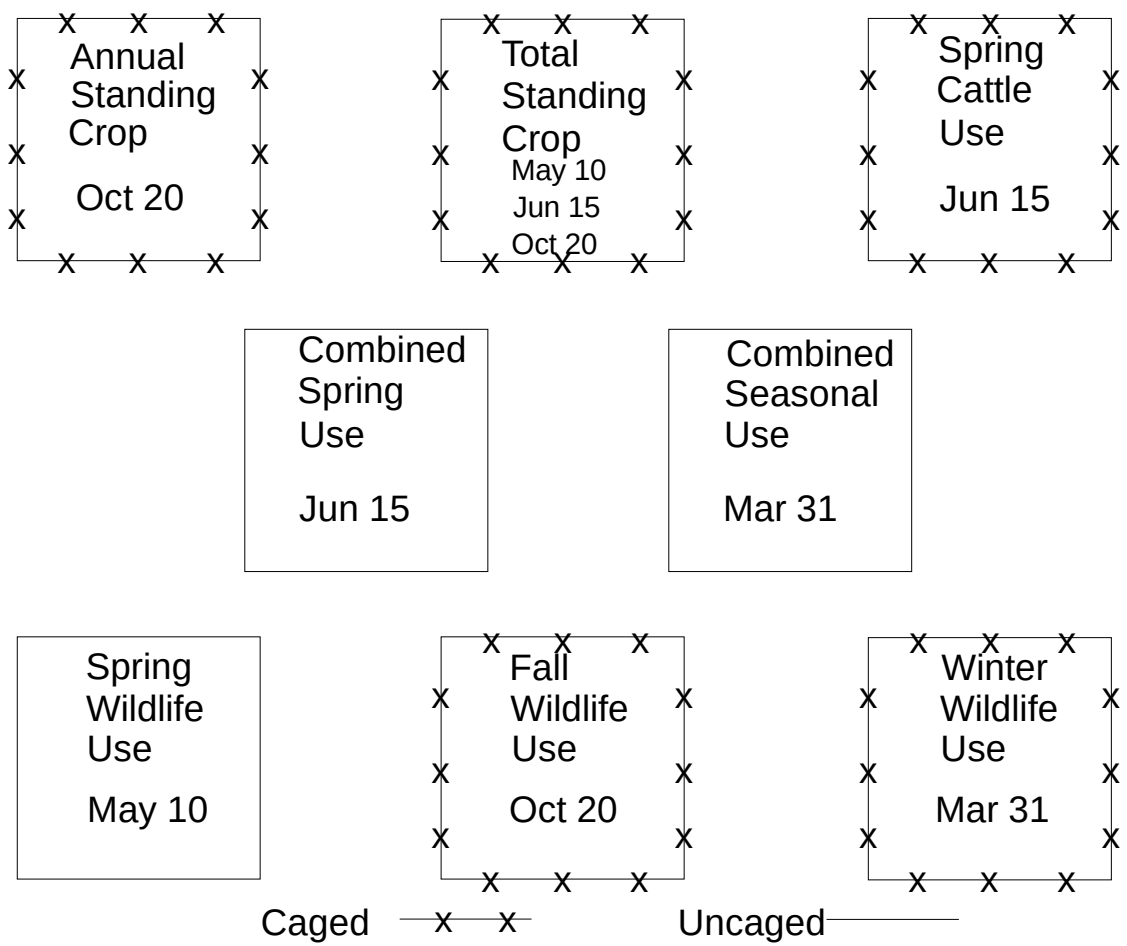


Figure 6. Schematic layout of cages and plots at each sampling location with approximate clipping dates for spring cattle grazing at Premier Ridge, Peckhams Lake and Pickering Hills.

Three plots, two caged and one uncaged, were designated wildlife use only (Figure 6). The spring wildlife use plot was left uncaged and was clipped in mid-May, 1992. The fall wildlife use plot was caged throughout the cattle grazing period then the cage was removed after the cattle were gathered. This plot was clipped in late-October, 1992. The winter wildlife use plot remained caged until late-October, then the cage was removed, and the plot clipped in late-March before spring green-up.

A single 1.0 m² plot was clipped under each cage and in the plots according the schedule outlined in Table 9. Plots were clipped to ground level and litter was sorted from current annual production. Clipped forage was stratified into bluebunch wheatgrass, rough fescue, Idaho fescue, other grasses and forbs. Each sample was stored in individually labeled bags, air dried, oven dried at 70° C for 48 hours, and then weighed. Percent use was calculated with the same formula that was used for Skookumchuck Prairie.

Standing crop production data for the three years, 1992 - 1994, were analyzed with the same methods as for Skookumchuck Prairie. ASC and TSC production data for the three years, 1992 - 1994, were analyzed at Peckhams Lake with a three-factor analysis to discern the effect of the individual year, clipping treatments (ASC vs. TSC), and grazing treatments (new and old seedings) on standing crop. Standing crop at Premier Ridge and Pickering Hills sites were analyzed with a two-way ANOVA using the year and clipping treatment effects as factors in the analysis.

3.8 Shrub Use

Bitterbrush and Saskatoon were monitored for browse production and use because these species are the dominant shrubs available for wild ungulate and cattle browsing at Skookumchuck Prairie, Premier Ridge, and Pickering Hills. Twenty shrubs of each species were randomly located adjacent to the transects established on each site in both the grazed areas, and in the ungulate exclosures. Four twig clusters were tagged on each shrub; one in each quadrant of the shrub. These twig clusters were marked with inconspicuous, numbered, painted metal tags for identification. Each twig cluster included five twigs of the previous year's annual growth.

At each site, percent use of Saskatoon and bitterbrush was estimated in 1992, 1993, and 1994 after the spring wildlife grazing period, after the spring or fall cattle grazing period, and at the end of the winter wildlife use period before spring green-up. Browse use was calculated using the twig measurement method (Aldous 1945; Dasmann 1948) which has been used previously for assessing both Saskatoon (Wikeem and Pitt 1987) and bitterbrush use (Jenson and Urness 1981). The average length of browsed and unbrowsed twigs within the sampled twig clusters were compared and percent use determined using the following formula:

$$\text{Percent Use} = \frac{\text{Unbrowsed Length} - \text{Browsed Length}}{\text{Unbrowsed Length}} \times 100.$$

Differences between browsed and unbrowsed twigs for the three years, 1992-1994, were analyzed independently by site with paired t-tests.

3.9 Shrub Production

Saskatoon and bitterbrush annual production also were determined within the ungulate exclosures at Skookumchuck Prairie, Premier Ridge and Pickering Hills in September

1992, 1993, and 1994. Both leaf and stem production were estimated for Saskatoon and bitterbrush. Shrub height and circumference were used to calculate the area of the shrub as one-half of a parabola. Annual production figures were combined to estimate production on a g/m³ basis.

$$\text{Shrub Volume} = ((\pi * r * h^2)/5) * 0.5$$

Ten Saskatoon and bitterbrush shrubs were tagged within and outside each enclosure on each site in 1992, 1993, and 1994 and clipped for annual production in September. Samples were stored in paper bags labeled to indicate site, shrub species, transect location, shrub number and twig cluster. Samples were air dried and oven dried at 70° C for 48 hours and weighed to the nearest 0.01 g. Saskatoon and bitterbrush leaves and stems were separated after drying to determine the proportions that stems and leaves contribute to total weight.

3.10 Photographic Record

Photographs were taken 1) after spring wildlife use, 2) after spring or fall cattle use, 3) after fall wildlife use, and 4) after winter wildlife use to visually document floristic changes on all four locations. Photographs were taken at Skookumchuck Prairie along one transect in the ungrazed enclosure, and in Cattle Only, Wildlife Only, and Combined Use Areas. A single bitterbrush and Saskatoon shrub were also photographed on each site at the same dates to document browsing impacts.

3.11 Range Condition Assessment

Very few long-term data are available which demonstrate changes in species composition resulting from ungulate grazing in the Ponderosa Pine or Douglas-fir Zones in the East Kootenay. Two long-term enclosures, however, exist at Skookumchuck Prairie and Pickering Hills. At Skookumchuck Prairie, a 0.40 ha (1 acre) enclosure was constructed in 1951. Vegetation was sampled by the Ministry of Forests and Agriculture Canada at approximately ten year intervals from 1960 to 1982 both inside the enclosure and in the area immediately adjacent to the enclosure which has been grazed by wildlife and cattle (Gale et al. 1982). A second enclosure was constructed immediately south and adjoining the original structure in 1991.

An enclosure was constructed at Pickering Hills in 1961. Although this enclosure has been periodically sampled, no data are readily available which document floristic conditions in 1961 or since. Nonetheless, this enclosure has been maintained since its construction, and the vegetation inside it represents one example of a relatively undisturbed plant community in the Douglas-fir Zone.

All three enclosures, as well as vegetation in the immediate area that is being grazed by cattle and wildlife, have been sampled in 1991 and 1992 using the canopy coverage method (Daubenmire 1959). Comparisons between the grazed and ungrazed vegetation provided an indication of how composition of the grazed plant community deviates from that of the protected vegetation.

Data from the baseline year, 1991, was compared with data from the same period in 1994. All sites were analyzed with Spearman's rank correlation procedure.

4.0 Results

4.1 Dietary Overlap Among Deer, Elk and Cattle

4.1.1 Deer Diets

Deer diets were generally the broadest compared to elk and cattle with the number of species in the diet ranging from 31 to 63 species (Table 10, 11, 12). Deer ate more forb species than either browse or grass species in all years except in the Wildlife Only area at Skookumchuck Prairie in 1992 (Table 10), in the Combined Use area at Skookumchuck Prairie in 1993 (Table 11), and at Premier Ridge in 1994 (Table 12). Grasses were used less than either forbs or shrubs in all years (Table 10, 11, 12).

Shrubs dominated the composition of deer diets at all sites (Table 10, 11, 12). Browse composition of deer diets, averaged over all sampling periods, ranged from nearly 50% at Peckhams Lake in 1992 to nearly 85% at the Combined Use area at Skookumchuck Prairie in 1993 (Table 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27). Except at Pickering Hills, deer browsed most from November to March in 1992. Deer browsed >55% in all periods at Skookumchuck Prairie in 1993 (Table 18, 19). At the secondary sites in 1993 deer ate >40% shrubs in all periods except April and May at Peckhams Lake (Table 20), November at Premier Ridge (Table 21), and May at Pickering Hills (Table 22). Except for April, June, and October at Peckhams Lake (Table 25) browse use exceeded 39% at all sites in all sampling periods in 1994.

Although deer browsed between 15 to 17 shrub species (Table 10, 11, 12), most of the diet resulted from 4 to 5 species. Important browse species for deer included Douglas-fir, bitterbrush, Saskatoon, low Oregon grape, buckbrush, rabbitbrush, and soopolallie. The proportion of these species in the diets varied among sites, likely reflecting local availability (Table 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27). Douglas-fir provided important winter browse at Peckhams Lake and Premier Ridge contributing more than 20% of the deer diet in 1992 averaged over all sampling periods (Table 15, 16). In 1993, when use was averaged over all sampling periods, it ranged from >14% in the Wildlife Only area at Skookumchuck Prairie to 47% at Peckhams Lake (Table 18, 19, 20, 21, 22). Douglas-fir ranged from 18% to 30% of deer diets at all sites, except for the Combined Use area in 1994 (Table 23, 24, 25, 26, 27).

Although this species is clearly important in deer diets, use patterns were somewhat different at all sites. Generally, deer used Douglas-fir between 20% and 40% in winter and less in spring. Indeed, this species comprised more than 75% of deer diet in January in 1992, and in January and February in 1993 at Peckhams Lake (Table 15, 20). At Pickering Hills and Skookumchuck Prairie in 1992, Douglas-fir comprised less than 15% of deer diets averaged over all sampling periods, but this species represented more than 45% of deer diets in the Combined Use area at Skookumchuck Prairie during January. In 1993 deer consumed more than 20% Douglas-fir at Peckhams Lake in all periods except May, while deer at the Combined Use area at Skookumchuck Prairie (Table 19) used Douglas-fir >19% in all periods. This species dominated deer diets in all sampling periods in 1994 except June and October (Table 23, 24, 25, 26, 27).

Bitterbrush was also an important browse species for deer at all sites, except for Peckhams Lake where it is not locally abundant. In 1992 bitterbrush comprised approximately 10% of diet composition at Skookumchuck Prairie, Premier Ridge, and Pickering Hills. When averaged over all sampling periods, bitterbrush ranged from >10% at Pickering Hills (Table 22)

Table 10. Deer dietary diversity by forage class on five sites in the East Kootenay region of southeastern British Columbia in 1992.

Site	Grasses	Forbs	Shrubs	Total
Skookumchuck (Wildlife)	14	14	16	44
Skookumchuck (Combined)	12	23	16	51
Peckhams Lake	12	34	16	62
Premier Ridge	14	34	15	63
Pickering Hills	11	29	17	57

Table 11. Deer dietary diversity by forage class on five sites in the East Kootenay region of southeastern British Columbia in 1993.

Site	Grasses	Forbs	Shrubs	Total
Skookumchuck (Wildlife)	11	15	15	41
Skookumchuck (Combined)	7	12	17	36
Peckhams Lake	10	22	16	48
Premier Ridge	12	16	15	43
Pickering Hills	12	24	16	52

Table 12. Deer dietary diversity by forage class on five sites in the East Kootenay region of southeastern British Columbia in 1994.

Site	Grasses	Forbs	Shrubs	Total
Skookumchuck (Wildlife)	10	18	16	44
Skookumchuck (Combined)	12	15	15	42
Peckhams Lake	12	23	15	50
Premier Ridge	12	14	16	42
Pickering Hills	9	19	17	45

Table 13. Deer diets in the Wildlife Only Area at Skookumchuck Prairie in 1992.

Species	Jan	Feb	Mar	Apr	Nov	Mean
Grass and Grasslike						
Agropyron spp.	0.0	0.0	0.0	0.0	0.0	0.3
Agrostis alba	0.0	0.0	0.6	0.0	0.0	0.2
Bromus inermis	0.2	0.5	0.6	0.2	0.0	0.3
Bromus tectorum	1.8	0.0	2.8	0.7	0.0	1.4
Calamagrostis rubescens	0.6	0.0	0.0	0.7	0.0	0.3
Carex spp.	0.4	0.0	0.0	0.0	0.0	0.1
Dactylis glomerata	0.0	0.0	0.0	0.0	0.0	0.1
Festuca idahoensis	1.0	0.0	3.0	0.0	0.0	0.7
Festuca scabrella	7.3	1.1	10.3	3.2	0.0	3.7
Koeleria cristata	0.8	0.0	2.0	0.0	0.0	0.5
Poa spp.	1.2	0.0	0.8	1.3	0.0	1.0
Stipa spp.	0.8	0.0	2.0	0.7	0.0	0.7
Other Grasses	0.6	0.0	1.0	0.7	0.3	0.5
Total Grass and Grasslike	14.7	1.6	23.1	7.5	0.3	9.7
Forbs and Bryophytes						
Achillea millefolium	0.0	1.1	0.0	0.4	0.5	0.5
Apocynum androsaemilfolium	0.0	0.0	0.0	0.0	0.0	0.2
Aster campestris	0.6	0.0	0.0	1.0	0.0	0.3
Balsamorhiza sagittata	0.7	1.2	2.5	0.7	0.0	0.9
Eriogonum umbellatum	0.0	0.0	0.0	0.0	0.0	0.3
Geum trifleurum	0.0	0.0	0.0	0.0	0.0	0.3
Lepidium densiflorum	0.0	0.0	1.0	2.2	0.0	0.5
Medicago/Trifolium	0.0	0.2	2.1	4.1	0.0	1.3
Penstemon procerus	10.3	3.3	13.4	11.0	0.0	7.3
Phlox rigida	0.0	5.4	4.7	0.4	0.0	1.8
Potentilla spp.	0.0	0.0	0.0	0.0	0.0	0.5
Taraxacum officinale	0.0	0.0	0.0	0.0	0.0	0.1
Verbascum thapsis	0.0	0.0	0.0	0.1	0.0	0.0
Other Forbs	0.3	1.1	3.8	4.0	4.2	3.3
Bryophytes	0.2	0.5	1.2	0.9	0.0	0.5
Total Forbs and Bryophytes	12.1	12.8	30.7	25.0	4.7	17.5

Table 13 (continued)

Species	Jan	Feb	Mar	Apr	Nov	Mean
Trees and Shrubs						
Amelanchier alnifolia	3.8	9.2	7.7	11.1	9.2	7.5
Berberis repens	2.6	2.3	0.4	0.5	0.5	1.1
Ceanothus velutinus	25.5	8.8	11.1	6.8	29.8	14.2
Chrysothamnus nauseosus	1.0	8.7	5.8	2.5	0.0	3.2
Pinus ponderosa	3.6	13.9	2.0	0.0	0.0	3.3
Populus tremuloides	0.6	0.7	1.8	6.8	0.0	3.5
Prunus virginianus	0.0	0.0	0.0	0.0	0.0	0.7
Pseudotsuga menziesii	5.5	18.8	10.9	11.5	9.7	9.5
Purshia tridentata	26.8	17.2	6.7	19.1	37.7	19.3
Rosa spp.	1.2	0.9	1.2	0.0	0.0	1.4
Salix spp.	0.0	0.0	0.0	0.0	2.8	0.5
Shepherdia canadensis	1.2	3.7	0.2	4.4	5.2	6.9
Spirea betulifolia	0.0	0.0	0.0	0.5	0.0	0.1
Symphoricarpos albus	0.0	1.4	0.0	0.0	0.0	0.2
Other Shrubs	0.0	0.0	0.0	0.0	0.0	0.1
Conifer bark	1.2	0.0	0.0	4.3	0.0	1.1
Total Trees and Shrubs	73.0	85.6	47.8	67.5	94.9	72.6

Table 14. Deer diets in the Combined Use Area at Skookumchuck Prairie in 1992.

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Dec	Mean
Grass and Grasslike									
Agropyron spp.	0.0	0.0	0.0	0.0	1.9	0.0	1.2	0.0	0.4
Agrostis alba	0.0	0.0	0.0	0.0	0.4	2.0	3.9	0.0	0.8
Bromus inermis	1.0	0.0	4.1	1.6	0.0	3.0	1.2	0.0	1.4
Bromus tectorum	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.4
Calamagrostis rubescens	0.0	0.0	0.0	0.0	0.4	0.7	0.0	0.0	0.1
Carex spp.	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Dactylis glomerata	0.0	0.0	0.0	0.0	0.6	1.0	1.2	0.0	0.4
Festuca idahoensis	2.6	0.6	8.6	4.0	0.0	2.7	2.7	0.3	2.7
Festuca scabrella	6.1	0.6	4.5	1.8	0.4	0.0	0.0	0.0	1.7
Poa spp.	1.4	0.4	2.8	3.2	2.7	1.3	1.2	0.0	1.6
Stipa spp.	0.0	0.0	0.9	2.3	0.8	5.3	0.0	0.0	1.2
Other Grass	0.0	0.0	1.1	1.4	0.6	0.0	0.0	0.0	0.4
Total Grass and Grasslike	11.1	1.6	22.2	14.3	10.9	16.0	11.4	0.3	11.0
Forbs and Bryophytes									
Achillea millefolium	0.0	0.0	0.0	2.3	0.8	0.7	0.3	0.0	0.5
Antennaria dimorpha	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Apocynum androsaemilfolium	0.0	0.0	0.0	0.0	1.4	3.0	0.0	0.0	0.6
Arabis holboellii	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.1
Aster campestris	0.3	0.0	0.0	0.8	0.2	0.3	0.0	0.0	0.2
Astragalus miser	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Balsamorhiza sagittata	0.1	0.1	3.8	1.7	0.0	0.0	0.6	0.8	0.9
Chrysopsis villosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Erigeron corymbosus	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.1
Eriogonum umbellatum	0.0	0.0	0.0	0.0	1.9	0.0	0.9	0.0	0.4
Fragaria virginiana	0.0	0.0	0.0	0.0	0.0	3.7	5.2	0.0	1.1
Geum trifleurum	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.4
Lepidium densiflorum	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	1.0
Lomatium triternatum	0.0	0.0	0.6	0.2	0.0	0.0	0.0	0.0	0.2
Lotus corniculatus	0.0	0.0	0.0	0.0	0.0	9.3	3.0	0.0	4.1
Medicago/Trifolium	0.0	0.0	4.5	8.3	1.2	23.8	8.0	0.1	5.7
Penstemon procerus	4.7	9.8	20.8	6.8	6.0	0.0	4.4	0.0	6.6

Table 14. (continued)

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Dec	Mean
Forbs and Bryophytes (continued)									
Phlox rigida	0.0	0.0	6.2	0.7	0.0	0.0	0.0	0.0	0.9
Potentilla spp.	0.0	0.0	0.0	0.0	2.9	2.0	0.0	0.0	0.6
Solidago spathulata	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.1
Taraxacum officinale	0.0	0.0	0.0	0.0	0.6	1.0	8.9	0.0	1.3
Other Forbs	1.0	2.4	0.8	3.6	7.8	6.7	14.9	0.0	4.7
Bryophytes	0.0	0.0	1.7	0.0	0.4	0.0	0.6	0.0	0.3
Total Forbs and Bryophytes	6.1	13.1	39.3	31.4	25.4	50.7	48.8	0.9	26.6
Trees and Shrubs									
Amelanchier alnifolia	16.5	7.3	5.3	13.5	3.9	2.3	0.0	4.1	6.6
Berberis repens	3.5	6.5	0.0	0.0	0.0	0.0	0.0	0.8	1.4
Ceanothus velutinus	23.3	25.1	4.9	3.7	3.1	0.0	1.5	6.5	8.5
Chrysothamnus nauseosus	0.8	2.3	8.1	2.2	1.3	0.0	0.0	0.0	2.9
Pinus ponderosa	0.9	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.2
Populus tremuloides	4.6	3.7	2.1	1.0	11.3	0.0	0.0	0.0	2.8
Prunus virginianus	0.9	2.9	0.0	0.7	4.1	1.7	0.0	0.0	1.3
Pseudotsuga menziesii	9.8	9.2	7.1	16.5	0.4	0.0	27.0	48.2	14.8
Purshia tridentata	21.2	20.6	9.0	14.0	8.0	0.0	3.3	31.3	13.4
Ribes spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.3
Rosa spp.	1.2	4.3	0.4	0.0	4.9	6.0	0.0	0.0	2.1
Salix/Populus	0.0	0.0	0.0	0.0	0.0	4.7	1.2	4.4	3.4
Shepherdia canadensis	0.0	0.6	0.0	1.9	26.5	10.8	7.3	2.6	6.2
Spirea betulifolia	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.7
Other Shrubs	0.0	0.0	0.0	0.0	0.4	0.0	0.6	0.0	0.1
Conifer bark	0.0	3.5	2.4	2.3	0.0	0.0	0.0	0.0	2.6
Total Trees and Shrubs	82.7	86.0	39.3	55.8	63.9	28.2	40.9	98.7	62.0

Table 15. Deer diets at Peckhams Lake in 1992.

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Grass and Grasslike										
Agrostis alba	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agropyron spp.	0.0	0.0	0.2	0.2	0.0	0.0	0.9	0.0	0.0	0.1
Bromus inermis	1.3	2.3	1.6	4.1	0.0	0.8	0.0	0.0	0.5	1.0
Bromus tectorum	0.0	0.3	0.0	1.5	0.5	4.2	0.0	0.0	0.0	0.9
Calamagrostis rubescens	0.0	0.3	0.0	0.0	0.5	2.5	0.0	0.0	0.0	0.4
Carex spp.	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dactylis glomerata	0.0	0.8	6.9	5.3	1.6	0.0	1.3	6.4	0.0	3.1
Festuca idahoensis	0.0	0.0	0.8	1.9	0.0	0.0	0.4	0.0	0.0	0.4
Festuca scabrella	0.0	0.0	0.0	11.1	0.0	0.0	0.0	0.0	0.0	1.6
Koeleria cristata	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	T
Poa spp.	0.0	0.3	3.1	2.2	3.2	0.0	0.4	0.0	0.0	1.3
Stipa spp.	0.0	0.0	0.0	0.7	0.0	2.5	0.0	1.7	0.0	0.7
Other Grass	0.3	0.0	0.0	2.9	1.0	0.0	1.5	0.0	0.0	0.8
Total Grass and Grasslike	1.5	4.7	12.6	30.1	6.8	10.0	3.6	8.1	0.5	10.2
Forbs										
Achillea millefolium	0.0	0.0	0.0	0.6	0.0	0.8	0.4	0.0	0.0	0.3
Allium cernuum	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.3
Antennaria dimorpha	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Aster campestris	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.3
Apocynum androsaemifolium	0.0	0.0	0.0	0.0	0.0	2.9	3.2	0.0	0.0	0.9
Arabis holboellii	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.6	0.0	0.4
Astragalus miser	0.0	0.0	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.1
Balsamorhiza sagittata	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.1
Calochortus macrocarpum	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.3
Castilleja thompsonii	0.0	0.0	0.0	0.0	0.0	1.2	1.5	0.0	0.0	0.4
Centaurea spp.	0.0	1.8	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.4
Cirsium spp.	0.1	0.3	0.0	0.0	0.0	0.0	0.0	1.2	1.5	0.4
Compositae family	0.0	0.0	0.0	0.0	5.0	0.4	0.0	1.0	0.4	1.0
Collinsia parviflora	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.2
Echium vulgare	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.2
Eriogonum umbellatum	0.0	0.0	0.5	0.0	2.1	0.0	0.0	0.0	0.0	0.4

Table 15. (continued)

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Forbs (continued)										
<i>Fragaria virginiana</i>	0.0	0.0	0.0	0.0	0.5	2.5	0.0	0.0	0.0	0.4
<i>Geum trifleurum</i>	0.0	0.0	0.0	0.0	3.7	0.4	0.0	0.0	0.0	0.6
<i>Heuchra cylindrica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.1
<i>Lepidium densiflorum</i>	0.7	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.2
<i>Leptodactylon pungens</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.1
<i>Lithospermum ruderales</i>	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.2
<i>Lomatium triternatum</i>	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.2
<i>Lotus corniculatus</i>	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.6
<i>Medicago/Trifolium</i>	1.2	3.7	1.4	52.9	62.4	22.4	24.8	2.2	0.6	23.8
Mustard family	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Orthocarpus luteus</i>	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.2
<i>Oxytropis campestris</i>	0.0	0.0	0.0	0.0	5.0	0.0	4.3	0.0	0.0	1.3
<i>Penstemon procerus</i>	3.2	10.2	3.3	0.7	0.0	1.7	0.6	0.6	0.8	1.1
<i>Potentilla hippiana</i>	0.0	0.0	0.0	0.0	2.4	4.4	0.8	1.3	0.0	1.0
<i>Phlox rigida</i>	0.3	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
<i>Senecio canas</i>	0.3	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.1
<i>Solidago spathulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.1
<i>Taraxacum officinale</i>	0.0	0.0	0.0	0.0	1.0	6.6	1.5	0.0	0.0	1.3
<i>Verbascum thapsis</i>	1.0	0.3	0.3	0.0	0.0	0.0	0.0	3.9	1.3	0.8
<i>Viola adunca</i>	0.0	0.0	0.0	0.0	2.1	0.0	1.1	0.0	0.0	0.5
Other Forbs	2.8	0.0	2.8	0.0	3.7	7.3	6.8	3.8	0.8	3.6
Bryophytes	0.7	1.8	0.7	1.8	0.7	0.0	6.9	0.0	0.0	1.4
Total Forbs and Bryophytes	10.4	21.7	8.5	55.4	90.0	60.5	57.8	14.6	5.4	43.7
Trees and Shrubs										
<i>Amelanchier alnifolia</i>	2.3	4.1	9.1	0.0	0.0	0.4	1.1	0.3	4.8	2.2
<i>Arctostaphylos uva-ursi</i>	1.8	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.1
<i>Berberis repens</i>	1.7	3.1	4.0	0.0	0.0	0.8	0.2	1.7	4.3	1.6
<i>Chrysothamnus nauseosus</i>	3.1	5.9	10.6	0.0	0.0	0.0	0.0	0.0	0.5	1.6
<i>Pinus ponderosa</i>	0.0	1.2	0.0	4.1	0.0	3.3	0.6	12.2	18.4	5.5
<i>Populus tremuloides</i>	2.6	4.8	1.0	1.0	0.0	0.0	0.0	0.0	0.3	0.3
<i>Prunus virginiana</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1

Table 15. (continued)

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Trees and Shrubs (continued)										
<i>Pseudotsuga menziesii</i>	77.4	48.2	41.1	7.7	0.0	10.8	16.5	52.6	61.6	27.2
<i>Ribes</i> spp.	0.4	0.0	0.7	0.0	0.0	0.0	0.0	3.2	0.8	0.7
<i>Rosa</i> spp.	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.1
<i>Salix</i> spp.	0.0	0.0	0.0	0.0	0.0	0.4	0.0	2.3	3.0	0.8
<i>Shepherdia canadensis</i>	0.8	1.0	0.8	1.0	3.2	0.8	1.9	0.0	1.0	1.2
<i>Spirea betulifolia</i>	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
<i>Symphoricarpos albus</i>	0.0	0.0	2.0	0.0	0.0	2.5	6.4	0.0	0.0	1.6
Other Shrubs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Trees and Shrubs	91.3	68.3	71.3	13.8	3.2	19.0	27.5	72.9	95.2	43.3

Table 16. Deer diets at Premier Ridge in 1992.

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Grass and Grasslike										
Agropyron spp.	1.2	0.0	0.5	1.6	4.0	1.3	0.0	1.1	0.0	1.1
Agrostis alba	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.5	2.0	0.6
Bromus inermis	0.7	0.5	3.5	3.3	1.6	1.3	0.0	1.1	0.0	1.3
Bromus tectorum	0.0	0.0	0.5	0.8	0.0	0.0	0.0	0.0	0.0	0.1
Carex spp.	0.2	0.6	1.1	1.6	0.0	0.0	0.0	0.0	0.0	0.4
Calamagrostis rubescens	0.0	0.0	0.0	1.9	1.2	1.3	0.0	0.0	0.0	0.5
Dactylis glomerata	0.0	2.8	5.1	1.6	1.2	0.0	0.0	0.8	0.0	1.3
Festuca idahoensis	0.0	0.0	3.5	1.4	1.6	0.0	0.0	0.0	0.0	0.7
Festuca scabrella	1.0	4.2	6.8	2.5	2.4	0.0	0.0	0.0	0.0	1.9
Koeleria cristata	0.0	0.0	1.9	0.1	0.0	0.0	0.0	0.0	0.0	0.2
Phleum pratense	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.1
Poa spp.	0.2	3.3	13.0	10.0	6.3	0.3	0.0	0.5	0.0	3.7
Stipa spp.	0.0	1.1	0.8	2.7	1.2	0.0	0.0	0.0	0.0	0.6
Other Grasses	0.0	0.0	2.4	0.5	0.8	0.0	0.0	0.0	0.0	0.4
Total Grass and Grasslike	3.3	12.5	39.1	28.5	23.3	4.2	0.0	4.0	2.0	13.0
Forbs										
Achillea millefolium	0.0	0.0	0.5	0.1	0.4	0.0	3.7	0.0	0.0	0.5
Antennaria dimorpha	0.0	0.0	0.0	0.0	0.4	1.1	0.0	0.0	0.0	0.2
Apocynum androsaemilfolium	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.4
Arabis holboellii	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.2
Aster campestris	0.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.2
Astragalus miser	0.0	0.0	0.0	0.0	0.9	1.1	0.0	0.3	0.0	0.3
Balsamorhiza sagittata	2.1	0.7	0.0	0.0	2.4	0.0	0.9	2.1	2.1	1.1
Calochortus macrocarpus	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.2
Campanula rotundifolia	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.2
Castilleja thompsonii	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.1	0.0	0.2
Cerastium arvense	0.0	0.0	0.0	0.0	7.1	0.0	1.5	0.0	0.0	1.0
Cirsium spp.	0.0	0.0	0.0	0.0	0.0	0.5	2.5	0.0	0.5	0.4
Compositae family	0.0	0.0	0.0	0.6	0.4	0.5	0.6	0.8	0.2	0.3
Collinsia parviflora	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.1
Crepis atrabarba	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.1

Table 16 (continued)

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Forbs (continued)										
Eriogonum umbellatum	0.0	0.0	0.0	0.5	0.0	0.0	1.2	0.8	0.0	0.3
Fragaria virginiana	0.0	0.0	0.0	0.0	0.0	4.8	10.0	0.0	0.0	1.6
Geum triflorum	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.0	0.7
Heuchra cylindrica	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.2
Leptodactylon pungens	0.0	0.0	0.0	0.0	0.0	0.8	1.2	0.0	0.0	0.2
Lithospermum ruderales	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.1
Lomatium triternatum	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.4
Lotus corniculatus	0.0	0.0	0.0	0.0	0.0	0.5	6.8	0.0	0.0	0.8
Medicago\Trifolium	0.0	0.0	0.0	1.1	1.8	5.1	14.1	0.0	0.0	2.5
Mustard family	0.0	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.1
Penstemon procerus	7.4	6.0	8.9	13.4	4.9	0.5	0.9	1.1	2.7	5.1
Phlox rigida	0.3	1.1	0.5	0.3	0.6	0.0	0.0	0.0	0.0	0.3
Potentilla hippiana	0.0	0.0	0.0	0.0	1.2	6.8	0.0	0.0	0.0	0.9
Senecio canus	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.6
Taraxacum officinale	0.0	0.0	0.0	0.0	0.0	4.8	3.4	0.0	0.0	0.9
Tragopogon pratense	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.1
Verbascum thapsis	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Viola adunca	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.4
Other Forbs	0.0	1.8	2.4	2.9	3.9	2.7	13.5	1.1	0.0	3.1
Bryophytes	0.9	3.1	0.0	0.6	1.8	1.3	1.2	0.0	0.0	1.0
Total Forbs and Bryophytes	10.5	9.6	12.7	19.2	25.0	41.2	81.7	7.3	5.5	24.6
Trees and Shrubs										
Amelanchier alnifolia	10.7	6.6	2.2	5.7	0.6	0.0	2.5	2.1	3.7	3.8
Berberis repens	0.0	21.1	0.5	0.0	0.0	0.0	0.0	4.8	0.0	2.9
Ceanothus velutinus	9.5	1.2	1.6	0.0	0.0	0.0	0.0	10.8	10.5	3.7
Chrysothamnus nauseosus	0.0	2.4	0.4	2.1	0.0	0.0	0.0	0.5	0.0	0.6
Pinus ponderosa	2.1	0.9	0.0	3.0	2.4	0.0	0.6	0.5	0.0	1.1
Populus tremuloides	2.3	2.6	4.6	3.3	1.6	0.0	0.0	0.0	0.0	1.6
Prunus virginianus	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.4
Pseudotsuga menziesii	36.8	24.5	14.2	23.1	32.0	14.5	0.9	23.5	32.6	22.5
Purshia tridentata	10.9	13.4	3.2	2.4	0.0	1.6	0.0	30.1	38.5	11.1

Table 16 (continued)

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Trees and Shrubs (continued)										
Ribes spp.	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.3	0.0	0.5
Rosa spp.	4.3	1.5	1.4	0.5	0.0	1.6	0.0	10.6	1.0	2.3
Salix spp.	0.0	0.0	0.0	0.0	0.0	1.2	6.7	2.6	2.2	1.4
Shepherdia canadensis	5.9	0.6	20.0	9.1	8.0	28.1	7.8	0.8	2.6	9.2
Symphoricarpos albus	0.0	0.0	0.0	0.5	0.0	0.0	0.0	1.9	0.0	0.3
Other Shrubs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.1
Total Trees and Shrubs	85.3	74.8	48.1	49.7	44.6	47.0	22.5	89.0	92.3	61.5

Table 17. Deer diets at Pickering Hills in 1992.

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Grass and Grasslike										
Agropyron spp.	0.0	0.0	0.0	0.0	0.9	0.0	0.7	0.0	2.8	0.5
Agrostis alba	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.5	0.2
Bromus inermis	0.0	0.5	0.0	1.0	0.0	0.9	1.8	0.0	1.9	0.7
Bromus tectorum	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.3
Calamagrostis rubescens	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.9	0.4
Carex spp.	2.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Dactylis glomerata	0.0	0.0	0.0	1.4	1.0	0.0	7.2	1.4	0.0	1.2
Festuca idahoensis	0.0	0.0	1.1	1.0	0.0	0.0	0.0	0.0	2.8	0.5
Poa spp.	0.6	0.0	2.8	4.5	2.1	0.0	1.1	0.0	3.3	1.6
Stipa spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	1.2
Other Grasses	0.0	0.3	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1
Total Grass and Grasslike	2.6	0.8	4.3	7.9	8.5	0.9	13.7	1.4	22.6	7.0
Forbs										
Achillea millefolium	0.0	0.0	0.0	0.0	0.4	0.0	1.3	0.0	0.0	0.2
Apocynum androsaemilfolium	0.0	0.0	0.0	0.0	1.4	4.4	1.1	0.0	0.0	0.8
Arabis holboellii	0.0	0.0	0.0	0.0	0.7	0.0	7.1	0.0	0.0	0.9
Astragalus miser	0.0	0.0	0.0	0.0	0.0	5.1	0.2	0.0	3.6	1.0
Balsamorhiza sagittata	0.0	0.0	0.2	0.0	0.0	0.2	2.5	0.6	0.5	0.4
Castilleja thompsonii	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.1
Cirsium spp.	0.0	0.0	0.0	0.0	0.0	5.7	0.4	0.0	0.0	0.7
Crepis atrabarba	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	0.0	0.6
Fragaria virginiana	0.0	0.0	0.0	0.0	1.4	10.1	0.0	0.0	0.0	1.3
Gaillardia aristata	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.3
Geum trifleurum	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.1
Heuchra cylindrica	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.6
Lepidium densiflorum	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.1
Lotus corniculatus	0.0	0.0	0.0	0.0	0.0	26.3	2.2	0.0	1.7	3.4
Medicago\Trifolium	0.0	0.0	0.0	0.5	2.1	10.8	20.1	0.0	0.2	3.7
Orthocarpus luteus	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.1
Oxytropis campestris	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.1
Penstemon procerus	0.6	0.2	7.9	2.5	2.1	1.3	5.6	0.0	2.8	2.6

Table 17. (continued)

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Forbs (continued)										
Phlox rigida	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.1
Potentilla hippiana	0.0	0.0	0.0	0.0	0.5	2.7	0.0	0.0	0.0	0.4
Taraxacum officinale	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.2
Verbascum thapsis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.1
Other Forbs	0.0	0.3	1.2	1.2	2.1	6.3	4.0	0.6	0.0	1.7
Bryophytes	0.0	0.0	0.0	0.0	0.0	0.6	7.4	0.6	0.0	1.0
Total Forbs and Bryophytes	0.6	0.5	9.3	4.8	13.1	80.2	54.1	1.2	9.7	20.3
Trees and Shrubs										
Amelanchier alnifolia	3.5	4.5	9.9	3.7	3.1	0.0	0.0	2.0	0.0	3.0
Arctostaphylos uva-ursi	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.1
Berberis repens	36.6	65.2	32.9	1.0	24.5	0.0	0.0	0.0	0.0	17.8
Ceanothus velutinus	18.4	12.4	11.8	13.4	5.2	0.0	0.0	14.3	0.0	8.4
Chrysothamnus nauseosus	0.0	0.0	0.0	4.2	0.0	0.0	0.0	1.4	0.0	0.6
Pinus ponderosa	0.6	0.7	0.0	0.4	8.0	0.0	0.0	0.0	1.4	1.2
Populus tremuloides	4.2	2.5	5.1	8.2	2.8	0.0	0.0	0.0	0.0	2.5
Prunus virginianus	1.2	0.0	0.0	0.0	0.7	0.0	0.0	0.6	0.0	0.3
Pseudotsuga menziesii	8.6	3.7	13.7	13.6	9.0	0.0	17.2	23.5	3.8	10.3
Purshia tridentata	17.7	8.9	6.0	19.6	5.9	0.0	1.6	16.7	0.5	8.5
Ribes spp.	0.9	0.0	0.4	0.0	10.4	0.0	0.0	2.0	9.9	2.6
Rosa spp.	3.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.9	0.5
Salix spp.	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.4	7.1	1.1
Shepherdia canadensis	0.4	0.8	6.2	21.9	4.3	15.7	5.5	0.6	0.0	6.2
Spirea betulifolia	1.3	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Other Shrubs	0.0	0.0	0.0	0.0	1.7	2.2	0.0	0.0	0.0	0.4
Total Trees and Shrubs	96.9	98.7	86.4	87.0	75.6	18.2	24.3	62.5	23.6	63.8

Table 18. Deer diet in the Wildlife Only Area at Skookumchuck Prairie in 1993.

Species	Mar	Apr	Nov	Mean
Grass and Grasslike				
Agropyron spp.	0.0	0.0	0.4	0.1
Bromus inermis	1.0	0.0	0.0	0.3
Calamagrostis rubescens	0.0	0.0	0.4	0.1
Carex spp.	0.0	1.5	0.0	0.5
Dactylis glomerata	0.0	0.0	1.0	0.3
Festuca idahoensis	0.8	1.2	0.0	0.7
Juncus spp.	2.1	0.0	0.0	0.7
Koeleria cristata	0.0	0.9	0.0	0.3
Poa spp.	5.7	0.0	0.0	1.9
Stipa spp.	1.0	1.2	0.0	0.7
Other Grasses	0.8	0.0	0.4	0.4
Total Grass and Grasslike	11.4	4.9	2.3	6.2
Forbs and Bryophytes				
Antennaria dimorpha	0.0	2.4	0.0	0.8
Aster campestris	0.5	0.0	0.0	0.2
Astragalus miser	7.0	2.3	0.0	3.1
Balsamorhiza sagittata	1.0	1.5	0.1	0.9
Castilleja sulphurea	0.0	0.3	0.0	0.1
Compositae family	0.0	0.2	0.5	0.2
Erigeron compositus	0.5	0.0	0.0	0.2
Lupinus spp.	2.1	2.6	0.0	1.5
Medicago/Trifolium	0.6	0.0	6.1	2.3
Mustard family	0.0	1.8	0.0	0.6
Penstemon procerus	16.0	14.6	6.3	12.3
Phlox rigida	2.6	1.2	0.0	1.3
Verbascum thapsus	0.0	0.0	0.4	0.1
Other Forbs	1.6	1.8	3.9	2.4
Bryophytes	1.3	1.5	2.2	1.7
Total Forbs and Bryophytes	33.2	30.2	19.6	27.7

Table 18. (continued)

Species	Mar	Apr	Nov	Mean
Trees and Shrubs				
Amelanchier alnifolia	0.5	2.7	0.0	1.1
Berberis repens	0.3	0.0	0.0	0.1
Ceanothus velutinus	14.0	0.9	7.2	7.3
Chrysothamnus spp.	8.0	5.5	0.0	4.5
Juniper	0.8	0.0	0.0	0.3
Pinus ponderosa	1.0	2.1	4.3	2.5
Populus tremuloides	0.0	0.0	0.8	0.3
Pseudotsuga menziesii	6.0	12.8	23.7	14.1
Purshia tridentata	24.8	32.5	22.1	26.5
Ribes spp.	0.0	1.5	0.0	0.5
Salix spp.	0.0	0.9	1.2	0.7
Shepherdia canadensis	0.0	0.0	8.1	2.7
Spiraea betulifolia	0.0	0.0	2.5	0.8
Symphoricarpos albus	0.0	0.0	7.6	2.5
Other Shrubs	0.0	6.1	0.8	2.3
Total Trees and Shrubs	55.4	64.9	78.1	66.2

Table 19. Deer diet in the Combined Use Area at Skookumchuck Prairie in 1993.

Species	Jan	Feb	Apr	Nov	Dec	Mean
Grass and Grasslike						
Agropyron spp.	0.0	2.0	2.5	0.4	0.2	1.0
Bromus inermis	0.0	0.0	0.0	0.9	1.2	0.4
Bromus tectorum	0.0	0.0	0.5	0.0	0.0	0.1
Festuca idahoensis	0.0	0.0	0.0	0.0	0.7	0.1
Festuca scabrella	0.0	0.0	0.0	0.0	0.3	0.1
Poa spp.	0.0	0.3	1.4	0.0	0.5	0.4
Stipa spp.	0.0	0.0	3.0	2.2	0.5	1.1
Total Grass and Grasslike	0.0	2.3	7.4	3.5	3.4	3.3
Forbs and Bryophytes						
Arabis spp.	0.0	0.0	0.0	0.0	0.2	0.0
Aster campestris	0.0	0.0	0.0	0.0	0.2	0.0
Balsamorhiza sagittata	0.0	0.0	0.0	0.0	0.1	0.0
Castilleja sulphurea	0.0	0.0	0.0	0.0	0.3	0.1
Compositae family	0.0	0.0	0.0	0.0	0.2	0.0
Lupinus spp.	0.0	0.0	0.0	0.2	0.0	0.0
Medicago/Trifolium	0.0	0.0	0.0	3.0	4.4	1.5
Penstemon procerus	0.0	2.3	4.8	6.2	12.3	5.1
Potentilla hippiana	0.0	0.0	0.5	0.0	0.0	0.1
Verbascum thapsus	0.0	0.0	0.0	0.4	0.2	0.1
Other Forbs	0.0	0.0	1.6	8.6	2.0	2.4
Bryophytes	0.0	0.0	0.0	1.6	9.9	2.3
Total Forbs and Bryophytes	0.0	2.3	6.9	20.0	29.8	11.8
Trees and Shrubs						
Amelanchier alnifolia	2.5	3.2	4.8	0.4	0.8	2.4
Berberis repens	7.8	20.4	0.2	1.8	0.3	6.1
Ceanothus velutinus	15.6	11.3	12.6	4.4	6.2	10.0
Chrysothamnus spp.	0.0	0.3	0.0	0.0	0.0	0.1
Juniper	2.1	0.7	2.1	0.0	0.0	1.0
Pinus ponderosa	3.6	2.3	0.7	2.7	0.3	1.9

Table 19. (continued)

Species	Jan	Feb	Apr	Nov	Dec	Mean
Trees and Shrubs (continued)						
Populus tremuloides	0.0	0.0	0.0	0.0	2.3	0.5
Pseudotsuga menziesii	38.3	19.7	22.5	25.5	22.1	25.6
Purshia tridentata	26.2	35.0	35.2	16.4	25.5	27.7
Ribes spp.	0.0	0.7	1.2	0.0	0.0	0.4
Rosa spp.	1.4	0.3	0.9	0.0	0.0	0.5
Salix spp.	0.0	0.7	1.6	0.2	3.7	1.2
Shepherdia canadensis	2.5	0.0	3.9	7.1	2.5	3.2
Spirea betulifolia	0.0	0.0	0.0	2.9	0.5	0.7
Symphoricarpos albus	0.0	0.0	0.0	12.4	1.9	2.9
Other Shrubs	0.0	0.0	0.0	1.3	0.0	0.3
Conifer bark	0.0	1.0	0.0	0.0	0.5	0.3
Total Trees and Shrubs	100.0	95.5	85.8	75.1	66.6	84.6

Table 20. Deer diet at Peckhams Lake in 1993.

Species	Jan	Feb	Mar	Apr	May	Nov	Dec	Mean
Grass and Grasslike								
Agrostis alba	0.0	4.0	0.0	1.6	0.0	0.0	0.0	0.8
Agropyron spp.	1.5	1.0	1.3	3.0	3.5	0.0	0.9	1.6
Bromus inermis	0.8	1.2	0.0	3.6	0.0	2.7	2.1	1.5
Calamagrostis rubescens	0.6	0.0	0.0	0.0	0.0	0.0	0.4	0.1
Dactylis glomerata	0.0	0.0	12.8	9.5	1.8	0.0	7.9	4.6
Danthonia spp.	0.0	0.0	0.0	6.3	0.0	0.0	0.0	0.9
Festuca idahoensis	0.4	1.2	0.0	1.6	0.0	0.0	0.0	0.5
Poa spp.	0.0	1.2	0.0	1.6	0.0	1.8	2.8	1.1
Stipa spp.	0.0	1.2	0.9	1.0	0.3	0.6	0.0	0.6
Other Grasses	1.3	0.0	0.4	1.6	0.0	0.0	0.0	0.5
Total Grass and Grasslike	4.6	9.9	15.4	29.9	5.5	5.0	14.1	12.1
Forbs and Bryophytes								
Achillea lanulosa	0.0	0.0	0.0	1.0	1.2	0.0	0.0	0.3
Allium cernuum	0.0	0.0	0.0	0.0	0.9	0.0	0.7	0.2
Aster campestris	0.0	0.0	0.0	0.0	0.9	0.2	0.0	0.1
Astragalus miser	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.3
Balsamorhiza sagittata	0.0	0.0	0.1	0.7	0.6	0.0	0.4	0.2
Castilleja sulphurea	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.1
Compositae family	0.0	0.0	0.2	0.2	1.2	0.0	0.0	0.2
Epilobium spp.	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Equisetum spp.	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Fragaria spp.	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Geum spp.	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.1
Lepidium densiflorum	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.2
Lomatium spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1
Lupinus spp.	0.0	0.0	0.0	0.5	0.0	0.0	0.1	0.1
Medicago/Trifolium	0.0	0.4	1.3	24.8	27.9	14.6	17.9	12.4
Mustard family	0.0	0.0	0.2	3.8	0.0	0.0	0.0	0.6
Penstemon procerus	0.0	1.0	0.4	7.2	0.9	4.5	4.9	2.7
Potentilla hippiana	0.0	0.0	0.2	0.0	4.4	0.3	0.7	0.8
Verbascum thapsus	2.7	3.4	0.0	0.0	0.0	0.0	0.1	0.9

Table 20 (continued)

Species	Jan	Feb	Mar	Apr	May	Nov	Dec	Mean
Forbs and Bryophytes (continued)								
Other Forbs	1.7	1.7	6.8	5.3	9.9	6.1	2.9	4.9
Bryophytes	0.0	0.7	2.0	0.0	8.2	6.7	7.9	3.6
Total Forbs and Bryophytes	5.8	7.2	11.3	45.4	58.6	32.7	35.9	28.1
Trees and Shrubs								
Amelanchier alnifolia	4.0	1.5	0.0	0.0	1.2	0.0	0.2	1.0
Berberis repens	0.4	0.3	0.4	0.0	1.5	0.0	0.4	0.4
Ceanothus velutinus	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.3
Chrysothamnus spp.	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.7
Juniper	2.3	0.0	7.5	2.0	0.0	0.0	0.0	1.7
Pinus ponderosa	2.5	3.2	1.8	0.7	0.0	0.0	0.7	1.3
Populus tremuloides	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.1
Pseudotsuga menziesii	77.3	75.2	51.8	20.1	4.7	55.0	44.8	47.0
Purshia tridentata	0.8	0.0	0.7	0.0	1.2	0.0	0.0	0.4
Ribes spp.	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Rosa spp.	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salix spp.	1.0	0.7	0.0	0.0	0.6	3.9	0.5	1.0
Shepherdia canadensis	0.2	1.0	0.0	0.0	24.8	0.0	0.0	3.7
Symphoricarpos albus	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.1
Conifer bark	0.0	0.0	5.5	0.0	0.0	1.8	1.2	1.2
Other Shrubs	0.0	0.0	0.7	2.0	0.0	0.0	0.0	0.4
Total Trees and Shrubs	89.6	81.9	73.2	24.7	35.9	60.9	48.9	59.3

Table 21. Deer diet at Premier Ridge in 1993.

Species	Jan	Feb	Mar	Apr	Nov	Dec	Mean
Grass and Grasslike							
Agropyron spp.	2.8	0.7	0.9	1.9	0.5	0.5	1.2
Bromus inermis	0.9	0.7	0.0	2.8	0.5	1.3	1.0
Calamagrostis rubescens	0.0	0.0	0.0	1.4	0.0	0.0	0.2
Carex spp.	0.0	0.0	0.0	1.2	0.0	0.0	0.2
Dactylis glomerata	1.2	0.0	0.0	0.0	0.8	0.2	0.4
Festuca idahoensis	0.0	0.0	3.2	0.9	1.8	0.0	1.0
Festuca scabrella	0.0	0.0	4.5	0.0	0.0	0.0	0.8
Koeleria cristata	0.0	0.0	0.0	0.0	0.5	0.0	0.1
Poa spp.	0.6	4.9	2.0	3.1	1.0	0.6	2.0
Stipa spp.	0.9	0.7	1.4	0.7	1.8	0.6	1.0
Other Grasses	0.0	0.7	0.5	0.0	0.8	0.0	0.3
Total Grass and Grasslike	6.5	7.5	12.5	12.0	7.7	3.3	8.2
Forbs and Bryophytes							
Achillea lanulosa	0.0	0.0	0.0	0.0	0.0	0.7	0.1
Aster campestris	0.0	0.0	0.0	0.0	0.0	1.8	0.3
Balsamorhiza sagittata	0.0	0.0	1.5	14.0	0.0	2.6	3.0
Compositae family	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Fragaria spp.	0.0	0.0	0.0	0.0	0.8	0.0	0.1
Gaillardia aristata	0.0	0.0	0.0	0.0	0.3	0.0	0.1
Geum spp.	0.0	0.0	0.0	0.0	2.8	0.0	5.5
Legume Pod	0.0	0.0	0.0	0.0	0.0	3.8	0.6
Lithospermum ruderales	0.3	0.0	0.0	0.0	0.0	0.0	0.1
Lomatium spp.	0.0	0.0	0.0	0.0	0.0	0.4	0.1
Lupinus spp.	0.0	0.0	0.0	0.2	4.4	0.0	0.8
Medicago/Trifolium	0.0	0.3	0.0	0.0	27.3	0.1	4.6
Mustard family	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Penstemon procerus	0.6	0.0	5.9	6.9	0.5	18.9	5.5
Phlox rigida	0.0	0.0	0.0	0.0	0.0	0.5	0.1
Taraxacum spp.	0.0	0.0	0.0	0.0	2.3	0.0	0.4
Other Forbs	1.8	0.0	0.9	2.8	14.1	1.5	3.5

Table 21. (continued)

Species	Jan	Feb	Mar	Apr	Nov	Dec	Mean
Forbs and Bryophytes (continued)							
Bryophytes	0.0	0.0	0.0	0.0	0.0	1.0	0.2
Total Forbs and Bryophytes	2.8	0.3	8.7	10.6	66.5	31.1	20.0
Trees and Shrubs							
Amelanchier alnifolia	5.5	0.7	7.7	10.9	0.0	0.7	4.2
Berberis repens	0.0	0.0	0.0	0.0	0.0	1.7	0.3
Ceanothus velutinus	6.8	10.9	11.1	6.1	0.0	0.0	5.8
Chrysothamnus spp.	0.0	0.0	0.7	0.0	0.0	0.0	0.1
Juniper	0.0	0.7	0.0	0.0	0.0	0.0	0.1
Pinus ponderosa	2.2	0.0	0.0	1.2	0.0	2.8	1.0
Pseudotsuga menziesii	38.7	27.2	9.3	28.6	0.0	17.4	20.2
Purshia tridentata	28.4	37.0	43.6	25.4	0.0	37.1	28.6
Rosa spp.	0.9	0.0	0.0	1.4	0.0	0.0	0.4
Salix spp.	0.0	0.0	0.0	0.5	5.1	1.2	1.1
Shepherdia canadensis	8.3	7.5	6.4	2.4	20.8	1.6	7.8
Spiraea betulifolia	0.0	0.0	0.0	0.0	0.0	3.0	0.5
Other Shrubs	0.0	0.0	0.0	0.9	0.3	0.0	0.2
Conifer bark	0.0	8.4	0.0	0.0	0.0	0.0	1.4
Total Trees and Shrubs	90.8	92.2	78.8	77.3	25.9	65.6	71.8

Table 22. Deer diets at Pickering Hills in 1993.

Species	Jan	Feb	Mar	Apr	May	Nov	Dec	Mean
Grass and Grasslike								
Agrostis alba	0.0	0.6	13.6	0.0	0.0	0.0	0.0	2.0
Agropyron spp.	0.7	2.0	5.3	2.1	0.0	0.6	0.0	1.5
Bromus inermis	1.5	0.8	1.2	0.9	0.0	0.6	0.0	0.7
Bromus tectorum	0.0	0.0	0.0	0.0	7.8	0.0	0.0	1.1
Calamagrostis rubescens	0.0	0.0	0.9	0.9	0.0	0.0	0.0	0.3
Carex spp.	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.1
Dactylis glomerata	0.0	0.4	6.7	0.0	1.6	0.0	0.0	1.2
Festuca idahoensis	0.7	2.2	1.2	0.0	0.0	0.0	0.0	0.6
Koeleria cristata	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Poa spp.	3.5	2.0	5.3	0.6	0.8	0.0	0.0	1.7
Stipa spp.	2.5	2.4	2.3	0.6	0.0	0.0	0.4	1.2
Other Grasses	0.0	1.0	0.7	0.0	0.0	0.4	0.0	0.3
Total Grass and Grasslike	10.1	12.4	37.1	5.1	10.1	1.6	0.4	11.0
Forbs and Bryophytes								
Achillea lanulosa	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.2
Allium cernuum	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.5
Antennaria dimorpha	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.1
Arabis spp.	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.1
Aster campestris	0.0	0.0	0.0	9.3	0.4	1.1	0.0	1.5
Astragalus miser	0.0	0.0	0.0	6.8	1.6	0.0	0.0	1.2
Balsamorhiza sagittata	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Castilleja sulphurea	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.1
Centaurea spp.	0.0	0.0	1.8	0.0	0.0	3.9	1.3	1.0
Compositae family	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Epilobium spp.	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.3
Eriogonum umbellatum	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.1
Fragaria spp.	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.1
Heuchera cylindrica	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.1
Lupinus spp.	0.0	0.0	0.0	7.8	1.9	0.6	1.7	1.7
Medicago/Trifolium	0.0	0.0	0.0	0.0	27.6	2.2	0.0	4.3
Mustard family	0.0	0.0	0.7	0.9	0.0	0.0	0.0	0.2

Table 22. (continued)

Species	Jan	Feb	Mar	Apr	May	Nov	Dec	Mean
Forbs and Bryophytes (continued)								
Orthocarpus spp.	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.2
Penstemon procerus	0.0	0.2	2.8	8.7	0.0	0.6	0.4	1.8
Phlox rigida	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Potentilla hippiana	0.0	0.0	0.0	1.1	6.2	0.0	0.0	1.0
Verbascum thapsus	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.2
Other Forbs	0.0	0.4	2.5	7.1	20.2	8.6	0.8	5.7
Bryophytes	1.5	0.0	0.0	3.6	0.8	2.6	0.9	1.3
Total Forbs and Bryophytes	1.5	0.6	9.2	51.3	61.9	22.6	5.8	21.8
Trees and Shrubs								
Amelanchier alnifolia	10.3	8.7	1.4	0.6	1.2	0.8	0.6	3.4
Berberis repens	12.6	9.3	12.2	0.0	1.6	6.0	35.4	11.0
Ceanothus velutinus	5.7	7.7	6.7	2.1	2.3	1.2	0.4	3.7
Chrysothamnus spp.	0.0	0.0	1.0	14.7	0.0	0.0	0.0	2.2
Juniper	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Pinus ponderosa	0.3	3.9	0.9	0.0	0.0	0.6	1.6	1.0
Populus tremuloides	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.3
Prunus virginiana	0.0	1.0	0.0	0.6	0.0	0.0	1.8	0.5
Pseudotsuga menziesii	26.1	32.6	19.1	6.6	10.1	38.4	31.9	23.5
Purshia tridentata	19.5	15.8	10.1	11.5	2.3	11.4	7.6	11.2
Ribes spp.	0.0	0.0	0.9	0.0	0.0	3.8	7.7	1.8
Rosa spp.	0.0	0.0	0.0	0.0	0.0	0.6	0.4	0.1
Salix spp.	1.0	1.6	1.4	2.1	0.4	1.4	1.2	1.3
Shepherdia canadensis	9.4	5.1	0.0	5.4	5.4	4.4	0.4	4.3
Symphoricarpos albus	0.0	0.0	0.0	0.0	4.7	2.2	0.0	1.0
Conifer bark	2.0	1.0	0.0	0.0	0.0	4.6	2.1	1.4
Total Trees and Shrubs	87.5	86.6	53.8	43.6	28.0	75.4	92.7	66.8

Table 23. Deer diets in the Wildlife Only Area at Skookumchuck Prairie in 1994.

Species	Mar	May	Jun	Nov	Dec	Mean
Grass and Grasslike						
Agrostis alba	0.0	0.0	0.0	0.0	0.6	0.1
Agropyron spp.	1.0	0.0	0.0	0.0	0.8	0.4
Bromus inermis	0.0	0.0	0.0	1.4	0.0	0.3
Carex spp.	0.0	0.0	0.5	0.0	0.0	0.1
Dactylis glomerata	0.0	0.0	0.0	0.0	0.6	0.1
Festuca idahoensis	0.0	0.6	2.2	2.0	2.9	1.5
Festuca scabrella	1.4	2.8	2.6	2.2	10.1	3.8
Poa spp.	0.4	4.8	0.0	1.7	2.6	1.9
Stipa spp.	0.0	1.4	0.0	0.0	2.8	0.8
Other Grasses	0.0	0.9	0.0	1.7	1.4	0.8
Total Grass and Grasslike	2.8	10.5	5.3	9.0	21.8	9.9
Forbs and Bryophytes						
Achillea lanulosa	0.3	0.9	0.7	0.0	0.0	0.4
Antennaria dimorpha	0.0	0.4	0.0	0.0	1.2	0.3
Aster campestris	0.0	0.0	0.0	2.0	0.0	0.4
Balsamorhiza sagittata	0.0	0.0	0.0	0.6	0.4	0.2
Compositae family	0.0	0.0	1.1	0.1	0.4	0.3
Equisetum spp.	0.0	0.0	0.0	1.1	0.0	0.2
Fragaria spp.	0.0	0.3	0.0	0.0	0.0	0.1
Gaillardia aristata	0.0	0.0	2.6	0.0	0.0	0.5
Geum spp.	0.0	0.0	3.9	0.0	0.0	0.8
Lotus spp.	0.0	0.0	0.0	0.0	0.2	0.0
Lupinus spp.	0.3	0.9	3.9	0.3	0.0	1.1
Medicago/Trifolium	5.2	3.1	11.1	0.1	0.0	3.9
Mustard family	0.0	0.7	0.0	0.0	0.0	0.1
Penstemon procerus	6.2	18.2	8.7	2.0	0.2	7.1
Phlox rigida	0.9	2.6	0.0	3.6	0.0	1.4
Potentilla hippiana	0.0	0.1	1.1	0.0	0.0	0.2
Other Forbs	3.3	0.8	6.1	1.4	3.8	3.1
Bryophytes	1.8	0.9	2.6	0.8	0.2	1.3
Total Forbs and Bryophytes	18.0	28.9	41.8	12.0	6.4	21.4

Table 23. (continued)

Species	Mar	May	Jun	Nov	Dec	Mean
Trees and Shrubs						
Amelanchier alnifolia	4.7	3.4	5.2	0.0	0.6	2.8
Berberis repens	1.0	0.8	0.0	1.4	7.2	2.1
Ceanothus velutinus	6.6	0.6	0.4	1.7	0.0	1.9
Chrysothamnus spp.	3.6	0.0	0.4	0.0	0.4	0.9
Pinus ponderosa	7.0	1.7	0.9	18.5	32.6	12.1
Populus tremuloides	0.0	0.0	0.0	3.1	1.0	0.8
Prunus virginiana	0.1	0.0	0.0	0.0	0.0	0.0
Pseudotsuga menziesii	19.7	43.5	0.0	19.1	7.8	18.0
Purshia tridentata	29.0	7.7	7.2	17.9	9.7	14.3
Rosa spp.	1.2	0.0	0.0	0.0	0.6	0.4
Salix spp.	0.5	0.0	32.7	0.0	0.0	6.6
Shepherdia canadensis	1.0	0.0	6.1	15.0	9.5	6.3
Spiraea betulifolia	0.0	0.0	0.0	1.7	1.6	0.7
Symphoricarpos albus	0.7	0.0	0.0	0.0	0.0	0.1
Other Shrubs	0.2	0.9	0.0	0.6	0.0	0.3
Conifer bark	0.7	2.0	0.0	0.0	0.8	0.7
Total Trees and Shrubs	76.0	60.6	52.9	79.0	71.8	68.1

Table 24. Deer diets in the Combined Use Area at Skookumchuck Prairie in 1994.

Species	Jan	Feb	Apr	Oct	Dec	Mean
Grass and Grasslike						
Agrostis alba	0.0	2.4	0.0	0.0	0.0	0.5
Agropyron spp.	4.0	1.2	0.0	0.5	1.3	1.4
Bromus inermis	0.0	0.7	0.0	0.0	0.6	0.3
Bromus tectorum	1.3	0.0	0.0	0.0	0.0	0.3
Calamagrostis rubescens	0.0	1.4	0.0	0.0	0.0	0.3
Carex spp.	0.0	0.0	0.0	0.0	0.4	0.1
Dactylis glomerata	0.0	0.2	0.0	0.0	0.0	0.0
Festuca idahoensis	2.8	5.8	1.1	0.5	5.8	3.2
Festuca scabrella	20.8	2.7	0.0	5.8	12.3	8.3
Poa spp.	0.4	3.8	3.1	0.7	8.6	3.3
Stipa spp.	0.8	0.5	0.0	0.5	2.9	0.9
Other Grasses	1.7	1.0	0.9	0.3	3.5	1.5
Total Grass and Grasslike	31.8	19.7	5.1	8.3	35.4	20.1
Forbs and Bryophytes						
Achillea lanulosa	1.3	0.5	2.1	1.0	0.0	1.0
Antennaria dimorpha	0.0	0.0	2.7	0.0	0.0	0.5
Aster campestris	0.0	0.2	0.0	0.0	0.0	0.0
Astragalus miser	0.0	0.0	0.1	0.0	0.0	0.0
Balsamorhiza sagittata	1.7	0.0	0.1	1.6	0.0	0.7
Compositae family	0.0	0.0	0.3	0.0	0.0	0.1
Lupinus spp.	1.1	0.5	1.9	0.8	0.0	0.9
Medicago/Trifolium	4.9	3.8	2.7	1.6	0.0	2.6
Mustard family	0.0	0.0	1.3	0.0	0.0	0.3
Penstemon procerus	16.2	18.2	6.2	2.2	7.9	10.1
Phlox rigida	0.0	0.0	2.8	0.0	1.5	0.9
Potentilla hippiana	0.0	0.0	0.4	0.0	0.0	0.1
Verbascum thapsus	0.2	0.0	0.0	0.0	0.0	0.0
Other Forbs	2.5	3.4	9.9	1.2	1.3	3.7
Bryophytes	0.6	0.0	8.5	0.0	0.0	1.8
Total Forbs and Bryophytes	27.9	26.6	30.5	8.4	10.7	20.8

Table 24. (continued)

Species	Jan	Feb	Apr	Oct	Dec	Mean
Trees and Shrubs						
Amelanchier alnifolia	2.3	1.0	0.0	2.9	0.6	1.4
Berberis repens	8.7	5.3	0.6	2.2	8.2	5.0
Ceanothus velutinus	4.5	5.5	1.4	13.3	2.3	5.4
Chrysothamnus spp.	0.0	1.9	5.8	2.5	0.0	2.0
Pinus ponderosa	0.8	1.7	4.0	1.0	5.4	2.6
Populus tremuloides	0.0	0.5	0.0	0.0	0.4	0.2
Prunus virginiana	0.0	0.0	1.1	0.5	1.0	0.5
Pseudotsuga menziesii	9.6	11.8	9.7	0.0	14.8	9.2
Purshia tridentata	7.9	20.0	27.0	49.6	10.8	23.1
Rosa spp.	0.0	0.5	0.0	0.0	3.5	0.8
Salix spp.	1.7	1.7	0.0	1.7	1.7	1.4
Shepherdia canadensis	4.2	3.8	0.6	9.6	3.8	4.4
Spiraea betulifolia	0.0	0.0	0.0	0.0	0.7	0.1
Other Shrub	0.0	0.0	0.0	0.0	0.7	0.1
Conifer bark	0.0	0.0	5.7	0.0	0.0	1.1
Total Trees and Shrubs	39.7	53.7	55.9	83.3	53.9	57.3

Table 25. Deer diets at Peckhams Lake in 1994.

Species	Jan	Feb	Mar	Apr	May	Jun	Oct	Nov	Dec	Mean
Grass and Grasslike										
Agrostis alba	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.4
Agropyron spp.	0.0	0.0	0.3	0.7	0.8	0.0	6.0	22.7	0.0	3.4
Bromus inermis	6.1	8.4	1.8	0.0	3.7	0.0	0.7	4.5	0.0	2.8
Bromus tectorum	0.0	0.0	0.0	3.7	0.0	2.4	0.0	0.0	0.0	0.7
Calamagrostis rubescens	1.6	0.0	1.2	0.0	0.0	0.0	0.0	0.3	0.0	0.3
Carex spp.	0.0	0.4	1.6	0.7	2.4	2.8	0.0	4.2	0.0	1.3
Dactylis glomerata	3.0	6.9	3.6	16.6	2.9	0.0	0.0	3.3	0.0	4.0
Festuca idahoensis	0.3	0.5	0.0	1.1	0.8	1.0	5.3	0.0	0.0	1.0
Festuca scabrella	8.9	0.0	1.6	0.0	0.0	2.4	0.0	0.8	0.0	1.5
Poa spp.	1.1	0.5	0.9	1.1	4.5	0.9	1.8	2.9	0.0	1.5
Stipa spp.	0.5	0.0	0.0	0.0	0.0	0.0	4.9	2.4	0.0	0.9
Other Grasses	1.0	0.0	1.0	3.7	0.4	4.3	1.4	1.9	1.4	1.7
Total Grass and Grasslike	22.5	16.7	12.0	27.6	15.5	13.8	20.1	46.6	1.4	19.5
Forbs and Bryophytes										
Achillea lanulosa	0.0	0.4	0.0	2.2	0.4	1.2	0.5	0.8	6.2	1.3
Antennaria dimorpha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.7
Astragalus miser	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.2	0.1
Balsamorhiza sagittata	0.8	0.8	0.0	1.3	0.0	0.0	0.5	0.2	1.4	0.6
Centaurea spp.	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.5	0.0	0.1
Cirsium spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
Compositae family	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.2	0.1
Disporum spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.1
Equisetum spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Fragaria spp.	0.0	0.0	0.0	0.7	5.1	0.0	0.0	1.5	0.0	0.8
Gaillardia aristata	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.1
Lithospermum ruderales	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Lotus spp.	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.3
Lupinus spp.	0.2	0.2	0.0	2.4	0.4	9.0	0.0	0.6	0.0	1.4
Medicago/Trifolium	6.7	5.8	10.5	12.4	17.0	55.3	32.6	0.6	5.4	16.3
Monocot	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0	0.0	0.5
Penstemon procerus	14.9	14.4	9.1	5.5	7.6	1.4	4.2	1.4	4.8	7.0

Table 25. (continued)

Species	Jan	Feb	Mar	Apr	May	Jun	Oct	Nov	Dec	Mean
Forbs and Bryophytes (continued)										
Potentilla hippiana	0.0	0.0	0.0	2.0	0.0	0.0	0.5	0.0	0.0	0.3
Taraxacum spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.1
Verbascum thapsus	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1
Viola spp.	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.2
Other Forbs	2.3	1.7	4.2	2.8	2.7	5.2	3.7	1.0	3.2	3.0
Bryophytes	2.0	2.8	4.6	7.8	2.2	0.0	0.4	0.3	0.0	2.2
Total Forbs and Bryophytes	27.9	26.1	28.6	38.0	35.4	77.0	48.8	13.9	21.8	35.3
Trees and Shrubs										
Amelanchier alnifolia	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Berberis repens	0.0	1.9	1.3	0.0	0.0	4.3	0.0	0.0	2.1	1.1
Ceanothus velutinus	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Chrysothamnus spp.	0.3	0.2	0.2	1.5	0.0	0.0	0.0	0.3	0.0	0.3
Pinus ponderosa	3.3	4.3	5.5	2.2	7.8	0.0	0.0	8.4	19.4	5.7
Populus tremuloides	2.5	1.7	2.4	0.0	0.0	0.0	4.9	1.9	2.1	1.7
Pseudotsuga menziesii	35.0	43.1	45.3	27.0	39.3	0.0	1.6	27.4	48.0	29.6
Purshia tridentata	0.0	0.4	0.0	3.0	0.0	0.0	0.5	0.5	0.9	0.6
Rosa spp.	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Salix spp.	0.0	2.6	1.3	0.0	0.8	4.0	0.0	0.0	0.0	1.0
Shepherdia canadensis	0.2	0.0	0.0	0.0	0.0	0.9	20.6	0.0	0.0	2.4
Spiraea betulifolia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.5	0.3
Symphoricarpos albus	0.0	0.0	1.3	0.0	0.0	0.0	3.5	0.0	0.0	0.5
Other Shrubs	2.0	1.7	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.5
Conifer bark	3.0	1.3	1.0	0.7	0.0	0.0	0.0	0.5	1.8	0.9
Total Trees and Shrubs	49.6	57.2	58.8	34.4	49.1	9.2	31.1	39.5	76.8	45.1

Table 26. Deer diets at Premier Ridge in 1994.

Species	Jan	Feb	Mar	Apr	May	Oct	Nov	Dec	Mean
Grass and Grasslike									
Agropyron spp.	0.0	0.5	1.6	1.3	0.0	0.0	0.0	0.5	0.5
Bromus inermis	1.0	0.0	0.2	2.7	0.0	0.0	0.0	0.0	0.5
Bromus tectorum	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.3
Calamagrostis rubescens	0.6	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.2
Carex spp.	0.0	0.7	2.3	1.3	1.3	0.0	0.6	0.0	0.8
Dactylis glomerata	0.4	0.7	0.5	0.9	0.0	0.0	0.0	0.0	0.3
Festuca idahoensis	0.0	0.5	1.5	0.5	0.9	0.0	0.0	1.4	0.6
Festuca scabrella	0.0	1.1	5.1	0.0	0.0	0.0	0.9	0.0	0.9
Koeleria cristata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.1
Poa spp.	0.0	2.7	4.1	3.6	2.6	0.0	0.0	1.4	1.8
Stipa spp.	1.6	0.0	0.0	1.3	0.4	0.0	0.0	0.0	0.4
Other Grasses	0.1	0.9	0.0	0.9	0.0	0.4	1.3	0.9	0.6
Total Grass and Grasslike	3.7	7.1	16.1	12.5	7.8	0.4	2.8	5.1	6.9
Forbs and Bryophytes									
Achillea lanulosa	0.0	0.1	0.5	0.0	0.0	1.9	2.6	1.2	0.8
Aster campestris	0.3	0.4	0.0	0.9	1.1	0.0	0.5	0.0	0.4
Astragalus miser	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.1
Balsamorhiza sagittata	0.1	0.0	0.5	0.0	2.4	0.0	0.9	0.9	0.6
Cirsium spp.	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.3
Compositae family	0.0	0.0	0.0	1.3	1.3	0.0	0.6	0.3	0.4
Lupinus spp.	0.0	0.2	0.3	0.0	1.6	0.0	0.3	0.0	0.3
Medicago/Trifolium	2.1	2.0	1.6	14.0	2.9	0.9	2.5	0.0	3.3
Mertensia spp.	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Mustard family	0.3	0.4	0.2	0.0	0.7	0.0	0.0	0.0	0.2
Penstemon procerus	6.6	6.7	9.9	5.8	7.5	1.1	5.3	2.0	5.6
Potentilla hippiana	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.2
Other Forbs	2.0	2.3	1.5	4.0	3.8	3.6	2.5	2.3	2.8
Bryophytes	1.0	1.6	2.5	10.9	8.4	0.0	0.0	0.9	3.2
Total Forbs and Bryophytes	14.8	13.7	17.0	38.2	30.6	7.5	17.4	7.6	18.4

Table 26. (continued)

Species	Jan	Feb	Mar	Apr	May	Oct	Nov	Dec	Mean
Trees and Shrubs									
Amelanchier alnifolia	0.0	2.3	2.6	0.0	0.5	2.2	0.6	0.0	1.0
Berberis repens	0.0	0.0	0.0	0.5	0.0	0.0	1.2	1.2	0.4
Ceanothus velutinus	4.3	3.1	0.3	0.0	0.0	0.0	0.0	7.8	1.9
Chrysothamnus spp.	0.0	1.6	3.9	0.0	0.0	0.4	1.6	0.0	0.9
Juniper	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.1
Pinus ponderosa	0.0	3.4	3.4	3.6	6.2	0.0	10.3	15.7	5.3
Populus tremuloides	0.0	0.4	0.0	0.9	0.0	2.6	0.0	0.0	0.5
Pseudotsuga menziesii	20.2	40.9	38.0	14.5	24.3	2.3	37.5	36.4	26.8
Purshia tridentata	29.5	14.6	14.4	20.9	21.4	69.2	8.4	18.0	24.6
Rosa spp.	0.0	4.5	0.5	0.0	0.0	0.0	0.3	0.0	0.7
Salix spp.	0.1	1.1	0.8	7.5	1.3	0.0	0.0	0.0	1.4
Shepherdia canadensis	15.8	5.2	1.1	0.5	6.6	9.8	16.8	7.7	7.9
Symphoricarpos albus	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Other Shrubs	2.0	1.4	0.3	0.0	1.3	0.0	1.2	0.5	0.8
Conifer bark	9.2	0.4	0.5	0.0	0.0	0.0	1.3	0.0	1.4
Other Conifer	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.1
Total Trees and Shrubs	81.1	79.3	66.9	49.3	61.6	86.5	79.2	87.3	73.9

Table 27. Deer diets at Pickering Hills in 1994.

Species	Jan	Feb	Mar	Apr	May	Oct	Nov	Dec	Mean
Grass and Grasslike									
Agropyron spp.	1.5	0	0	0	0	0.9	0	0.3	0.3
Bromus inermis	2.3	0	0.3	0	9.6	2.2	0	0	1.8
Calamagrostis rubescens	0.9	0	0.9	0	0	0	0	0	0.2
Carex spp.	0	0	0	0.6	0	0	0	0	0.1
Dactylis glomerata	0.4	0	0	0	0	0	0	0	0.1
Festuca idahoensis	0.6	0	0.4	0.6	8.4	1.8	0	0	1.5
Poa spp.	1.2	0.1	0.4	7.5	0.6	0.5	1.2	0	1.4
Stipa spp.	0	0	0	0.6	0	0	0	0	0.1
Other Grasses	1.3	0	0.7	0.9	2.7	0	0.3	0	0.7
Total Grass and Grasslike	8.2	0.1	2.7	10.2	21.3	5.4	1.5	0.3	6.2
Forbs and Bryophytes									
Achillea lanulosa	0	0	0	0	3	0	0	0	0.4
Antennaria dimorpha	0	0	0	0.6	2.1	0	0	0	0.3
Astragalus miser	0	0	0	0	2.7	0	0	0	0.3
Balsamorhiza sagittata	0	0	0	0	0.9	0	0	0	0.1
Centaurea spp.	6	0	0.4	0	0	0	0	0	0.8
Cirsium spp.	0	0	0	0	0	1.8	0	0	0.2
Compositae family	0	0	0.3	0	2.7	0.7	0	0	0.5
Fragaria spp.	0	0	0	0.9	0	0	0.2	0	0.1
Gaillardia aristata	0	0	0	0	0	3.1	0	0	0.4
Lupinus spp.	1.9	0.5	0.2	0	1.2	0.5	0.3	0.6	0.7
Medicago/Trifolium	2.9	0	0.1	2.3	3.3	8.2	0	0	2.1
Mertensia spp.	0.3	0	0	0	0	0	0	0	0
Mustard family	0	0	0	0.8	0.3	0	0.3	0	0.2
Penstemon procerus	3.5	2.9	7.1	10.3	4.8	2.7	0.9	1.1	4.2
Phlox rigida	1	0	0.3	0	0	0	0	0	0.2
Potentilla hippiana	0	0	0	0	3	0	7.1	0	1.3
Taraxacum spp.	0	0	0	0	0	0	0.6	0	0.1
Other Forbs	2.3	0.2	3	1.5	6	8.2	3.1	0.1	3.1
Bryophytes	1.6	0.5	1.4	1.8	0	1.3	0	0.3	0.9
Total Forbs and Bryophytes	19.5	4.1	12.8	18.2	30	26.5	12.5	2.1	15.7

Table 27. (continued)

Species	Jan	Feb	Mar	Apr	May	Oct	Nov	Dec	Mean
Trees and Shrubs									
<i>Amelanchier alnifolia</i>	1.8	2.8	1.1	0.9	0	5.3	1.9	3.2	2.1
<i>Berberis repens</i>	16.2	58.8	29.6	33	8.4	0	41.9	38.9	28.4
<i>Ceanothus velutinus</i>	0.3	0.2	0.1	0	0	0	6.2	0	0.9
<i>Chrysothamnus</i> spp.	0.4	0	0.3	0.3	0	0	0.3	0	0.2
<i>Pinus ponderosa</i>	4.6	2.9	10.4	0	0.7	0	4.3	11.9	4.4
<i>Populus tremuloides</i>	2.1	0.2	1.2	0	0	12.8	1.2	3.4	2.6
<i>Prunus virginiana</i>	0	1.6	0	0	0	0	0	0.8	0.3
<i>Pseudotsuga menziesii</i>	40.7	24	35.1	29.9	12.6	0	6.5	31.1	22.5
<i>Purshia tridentata</i>	3.7	0.2	2.7	5.1	15	18.5	11.1	2	7.3
<i>Ribes</i> spp.	0	0	0	0	0	0	1.5	2.4	0.5
<i>Rosa</i> spp.	0	0	0	0	0	0	1.5	1	0.3
<i>Salix</i> spp.	0.6	0.5	0.7	0	7.2	0	0	0	1.1
<i>Shepherdia canadensis</i>	0.4	0.7	0	2.4	4.8	25.2	8.4	1.8	5.5
<i>Spiraea betulifolia</i>	0	0	0	0	0	3.6	0	0	0.5
<i>Symphoricarpos albus</i>	0	0	2	0	0	0	0	0	0.3
Other Shrubs	0	0	0.5	0	0	2.7	0	0	0.4
Conifer bark	1.5	0.8	0.8	0	0	0	0	1.1	0.5
Total Trees and Shrubs	72.3	92.7	84.5	71.6	48.7	68.1	84.8	97.6	77.5

to >30% at Premier Ridge in 1993 (Table 21). Deer browsed bitterbrush less in spring at Pickering Hills (Table 22), but use was consistent throughout all periods at Premier Ridge (Table 21) and Skookumchuck Prairie (Table 18, 19). Bitterbrush was used to >25% in the Combined Use area at Skookumchuck Prairie and at Premier Ridge in 1994 (Table 24, 26).

Saskatoon generally represented a small proportion of deer diet composition. Indeed, Saskatoon was not represented in deer diets at more than 3.0% at any site in any year except >7% in the Wildlife Only area at Skookumchuck Prairie in 1992, and >4% at Premier Ridge in 1993 (Table 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27).

Ponderosa pine was more important in deer diets in 1994 than in 1992 or 1993. Deer ate between 2.6% in the Combined Use area at Skookumchuck Prairie and 12.1% at Wildlife Only area at Skookumchuck Prairie (Table 23, 24, 25, 26, 27).

Forbs comprised the largest number of species eaten by deer on all sites except in the Wildlife Only area at Skookumchuck Prairie but most native forbs were eaten in small quantities and at specific times of the year (Table 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27). Forbs were the second most abundant forage class in deer diets ranging from >11% in the Combined Use area at Skookumchuck Prairie (Table 19) to >28% at Peckhams Lake (Table 20). Deer ate fewer forbs at all sites in 1993 when compared to 1992, although with the exception of the Combined Use area at Skookumchuck Prairie, forbs still comprised the largest number of species eaten. Forbs represented the largest number of species eaten by deer on three of the five sites in 1994 (Table 12), but forbs were less important in deer diets than browse at all sites. Deer use of forbs in 1994 was highest at Peckhams Lake (35.2%) and lowest at Pickering Hills (15.7%).

Small-flowered penstemon was the most predominant native forb in deer diets. This plant species was eaten in almost all sampling periods and averaged nearly 5% of deer diet over all five sites in 1992 (Table 13, 14, 15, 16, 17). Small-flowered penstemon ranged from 1.8% at Pickering Hills to 12.3 % at the Wildlife Only area at Skookumchuck Prairie in 1993 and was most important in March, April, November, and December (Table 18, 19, 20, 21, 22). In 1994, small-flowered penstemon was found in deer diets in all sampling periods at all sites, ranging from >4% at Pickering Hills (Table 27) to approximately 10% in the Combined Use area at Skookumchuck Prairie (Table 24). Small-flowered penstemon was particularly important in January and February at Skookumchuck Prairie (Table 23, 24) and at Peckhams Lake (Table 25) in 1994.

Other important native or naturalized forbs were timber milkvetch, western meadow aster, and knapweed (Pickering Hills) (Table 22). Most other native forbs did not exceed 1% of deer diet when averaged over all sampling periods. Exceptions were lupines in the Wildlife Only area at Skookumchuck Prairie (Table 23) and at Peckhams Lake (Table 25), and cinquefoil species at Pickering Hills (Table 27).

Alfalfa/clover was present in deer diets at all sites in all years. These species were most predominant in deer diets at Peckhams Lake averaging 12 - 20% of deer diet over the 3 years (Table 15, 20, 25). The proportion of alfalfa and clover ranged between 1% and 5% at Skookumchuck Prairie, Premier Ridge, and Pickering Hills in 1992 (Table 13, 15).

Maximum levels of use on alfalfa and clover occurred at Peckhams Lake in April and May 1992, where more than 50% of the deer diet was comprised of this species (Table 15). Deer ate >24% in April and May of 1993 (Table 20). Alfalfa/clover use exceeded 50% and 30% in 1994 in June and October, respectively (Table 25). These species were eaten mostly in March, to May, and October to December. In 1994 alfalfa and clover use by deer peaked in

April, June, and October at Premier Ridge (Table 26), in June in the Wildlife Only area at Skookumchuck Prairie (Table 23), and in October at Pickering Hills in 1994 (Table 27).

Birdsfoot trefoil was eaten on all sites in July and October 1992 except in the Wildlife Only area at Skookumchuck Prairie. The proportion of diet varied from 1.0% in July at Peckhams Lake to more than 26% in July at Pickering Hills (Table 15, 17). Birdsfoot trefoil was not found in deer diets in 1993, and only at Peckhams Lake in October of 1994 (Table 25).

Grasses as a forage group consistently comprised both the fewest species and the lowest proportion of deer diet composition on all sites (Table 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27). Averaged over all sampling periods, grasses comprised less than 15% of deer diets in 1992. In 1993, grasses comprised the lowest proportion of deer diet at Skookumchuck Prairie at 3.3% and 6.2% in the Combined Use and Wildlife Only areas, respectively, while the highest use was at Premier Ridge (15.5%). Although deer generally used grasses most in March and April, deer diet at Premier Ridge was >50% grasses in November of 1993 (Table 21). Grasses were grazed most by deer in March and April. Use of grass and grasslike species ranged from 6.2% at Pickering Hills to 20.1% in the Combined Use area at Skookumchuck Prairie. At both Skookumchuck Prairie sites (Table 23, 24) grasses were used most in December, 1994. In contrast grasses were used least by deer in December at Peckhams Lake, but were used >20% in January, April, October, and November (Table 25). Grasses were used most in March and April at Premier Ridge (Table 26), and in April and May at Pickering Hills (Table 27).

Important grass species included bentgrasses, orchardgrass, Idaho fescue, rough fescue, and bluegrass species. Rough fescue was the most important grass species for deer in the Wildlife Only and Combined Use areas at Skookumchuck Prairie in 1994. Deer ate more than 10% rough fescue at both sites in December, and more than 20% at the Combined Use area in January (Table 23, 24). Orchardgrass, wheatgrass species, and smooth brome grass were the most prevalent in deer diets at Peckhams Lake, in April (Table 25). In contrast, bluegrass species were common in deer diets at Premier Ridge (Table 26) and Pickering Hills (Table 27).

Bryophytes were a minor component of 1992 and 1993 deer diets. They were generally used more in winter although the highest use was in October at Peckhams Lake and Pickering Hills in 1992 (Table 15, 17). Bryophytes were eaten most consistently by deer at Peckhams Lake in 1993 (Table 20). Bryophytes were present in deer diet at all sites in 1994 (Table 23, 24, 25, 26, 27). They were especially important in the Combined Use area at Skookumchuck Prairie, Premier Ridge, and Peckhams Lake, particularly in March, April, and May, totaling up to 10.4% at Premier Ridge (Table 26).

4.1.2 Elk Diets

The diversity of elk diets was similar among the five sites sampled ranging from 36 to 55 species eaten (Table 28, 29, 30) although the diet composition varied among the sites. Forbs consistently comprised the greatest number of species in the diet with an approximately equal number of grasses and shrubs eaten (Table 28, 29, 30). Grasses as a group, comprised the largest component of elk diet on all sites. Grass composition in elk diets ranged from nearly 46% to 76% averaged over all sampling periods (Table 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45).

Table 28. Elk dietary diversity by forage class on five sites in the East Kootenay region of southeastern British Columbia in 1992.

Site	Grasses	Forbs	Shrubs	Total
Skookumchuck (Wildlife)	14	17	16	47
Skookumchuck (Combined)	14	23	15	52
Peckhams Lake	13	23	15	51
Premier Ridge	13	27	14	54
Pickering Hills	14	24	17	55

Table 29. Elk dietary diversity by forage class on five sites in the East Kootenay region of southeastern British Columbia in 1993.

Site	Grasses	Forbs	Shrubs	Total
Skookumchuck (Wildlife)	13	11	16	40
Skookumchuck (Combined)	13	13	10	36
Peckhams Lake	14	25	16	55
Premier Ridge	14	20	14	48
Pickering Hills	14	19	15	48

Table 30. Elk dietary diversity by forage class on five sites in the East Kootenay region of southeastern British Columbia in 1994.

Site	Grasses	Forbs	Shrubs	Total
Skookumchuck (Wildlife)	13	17	15	45
Skookumchuck (Combined)	13	17	16	46
Peckhams Lake	13	18	16	47
Premier Ridge	13	21	15	49
Pickering Hills	13	17	16	46

Table 31. Elk diets in the Wildlife Only Area at Skookumchuck Prairie in 1992.

Species	Jan	Feb	Mar	Apr	May	Nov	Dec	Mean
Grass and Grasslike								
Agropyron spp.	4.5	7.1	7.1	5.7	2.3	2.5	9.3	5.5
Agrostis alba	2.5	0.6	1.0	3.7	2.3	0.0	0.0	1.4
Bromus inermis	0.0	0.0	0.0	4.3	1.2	2.5	4.2	1.7
Bromus tectorum	6.3	6.2	7.4	5.2	0.0	0.6	0.0	3.7
Calamagrostis rubescens	0.6	2.4	0.3	0.6	0.0	1.1	0.9	0.8
Carex spp.	1.3	4.4	1.2	0.0	0.0	0.0	0.0	1.0
Dactylis glomerata	4.1	3.6	4.4	1.8	1.2	0.0	0.0	2.2
Festuca idahoensis	14.1	8.1	11.1	4.7	10.7	8.1	6.8	9.1
Festuca scabrella	13.3	11.3	8.3	45.8	19.1	35.3	2.0	19.3
Juncus spp.	3.5	0.0	0.0	0.2	0.0	0.0	0.0	0.5
Koeleria cristata	0.0	0.6	1.5	0.0	1.6	2.8	0.0	0.9
Poa spp.	14.6	8.7	22.1	5.4	9.3	12.8	7.6	11.5
Stipa spp.	9.3	6.2	8.0	8.4	8.4	1.7	3.7	6.5
Other Grasses	1.8	0.2	0.9	0.4	0.0	0.0	0.0	0.5
Total Grass and Grasslike	75.9	59.4	73.3	86.2	56.1	67.4	34.5	64.6
Forbs and Bryophytes								
Achillea millefolium	0.0	0.8	0.3	0.0	0.9	0.0	0.0	0.3
Antennaria dimorpha	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.3
Apocynum androsaemilfolium	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.2
Calochortus macrocarpus	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.5
Castilleja thompsonii	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.1
Equisetum spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.1
Eriogonum umbellatum	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Gaillardia aristata	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.1
Lepidium densiflorum	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.4
Medicago/Trifolium	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1
Orthocarpus luteus	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.2
Penstemon procerus	1.8	9.7	8.1	5.8	3.0	3.1	3.1	4.9
Phlox rigida	0.6	6.8	0.2	0.0	0.0	0.0	0.0	1.1
Potentilla hippiana	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.4
Verbascum thapsis	0.0	0.5	0.0	0.0	0.0	0.3	0.0	0.1

Table 31. (continued)

Species	Jan	Feb	Mar	Apr	May	Nov	Dec	Mean
Forbs and Bryophytes (continued)								
Other Forbs	0.7	0.2	1.0	0.2	7.9	0.0	0.0	1.4
Bryophytes	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.3
Total Forbs and Bryophytes	3.1	19.8	11.4	6.2	25.4	3.5	3.8	10.5
Trees and Shrubs								
Amelanchier alnifolia	0.3	0.0	6.7	3.2	0.0	0.0	8.5	2.7
Arctostaphylos uva-ursi	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Artemisia spp.	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Berberis repens	11.4	13.4	3.5	2.0	0.0	15.4	0.0	6.5
Ceanothus velutinus	0.0	0.8	0.6	0.3	0.0	1.1	0.0	0.4
Chrysothamnus nauseosus	0.0	4.2	0.0	0.1	0.0	0.0	0.0	0.6
Pinus ponderosa	0.0	0.6	0.6	0.7	1.6	0.0	7.9	1.6
Populus tremuloides	1.6	0.0	4.0	1.1	5.1	0.0	0.0	1.7
Prunus virginianus	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudotsuga menziesii	0.0	0.6	0.0	0.0	0.0	0.0	11.6	1.7
Purshia tridentata	1.5	0.0	0.0	0.0	0.0	1.7	0.0	0.5
Ribes spp.	3.8	1.1	0.0	0.0	0.0	3.3	0.0	1.2
Rosa spp.	1.2	0.0	0.0	0.2	0.0	0.0	0.9	0.3
Salix spp.	0.0	0.0	0.0	0.0	0.0	1.5	4.8	0.9
Shepherdia canadensis	0.0	0.0	0.0	0.0	9.9	1.7	28.2	5.7
Other Shrubs	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.1
Total Trees and Shrubs	21.3	20.7	15.4	7.6	17.3	24.7	61.9	24.1

Table 32. Elk diets in the Combined Use Area at Skookumchuck Prairie in 1992.

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Grass and Grasslike										
Agropyron spp.	4.1	6.8	3.3	2.8	6.4	7.5	4.7	3.6	10.9	5.6
Agrostis alba	1.1	1.9	0.0	4.4	0.0	2.8	0.5	0.0	0.0	1.2
Bromus inermis	0.0	0.0	0.0	0.0	5.7	2.3	3.4	1.3	3.6	1.8
Bromus tectorum	15.2	8.9	5.3	4.9	0.0	0.0	0.0	3.6	0.4	4.3
Calamagrostis rubescens	0.6	0.0	0.8	1.9	0.0	0.0	1.8	2.0	2.2	1.0
Carex spp.	0.0	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.7	0.1
Dactylis glomerata	0.9	0.0	0.6	1.2	0.0	0.9	1.8	1.0	0.0	0.7
Festuca idahoensis	7.5	6.3	8.3	6.1	10.7	10.3	4.1	5.4	10.5	7.7
Festuca scabrella	31.6	24.2	41.1	46.5	40.2	29.2	1.3	44.3	2.5	29.0
Juncus spp.	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Koeleria cristata	0.9	0.0	3.9	1.9	1.8	0.9	0.0	6.9	2.2	2.1
Poa spp.	11.6	12.7	11.5	6.9	9.5	8.9	8.8	13.5	17.1	11.2
Stipa spp.	6.2	11.6	4.6	4.2	8.6	12.6	1.5	5.9	7.6	7.0
Other Grasses	1.5	0.8	0.4	1.2	1.8	1.9	1.5	0.0	0.2	1.0
Total Grass and Grasslike	81.8	73.7	80.2	82.0	84.7	77.3	29.4	87.5	57.9	72.6
Forbs and Bryophytes										
Achillea millefolium	0.9	0.6	0.1	0.2	0.7	0.7	2.1	0.0	0.0	0.6
Allium cernuum	0.0	1.7	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.4
Antennaria dimorpha	0.0	0.4	0.5	0.5	0.0	0.0	1.5	0.0	0.0	0.3
Arabis holboellii	0.0	0.0	0.0	0.0	0.0	0.2	1.0	0.0	0.0	0.1
Astragalus miser	0.0	0.0	0.0	0.0	0.0	0.0	5.7	0.0	0.0	0.6
Balsamorhiza sagittata	0.0	0.0	0.0	0.0	0.2	0.2	0.5	0.0	0.0	0.1
Calochortus macrocarpum	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.1
Castilleja thompsonii	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.1
Cirsium spp.	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0	0.6
Erigeron compositus	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.1
Fragaria virginiana	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.3
Lepidium densiflorum	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.1
Lithospermum ruderales	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.1
Lotus corniculatus	0.0	0.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0	0.7
Medicago\Trifolium	0.0	0.0	0.0	0.0	0.1	0.0	15.5	0.0	0.0	1.7

Table 32. (continued)

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Forbs and Bryophytes (continued)										
Oxytropis campestris	1.1	0.5	0.8	1.1	0.0	0.0	0.0	0.0	0.0	0.4
Penstemon procerus	0.0	0.8	7.6	7.1	1.8	5.4	4.4	6.2	1.3	3.8
Phlox rigida	0.0	3.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Potentilla spp.	0.0	0.0	0.0	0.0	0.7	0.5	0.0	0.0	0.0	0.1
Taraxacum officinale	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.2
Verbascum thapsis	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.7	0.4	0.2
Other Forbs	1.9	2.3	1.5	1.3	4.9	4.7	10.9	1.3	0.0	3.2
Bryophytes	0.0	0.3	0.2	0.4	0.0	0.5	0.0	0.0	0.0	0.2
Total Forbs and Bryophytes	4.1	10.6	10.9	10.6	12.1	16.4	58.5	8.2	1.7	14.8
Trees and Shrubs										
Amelanchier alnifolia	0.8	0.5	3.8	4.3	0.0	0.0	0.0	0.0	8.6	2.0
Arctostaphylos uva-ursi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.1
Berberis repens	9.9	11.4	0.6	1.2	0.0	1.4	0.0	2.3	0.7	3.1
Ceanothus velutinus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.2
Chrysothamnus nauseosus	0.0	0.0	0.8	0.3	0.0	0.0	0.0	0.0	0.0	0.1
Pinus ponderosa	1.5	1.1	3.0	0.5	0.0	0.7	1.5	0.0	2.7	1.2
Populus tremuloides	0.8	0.8	0.5	1.1	1.1	0.0	0.0	0.0	0.0	0.5
Prunus virginianus	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Pseudotsuga menziesii	0.0	0.3	0.0	0.0	1.4	0.0	0.8	0.0	7.7	1.1
Purshia tridentata	0.4	0.0	0.0	0.0	0.0	0.0	0.8	0.0	3.3	0.5
Ribes spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.1
Rosa spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.1
Salix spp.	0.0	0.0	0.0	0.0	0.0	2.8	0.5	1.0	9.2	1.3
Shepherdia canadensis	0.4	0.0	0.0	0.0	3.3	2.8	8.1	0.3	4.9	2.2
Symphoricarpos albus	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Total Trees and Shrubs	14.2	15.2	8.8	7.4	5.8	7.7	11.7	4.3	40.5	12.8

Table 33. Elk diets at Peckhams Lake in 1992.

Species	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Grass and Grasslike								
Agropyron spp.	6.2	3.4	8.7	0.0	0.0	4.6	7.5	4.3
Agrostis alba	0.8	2.4	0.0	2.4	0.4	1.3	0.3	1.1
Bromus inermis	6.4	13.9	2.4	6.2	3.5	4.8	3.6	5.8
Bromus tectorum	2.7	3.8	0.0	0.0	0.0	1.2	0.6	1.2
Calamagrostis rubescens	0.0	0.5	0.0	0.5	2.8	2.2	2.3	1.2
Carex spp.	4.4	0.5	0.0	0.0	0.9	0.6	0.0	0.9
Dactylis glomerata	1.8	4.6	0.0	2.2	9.9	2.5	0.0	3.0
Festuca idahoensis	7.1	1.7	5.9	5.9	7.2	8.3	4.6	5.8
Festuca scabrella	3.8	18.0	1.6	30.5	31.6	15.0	4.6	15.0
Koeleria cristata	1.8	0.7	2.0	1.4	2.4	0.9	0.0	1.3
Poa spp.	30.5	13.4	11.0	13.2	10.5	7.0	7.8	13.3
Stipa spp.	6.3	1.2	3.5	7.8	7.0	6.1	3.6	5.1
Other Grasses	0.0	1.2	0.8	0.3	0.0	0.0	0.0	0.3
Total Grass and Grasslike	71.8	65.3	35.9	70.4	76.2	54.5	34.9	58.4
Forbs								
Achillea millefolium	0.0	0.9	0.0	0.0	1.1	0.0	0.0	0.3
Allium cernuum	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.4
Antennaria dimorpha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Apocynum androsaemifolium	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Aster campestris	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.1
Astragalus miser	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.3
Balsamorhiza sagittata	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.1
Centaurea spp.	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.3
Cirsium spp.	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.1
Compositae family	0.0	0.0	10.8	0.4	0.9	0.0	0.0	1.7
Erigeron corymbosus	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.1
Erigeron compositus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eriogonum umbellatum	1.2	2.4	0.0	0.0	0.0	0.0	0.0	0.5
Lepidium densiflorum	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Leptodactylon pungens	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.3
Lomatium triternatum	0.0	0.7	0.0	0.5	0.0	0.0	0.0	0.2

Table 33. (continued)

Species	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Forbs (continued)								
Lotus corniculatus	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.5
Medicago\Trifolium	1.6	15.4	23.9	1.5	1.3	0.1	0.2	6.3
Oxytropis campestris	5.8	1.8	0.0	0.0	0.0	0.0	0.0	1.1
Penstemon procerus	4.8	1.0	0.0	5.4	2.8	10.1	0.0	3.4
Potentilla hippiana	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.1
Potentilla sulphurea	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Verbascum thapsis	0.0	0.0	0.0	0.0	0.0	4.2	1.0	0.7
Other Forbs	1.2	0.7	2.8	5.5	2.8	0.0	0.0	1.9
Bryophytes	0.0	1.5	0.3	0.5	9.0	0.8	1.3	1.7
Total Forbs and Bryophytes	14.6	28.7	44.4	16.4	9.6	14.4	1.2	20.5
Trees and Shrubs								
Amelanchier alnifolia	6.0	1.9	2.4	0.0	0.4	0.6	2.9	2.0
Berberis repens	0.7	0.0	0.0	0.0	0.0	0.0	12.8	1.9
Ceanothus velutinus	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Chrysothamnus nauseosus	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Pinus ponderosa	0.0	0.0	0.4	1.1	2.8	5.4	0.0	1.4
Populus tremuloides	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.1
Prunus virginiana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Pseudotsuga menziesii	3.3	2.2	0.8	0.0	2.0	20.2	20.9	7.1
Purshia tridentata	0.0	0.0	0.0	0.3	0.0	0.0	6.7	1.0
Ribes spp.	0.3	1.4	0.0	0.0	0.0	0.0	13.1	2.1
Rosa spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Salix spp.	0.0	0.0	0.0	2.2	1.5	1.9	4.9	1.5
Shepherdia canadensis	0.1	0.0	5.5	1.6	1.3	0.7	0.0	1.3
Spirea betulifolia	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Symphoricarpos albus	1.0	0.0	0.0	0.0	0.0	0.0	1.3	0.3
Total Trees and Shrubs	13.2	5.5	9.1	7.4	9.5	29.8	63.2	19.7

Table 34. Elk diets at Premier Ridge in 1992.

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Grass and Grasslike										
Agropyron spp.	19.7	14.0	7.2	9.5	6.5	9.8	3.2	8.4	13.6	10.2
Agrostis alba	4.0	1.1	2.5	1.0	2.3	0.8	3.0	1.4	4.7	2.3
Bromus inermis	4.4	3.2	7.2	5.5	4.7	2.6	2.3	4.9	12.9	5.3
Bromus tectorum	1.5	0.5	0.9	0.0	0.0	0.0	0.6	0.0	0.7	0.5
Carex spp.	0.0	0.4	0.3	0.6	0.4	0.6	1.9	1.6	0.0	0.6
Calamagrostis rubescens	0.8	0.0	0.6	0.8	1.8	2.0	0.0	1.1	0.7	0.9
Dactylis glomerata	7.7	4.5	2.3	2.1	4.9	3.2	4.3	3.8	0.0	3.6
Festuca idahoensis	13.4	7.5	6.9	8.6	9.4	5.8	8.5	16.4	7.5	9.3
Festuca scabrella	9.4	22.6	5.8	16.0	22.7	21.4	10.3	18.7	8.6	15.1
Koeleria cristata	4.4	2.0	2.8	4.2	3.5	0.6	3.2	0.0	3.6	2.7
Poa spp.	24.7	22.8	26.6	20.5	11.2	8.4	9.2	15.4	18.2	17.4
Stipa spp.	5.0	6.4	5.3	7.4	5.1	1.6	14.7	8.4	15.0	7.7
Other Grasses	0.6	0.0	0.6	0.3	0.8	0.0	0.0	0.8	0.0	0.3
Total Grass and Grasslike	95.6	85.0	69.0	76.5	73.3	56.8	61.2	80.9	85.5	76.0
Forbs										
Achillea millefolium	0.0	0.0	0.0	0.0	0.4	0.8	0.9	1.6	0.0	0.4
Allium cernuum	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.2
Antennaria dimorpha	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.1
Arabis holboellii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
Aster campestris	0.0	0.5	0.2	0.0	0.0	0.8	1.5	0.0	0.0	0.3
Astragalus miser	0.0	0.0	0.4	0.4	0.0	0.0	0.4	0.0	0.0	0.1
Balsamorhiza sagittata	0.0	1.0	0.7	0.1	0.0	3.5	3.5	1.6	0.0	1.2
Calochortus macrocarpus	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.3
Castilleja thompsonii	0.0	0.2	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.1
Centaurea spp.	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.1
Equisetum spp.	0.0	0.0	0.0	0.0	0.0	1.0	0.6	0.0	0.0	0.2
Erigeron corymbosus	0.0	0.0	0.4	0.8	0.0	0.0	0.0	0.0	0.0	0.1
Eriogonum umbellatum	0.0	0.5	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Fragaria virginiana	0.0	0.0	0.0	0.0	0.0	1.2	2.6	0.0	0.0	0.4
Lithospermum ruderales	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.2
Lomatium triternatum	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.1

Table 34. (continued)

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Forbs (continued)										
Lotus corniculatus	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.1
Medicago/Trifolium	0.0	0.0	0.0	0.0	3.2	1.2	0.0	0.3	0.0	0.5
Mustard family	0.0	0.2	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Oxytropis campestris	0.0	5.0	3.2	0.7	0.0	0.0	0.0	0.0	0.0	1.0
Penstemon procerus	0.0	0.0	11.3	8.1	3.1	4.0	1.7	0.8	3.9	3.7
Phlox rigida	0.0	0.0	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.1
Potentilla spp.	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0
Tragopogon pratense	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.1
Other Forbs	0.2	0.0	0.6	1.1	2.8	5.1	4.5	2.9	1.6	2.1
Bryophytes	0.0	0.0	1.2	1.7	0.0	1.0	0.4	1.4	2.2	0.9
Total Forbs and Bryophytes	0.2	7.4	21.8	14.4	11.2	23.2	20.9	8.9	7.7	12.8
Trees and Shrubs										
Amelanchier alnifolia	0.0	1.3	6.4	2.1	0.0	0.0	0.0	0.8	0.7	1.3
Artemesia spp.	0.0	0.0	0.0	0.0	0.0	0.5	2.6	0.0	0.0	0.3
Berberis repens	0.0	0.7	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.3
Chrysothamnus nauseosus	1.0	0.5	0.0	1.0	0.0	3.4	4.7	0.0	0.0	1.2
Pinus ponderosa	0.0	2.3	0.6	0.6	0.0	0.8	5.6	0.5	1.4	1.3
Populus tremuloides	0.4	0.4	1.3	0.6	1.6	0.0	0.0	0.0	0.0	0.5
Pseudotsuga menziesii	2.1	0.4	0.0	0.8	0.0	0.0	0.0	2.2	4.7	1.1
Purshia tridentata	0.0	0.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Ribes spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.1
Rosa spp.	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Salix spp.	0.0	0.0	0.0	0.0	0.0	6.2	0.7	2.2	0.0	1.0
Shepherdia canadensis	0.0	1.3	0.2	4.1	12.9	3.4	1.3	1.6	0.0	2.8
Vaccinium spp.	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.5
Other Shrubs	0.0	0.0	0.0	0.0	0.6	0.6	3.0	0.0	0.0	0.5
Total Trees and Shrubs	4.1	7.3	9.2	9.2	15.1	19.5	17.9	9.4	6.8	10.9

Table 35. Elk diets at Pickering Hills in 1992.

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Grass and Grasslike										
Agropyron spp.	5.1	5.6	7.6	7.6	8.4	4.4	5.7	4.5	7.7	6.3
Agrostis alba	3.3	2.4	1.0	0.9	6.8	1.0	2.7	3.0	0.0	2.3
Bromus inermis	3.1	4.0	6.2	6.0	2.2	2.0	8.0	5.1	6.3	4.8
Bromus tectorum	0.0	2.2	0.0	0.0	0.0	0.0	0.7	0.8	0.0	0.4
Calamagrostis rubescens	1.7	0.2	1.4	0.7	1.1	1.6	2.3	1.1	1.1	1.2
Carex spp.	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.1
Dactylis glomerata	1.0	1.1	2.9	2.8	4.0	0.8	8.0	2.6	0.0	2.6
Festuca idahoensis	3.3	2.9	7.5	7.2	4.1	5.9	7.3	5.3	1.1	5.0
Festuca scabrella	0.9	0.9	2.6	9.7	0.0	41.8	15.7	3.2	1.4	8.5
Koeleria cristata	0.5	0.0	0.7	3.2	3.4	2.8	0.7	1.7	0.7	1.5
Phleum pratense	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.2
Poa spp.	11.4	11.1	26.1	24.5	18.2	6.5	5.5	10.5	8.1	13.5
Stipa spp.	3.1	1.9	8.4	5.2	6.8	10.7	9.8	7.9	6.7	6.7
Other Grasses	0.3	0.0	0.3	0.0	1.8	0.0	3.4	0.0	0.0	0.6
Total Grass and Grasslike	33.7	32.3	65.0	68.3	56.8	79.5	69.8	45.7	33.1	53.8
Forbs										
Achillea millefolium	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.2
Aster campestris	0.0	0.0	0.0	0.1	0.0	0.4	0.0	0.0	0.0	0.1
Calochortus macrocarpus	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.2
Centaurea spp.	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1
Compositae family	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.1	0.0	0.2
Erigeron corymbosus	0.0	0.0	0.0	0.8	0.1	0.0	0.0	0.0	0.0	0.1
Eriogonum umbellatum	0.0	0.0	0.4	1.2	0.0	0.0	0.0	0.0	0.0	0.2
Fragaria virginiana	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.3
Letodactylon pungens	0.0	0.0	1.2	0.0	0.0	0.4	0.0	0.0	0.0	0.2
Lithospermum ruderales	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Lomatium triternatum	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.1
Lotus corniculatus	0.0	0.0	0.0	1.1	0.0	0.0	3.2	0.0	0.0	0.5
Medicago\Trifolium	0.0	0.0	0.0	0.0	0.4	0.1	4.8	0.2	0.3	0.6
Mustard family	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.1
Oxytropis campestris	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1

Table 35. (continued)

Species	Jan	Feb	Mar	Apr	May	Jul	Oct	Nov	Dec	Mean
Forbs (continued)										
Penstemon procerus	0.0	0.0	1.6	0.3	0.4	11.5	5.7	0.0	0.0	2.2
Phlox rigida	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Potentilla hippiana	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Verbascum thapsis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	2.8	0.4
Viola adunca	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.1
Other Forbs	0.7	0.9	0.1	4.9	2.5	0.8	7.3	0.8	0.3	2.0
Bryophytes	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0
Total Forbs and Bryophytes	0.7	2.3	4.7	12.0	3.4	13.2	26.1	3.1	3.4	7.7
Trees and Shrubs										
Amelanchier alnifolia	0.0	0.8	3.0	0.5	0.6	0.6	0.0	0.9	10.6	1.9
Arctostaphylos uva-ursi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Berberis repens	51.5	45.5	16.7	0.7	26.3	0.2	0.0	25.8	27.8	21.6
Ceanothus velutinus	0.0	2.9	1.1	0.0	0.0	0.0	0.0	0.6	1.1	0.6
Chrysothamnus nauseosus	0.0	0.0	0.0	0.0	0.1	0.8	0.0	0.0	0.0	0.1
Cornus spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.1
Pinus ponderosa	0.0	1.1	1.1	1.1	2.5	2.4	2.0	0.8	0.0	1.2
Populus tremuloides	1.5	1.4	1.8	1.3	0.2	0.0	0.0	1.7	0.0	0.9
Pseudotsuga menziesii	0.0	2.2	3.0	5.6	1.1	0.0	0.2	6.2	9.1	3.0
Purshia tridentata	4.3	7.5	0.3	2.4	1.7	0.0	0.0	2.6	4.2	2.6
Ribes spp.	7.0	0.0	0.0	0.0	5.6	0.0	0.0	7.3	5.3	2.8
Rosa spp.	1.0	1.3	0.3	0.0	0.0	0.0	0.0	0.6	0.0	0.4
Salix spp.	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.7	5.3	0.9
Shepherdia canadensis	0.3	0.3	0.0	7.4	1.1	1.4	0.9	0.0	0.0	1.3
Symphoricarpos albus	0.0	1.3	2.5	0.0	0.0	0.0	0.0	0.4	0.0	0.5
Other Shrubs	0.0	0.0	0.4	0.0	0.2	0.8	0.0	0.4	0.0	0.2
Total Trees and Shrubs	65.6	64.3	30.2	19.0	39.4	6.2	4.2	50.2	63.4	38.1

Table 36. Elk diets in the Wildlife Only Area at Skookumchuck Prairie in 1993.

Species	Jan	Feb	Mar	Apr	Dec	Mean
Grass and Grasslike						
Agrostis alba	3.2	3.6	0.0	3.0	0.0	2.0
Agropyron spp.	9.3	2.3	6.5	7.7	5.4	6.2
Bromus inermis	6.1	3.9	2.6	2.7	1.6	3.4
Bromus tectorum	1.3	0.0	0.0	0.0	0.0	0.3
Calamagrostis rubescens	0.6	0.0	0.8	1.8	0.4	0.7
Carex spp.	0.0	0.7	3.0	0.0	1.0	0.9
Dactylis glomerata	1.9	2.3	2.4	4.4	0.4	2.3
Festuca idahoensis	3.2	2.3	14.3	9.3	11.8	8.2
Festuca scabrella	5.1	1.0	14.7	24.2	16.4	12.3
Koeleria cristata	0.6	0.0	5.7	3.2	0.6	2.0
Poa spp.	13.2	6.5	12.1	13.2	10.8	11.2
Stipa spp.	6.4	4.9	4.0	12.2	6.8	6.8
Other Grasses	1.0	0.0	0.0	0.0	0.4	0.3
Total Grass and Grasslike	52.1	27.3	65.9	81.7	55.4	56.5
Forbs and Bryophytes						
Achillea lanulosa	0.0	0.0	3.6	0.0	0.4	0.8
Antennaria dimorpha	0.0	0.0	0.8	0.2	0.0	0.2
Aster campestris	0.0	0.0	0.6	0.5	0.4	0.3
Medicago/Trifolium	0.0	0.0	0.0	0.0	2.1	0.4
Mertensia spp.	0.0	0.0	0.4	0.0	0.0	0.1
Mustard family	0.0	0.0	0.4	0.3	0.0	0.1
Penstemon procerus	1.9	0.0	16.4	5.6	3.4	5.5
Phlox rigida	0.0	0.0	0.0	0.0	3.2	0.6
Verbascum thapsus	0.0	0.0	0.2	0.0	0.8	0.2
Other Forbs	1.3	0.7	2.2	1.5	1.4	1.4
Bryophytes	0.0	0.0	0.8	0.3	0.0	0.2
Total Forbs and Bryophytes	3.2	0.7	25.4	8.3	11.7	9.8

Table 36. (continued)

Species	Jan	Feb	Mar	Apr	Dec	Mean
Trees and Shrubs						
<i>Amelanchier alnifolia</i>	3.2	4.2	0.0	0.0	2.2	1.9
<i>Arctostaphylos uva-ursi</i>	0.0	0.7	0.0	0.0	0.0	0.1
<i>Berberis repens</i>	1.3	0.7	1.4	3.2	18.7	5.0
<i>Ceanothus velutinus</i>	3.2	1.0	0.0	0.0	0.0	0.8
<i>Chrysothamnus</i> spp.	0.0	0.0	1.4	0.0	0.0	0.3
<i>Pinus ponderosa</i>	2.9	3.3	1.4	1.2	0.4	1.8
<i>Prunus virginiana</i>	1.9	0.0	0.0	0.0	0.0	0.4
<i>Pseudotsuga menziesii</i>	7.6	13.5	0.0	5.4	3.0	5.9
<i>Purshia tridentata</i>	1.3	0.0	0.0	0.3	4.0	1.1
<i>Ribes</i> spp.	1.0	0.7	1.0	0.0	3.4	1.2
<i>Rosa</i> spp.	1.9	2.3	0.0	0.0	0.0	0.8
<i>Salix</i> spp.	1.3	2.9	3.0	0.0	0.6	1.6
<i>Shepherdia canadensis</i>	17.8	41.4	0.6	0.0	0.2	12.0
<i>Spirea betulifolia</i>	0.3	0.0	0.0	0.0	0.0	0.1
<i>Symphoricarpos albus</i>	0.0	0.7	0.0	0.0	0.0	0.1
Other Shrubs	1.0	1.0	0.0	0.0	0.0	0.4
Total Trees and Shrubs	44.7	72.1	8.7	10.1	32.5	33.6

Table 37. Elk diets in the Combined Use Area at Skookumchuck Prairie in 1993.

Species	Jan	Feb	Mar	Apr	Dec	Mean
Grass and Grasslike						
Agrostis alba	1.1	1.9	0.0	0.0	0.7	0.7
Agropyron spp.	2.9	2.3	12.5	8.8	9.0	7.1
Bromus inermis	4.8	4.2	6.1	5.0	2.9	4.6
Bromus tectorum	0.0	0.0	0.0	0.0	2.2	0.4
Calamagrostis rubescens	0.0	0.8	1.2	0.4	1.8	0.8
Carex spp.	0.0	1.7	0.6	0.0	2.0	0.9
Dactylis glomerata	4.2	1.5	5.5	1.2	3.6	3.2
Festuca idahoensis	4.0	0.0	7.2	7.3	0.0	3.7
Festuca scabrella	1.6	0.4	13.7	38.8	9.9	12.9
Koeleria cristata	0.0	0.0	6.1	4.4	9.0	3.9
Poa spp.	4.5	8.1	11.7	8.8	4.5	7.5
Stipa spp.	7.7	0.4	5.8	13.9	9.9	7.5
Other Grasses	0.0	0.0	0.0	0.0	9.6	1.9
Total Grass and Grasslike	30.6	21.4	70.4	88.5	65.0	55.2
Forbs and Bryophytes						
Achillea lanulosa	0.0	0.0	5.2	0.6	2.2	1.6
Antennaria dimorpha	0.0	0.0	0.0	0.3	0.0	0.1
Arabis spp.	0.0	0.0	0.0	0.0	0.2	0.0
Aster campestris	0.0	0.0	0.0	0.0	0.3	0.1
Lupinus spp.	0.0	0.0	0.0	0.0	0.2	0.0
Medicago/Trifolium	0.0	0.0	0.3	0.0	5.7	1.2
Mustard family	0.0	0.0	0.8	0.2	0.0	0.2
Penstemon procerus	5.8	5.2	10.1	3.1	8.7	6.6
Phlox rigida	0.0	0.0	0.0	0.0	1.4	0.3
Potentilla hippiana	0.0	0.0	0.0	0.0	1.4	0.3
Verbascum thapsus	0.0	0.0	0.3	1.7	0.2	0.4
Other Forbs	1.1	0.0	1.2	1.9	4.9	1.8
Bryophytes	0.0	0.0	1.2	0.4	1.6	0.6
Total Forbs and Bryophytes	6.9	5.2	19.0	8.1	26.9	13.2

Table 37. (continued)

Species	Jan	Feb	Mar	Apr	Dec	Mean
Trees and Shrubs						
Amelanchier alnifolia	2.4	3.1	0.0	0.0	0.0	1.1
Berberis repens	0.0	1.5	4.9	0.4	3.1	2.0
Pinus ponderosa	12.1	6.6	1.8	1.7	0.7	4.6
Prunus virginiana	0.0	5.0	0.0	0.0	0.0	1.0
Pseudotsuga menziesii	2.1	5.2	0.6	0.6	0.0	1.7
Purshia tridentata	4.8	0.0	0.0	0.4	0.0	1.0
Ribes spp.	0.0	0.4	2.4	0.0	1.8	0.9
Rosa spp.	7.4	0.4	0.0	0.0	0.0	1.6
Salix spp.	3.7	3.1	0.0	0.4	1.6	1.7
Shepherdia canadensis	30.1	48.2	0.8	0.0	0.0	15.8
Total Trees and Shrubs	62.5	73.4	10.5	3.4	7.2	31.4

Table 38. Elk diets at Peckhams Lake in 1993.

Species	Jan	Feb	Mar	Apr	May	Nov	Dec	Mean
Grass and Grasslike								
Agrostis alba	0.0	5.3	3.7	6.2	0.0	1.9	2.2	2.7
Agropyron spp.	0.7	9.8	12.5	4.7	5.5	5.2	3.3	5.9
Bromus inermis	0.3	0.0	4.7	15.9	2.2	11.3	8.5	6.1
Bromus tectorum	0.0	0.0	0.0	1.2	0.5	0.0	0.0	0.2
Calamagrostis rubescens	0.4	0.8	2.2	1.0	0.0	3.5	8.4	2.3
Carex spp.	0.0	0.0	4.7	2.7	5.3	0.0	3.6	2.3
Dactylis glomerata	0.5	0.5	14.9	21.1	2.2	44.7	24.1	15.4
Festuca idahoensis	1.1	2.4	5.1	1.0	1.7	7.4	3.3	3.1
Festuca scabrella	0.0	2.9	7.6	8.5	0.0	5.0	5.8	4.3
Juncus spp.	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.2
Koeleria cristata	0.5	1.3	1.0	1.2	0.7	0.9	0.0	0.8
Poa spp.	2.2	6.1	11.3	11.2	5.0	5.2	4.7	6.5
Stipa spp.	1.1	3.7	6.4	6.7	0.0	3.0	0.9	3.1
Other Grasses	0.7	0.5	2.2	2.0	0.0	0.6	0.7	1.0
Total Grass and Grasslike	7.4	33.4	77.6	83.6	22.9	88.5	65.5	54.1
Forbs and Bryophytes								
Achillea lanulosa	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.3
Allium cernuum	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.2
Antennaria dimorpha	0.4	0.5	0.9	0.1	0.2	0.0	0.0	0.3
Arabis spp.	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.2
Aster campestris	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.1
Astragalus miser	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Balsamorhiza sagittata	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compositae family	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.1
Epilobium spp.	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.3
Equisetum spp.	6.0	1.1	0.5	0.0	6.7	0.0	0.0	2.0
Erigeron compositus	0.0	0.0	0.7	0.0	1.7	0.0	0.0	0.3
Eriogonum sulphurescens	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.1
Geum spp.	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.1
Leptodactylon pungens	0.0	1.9	2.2	0.0	0.0	0.0	0.0	0.6
Lithospermum ruderales	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.6

Table 38. (continued)

Species	Jan	Feb	Mar	Apr	May	Nov	Dec	Mean
Forbs and Bryophytes (continued)								
Lotus corniculatus	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.4
Lupinus spp.	0.0	0.0	0.0	1.0	0.7	0.4	0.0	0.3
Medicago/Trifolium	0.1	0.0	0.1	3.1	22.0	3.7	2.5	4.5
Oxytropis campestris	0.0	3.4	0.0	0.0	1.2	0.0	0.0	0.7
Penstemon procerus	1.4	2.1	2.9	3.0	0.0	1.7	7.4	2.6
Potentilla hippiana	0.0	0.0	0.0	0.0	4.1	0.0	0.0	0.6
Taraxacum spp.	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.3
Verbascum thapsus	1.1	1.3	0.7	0.0	0.0	2.0	1.3	0.9
Other Forbs	2.7	3.3	1.2	6.7	17.2	1.4	1.6	4.9
Bryophytes	0.0	0.0	0.0	0.0	0.7	0.0	0.9	0.2
Total Forbs and Bryophytes	11.8	14.7	12.1	16.4	67.7	9.1	13.8	20.8
Trees and Shrubs								
Amelanchier alnifolia	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctostaphylos uva-ursi	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Berberis repens	0.0	0.0	0.0	0.0	0.0	0.6	0.2	0.1
Ceanothus velutinus	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Chrysothamnus spp.	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Juniper	1.6	4.8	0.0	0.0	0.0	0.0	0.0	0.9
Pinus ponderosa	0.7	1.9	0.0	0.0	0.0	0.0	0.4	0.4
Populus tremuloides	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1
Prunus virginiana	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Pseudotsuga menziesii	54.4	29.1	8.8	0.0	0.0	1.5	16.9	15.8
Purshia tridentata	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Ribes spp.	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.1
Rosa spp.	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Salix spp.	4.2	6.9	0.5	0.0	2.4	0.0	0.5	2.1
Shepherdia canadensis	0.4	0.0	0.0	0.0	5.5	0.0	0.0	0.8
Conifer bark	14.6	9.0	0.0	0.0	0.0	0.0	1.8	3.6
Total Trees and Shrubs	80.7	51.7	9.6	0.0	7.9	2.4	20.3	24.7

Table 39. Elk diets at Premier Ridge in 1993.

Species	Jan	Feb	Mar	Apr	May	Nov	Dec	Mean
Grass and Grasslike								
Agrostis alba	0.0	2.6	1.3	0.4	0.0	0.0	0.0	0.6
Agropyron spp.	3.8	6.6	11.2	7.7	8.6	10.9	14.8	9.1
Bromus inermis	7.4	5.2	4.8	2.6	11.5	11.6	2.0	6.4
Bromus tectorum	0.0	0.0	0.8	0.0	0.7	1.3	0.7	0.5
Calamagrostis rubescens	1.0	3.2	1.3	2.8	0.0	0.0	2.2	1.5
Carex spp.	0.6	0.0	4.0	3.2	0.0	0.0	0.3	1.2
Dactylis glomerata	8.3	2.3	16.2	4.9	0.3	1.1	2.9	5.1
Danthonia spp.	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.3
Festuca idahoensis	5.8	3.5	14.1	16.3	13.1	12.9	9.1	10.7
Festuca scabrella	1.0	2.9	4.3	12.9	2.6	4.5	22.8	7.3
Koeleria cristata	0.6	0.6	4.0	7.7	1.8	0.4	5.3	2.9
Poa spp.	21.4	9.2	20.2	14.8	9.0	14.0	12.3	14.4
Stipa spp.	11.8	4.3	8.5	11.0	3.7	12.4	5.6	8.2
Other Grasses	0.0	1.7	0.8	0.6	0.0	0.0	0.0	0.4
Total Grass and Grasslike	61.7	42.0	91.5	84.7	51.1	70.8	77.9	68.5
Forbs and Bryophytes								
Achillea lanulosa	0.0	0.0	0.0	1.1	0.0	0.0	0.5	0.2
Arabis spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Aster campestris	0.0	0.0	0.3	0.0	0.0	0.0	0.9	0.2
Balsamorhiza sagittata	0.0	0.0	0.0	0.2	0.0	0.0	4.6	0.7
Centaurea spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.1
Compositae family	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.1
Equisetum spp.	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Fragaria spp.	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legume pod	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.2
Lupinus spp.	0.0	0.0	0.0	0.2	0.8	0.8	0.9	0.4
Medicago/Trifolium	0.0	0.0	0.0	0.0	13.9	8.6	0.3	3.3
Mustard family	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Penstemon procerus	3.8	1.7	4.3	6.0	8.9	6.4	1.3	4.6
Potentilla hippiana	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Verbascum thapsus	0.3	0.0	0.0	0.2	2.1	1.0	0.2	0.5

Table 39. (continued)

Species	Jan	Feb	Mar	Apr	May	Nov	Dec	Mean
Forbs and Bryophytes (continued)								
Other Forbs	0.0	2.3	1.3	1.7	1.5	1.5	2.3	1.5
Bryophytes	0.0	0.0	0.5	2.1	0.0	0.4	0.0	0.4
Total Forbs and Bryophytes	6.1	4.2	6.6	11.4	27.2	18.8	13.3	12.5
Trees and Shrubs								
Amelanchier alnifolia	1.3	12.1	0.0	0.0	0.0	0.0	0.7	2.0
Berberis repens	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Ceanothus velutinus	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Pinus ponderosa	2.2	5.8	0.0	3.4	0.0	0.6	0.2	1.7
Populus tremuloides	0.3	0.0	0.0	0.0	2.7	1.3	1.1	0.8
Prunus virginiana	0.3	2.0	0.0	0.0	0.0	0.0	0.4	0.4
Pseudotsuga menziesii	5.4	3.5	0.5	0.0	0.0	3.7	5.7	2.7
Purshia tridentata	0.3	1.7	1.1	0.0	0.0	3.0	0.0	0.9
Ribes spp.	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Rosa spp.	1.0	0.6	0.0	0.4	0.0	0.0	0.0	0.3
Salix spp.	2.2	8.3	0.0	0.2	0.1	0.0	0.0	1.5
Shepherdia canadensis	17.6	13.5	0.3	0.0	15.1	1.6	0.4	6.9
Spirea betulifolia	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.2
Other Shrubs	0.0	1.7	0.0	0.0	0.3	0.0	0.0	0.3
Total Trees and Shrubs	32.3	50.4	1.9	3.9	18.2	10.3	8.8	18.0

Table 40. Elk diets at Pickering Hills in 1993.

Species	Jan	Feb	Mar	Apr	May	Dec	Mean
Grass and Grasslike							
Agrostis alba	0.9	2.4	2.0	3.9	1.4	0.4	1.8
Agropyron spp.	5.7	4.6	9.1	9.3	8.4	3.4	6.7
Bromus inermis	2.2	6.8	6.5	8.1	2.4	3.3	4.9
Bromus tectorum	1.7	0.0	0.8	0.7	0.0	0.8	0.7
Calamagrostis rubescens	1.7	2.7	0.0	0.0	0.0	0.0	0.7
Carex spp.	0.0	0.0	0.0	0.0	1.6	0.0	0.3
Dactylis glomerata	0.7	0.6	5.9	7.3	0.0	5.0	3.3
Danthonia spp.	0.0	0.0	0.0	0.0	0.0	0.7	0.1
Festuca idahoensis	2.8	2.1	8.1	11.7	3.3	4.5	5.4
Festuca scabrella	2.8	0.6	3.6	6.4	0.5	1.5	2.6
Koeleria cristata	0.0	0.9	2.4	1.0	0.0	0.2	0.8
Poa spp.	6.8	11.8	12.1	13.2	10.8	9.5	10.7
Stipa spp.	0.7	7.3	3.8	17.6	7.9	2.9	6.7
Other Grasses	1.1	0.6	2.6	5.4	1.4	0.8	2.0
Total Grass and Grasslike	27.0	40.4	56.9	84.5	37.7	33.0	46.6
Forbs and Bryophytes							
Allium cernuum	0.0	0.0	0.0	0.0	3.5	0.0	0.6
Arabis spp.	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Aster campestris	0.0	0.0	0.0	0.7	0.3	0.2	0.2
Astragalus miser	0.0	0.0	0.0	0.0	1.1	0.0	0.2
Balsamorhiza sagittata	0.0	1.5	0.0	0.0	2.2	0.0	0.6
Collinsia spp.	0.0	0.0	0.0	0.0	1.6	0.0	0.3
Compositae family	0.0	0.0	0.0	0.0	1.5	0.0	0.2
Epilobium spp.	0.0	0.0	0.0	0.0	2.2	0.0	0.4
Fragaria spp.	0.0	0.2	0.0	0.0	3.9	0.0	0.7
Lithospermum ruderales	0.0	0.0	0.0	0.0	1.4	0.0	0.2
Lupinus spp.	0.0	0.0	1.0	0.6	0.5	0.0	0.4
Medicago/Trifolium	0.0	0.0	0.0	0.0	17.4	0.0	2.9
Mustard family	0.0	0.3	0.0	0.3	0.0	0.0	0.1
Penstemon procerus	1.5	0.0	1.0	3.2	0.0	0.0	0.9
Phlox rigida	0.0	0.0	0.0	2.9	0.0	0.0	0.5

Table 40. (continued)

Species	Jan	Feb	Mar	Apr	May	Dec	Mean
Forbs and Bryophytes (continued)							
Potentilla hippiana	0.0	0.0	0.0	0.7	2.7	0.0	0.6
Verbascum thapsus	3.1	0.0	0.0	0.0	0.0	1.9	0.8
Other Forbs	3.9	1.8	0.6	1.2	14.4	1.5	3.9
Bryophytes	1.7	0.3	0.0	0.7	0.0	0.0	0.5
Total Forbs and Bryophytes	8.5	3.8	2.6	9.6	52.6	3.7	13.5
Trees and Shrubs							
Amelanchier alnifolia	2.0	5.5	0.0	0.0	0.0	0.7	1.4
Berberis repens	8.3	8.5	26.5	2.2	0.0	23.3	11.5
Ceanothus velutinus	3.5	0.6	0.0	0.0	0.0	0.0	0.7
Juniper	4.1	0.6	0.0	0.0	0.0	0.0	0.8
Pinus ponderosa	3.1	1.2	0.0	0.0	0.0	0.6	0.8
Populus spp.	0.0	8.8	1.6	0.3	0.8	0.0	1.9
Pseudotsuga menziesii	20.7	19.1	2.0	0.7	0.5	16.8	10.0
Purshia tridentata	2.4	0.0	0.8	0.7	0.0	0.0	0.7
Ribes spp.	3.5	2.4	9.1	1.2	0.0	18.1	5.7
Rosa spp.	0.7	1.8	0.6	0.0	0.0	0.0	0.5
Salix spp.	3.3	0.0	0.0	0.0	0.0	2.8	1.0
Shepherdia canadensis	4.2	1.8	0.0	0.0	7.6	0.0	2.3
Symphoricarpos albus	0.7	0.0	0.0	0.0	0.0	0.0	0.1
Conifer bark	6.1	4.6	0.0	0.0	0.0	0.0	1.8
Other Shrubs	0.0	0.0	0.0	0.0	0.8	0.9	0.3
Total Trees and Shrubs	62.3	54.9	40.6	5.1	9.8	63.2	39.3

Table 41. Elk diets in the Wildlife Only Area at Skookumchuck Prairie in 1994.

Species	Jan	Feb	Mar	Apr	May	Jun	Nov	Dec	Mean
Grass and Grasslike									
Agrostis alba	0.6	0.7	0.0	0.0	0.0	0.0	2.0	1.7	0.6
Agropyron spp.	8.4	13.4	7.1	6.4	11.3	3.3	11.3	10.3	8.9
Bromus inermis	5.0	3.7	2.6	5.1	5.1	0.0	9.3	5.3	4.5
Bromus tectorum	0.0	0.7	1.5	0.3	0.0	2.5	3.9	0.0	1.1
Calamagrostis rubescens	2.6	0.4	0.5	2.2	0.0	0.0	0.6	2.1	1.1
Carex spp.	0.0	0.0	0.0	0.3	0.0	0.0	0.0	1.3	0.2
Dactylis glomerata	1.6	2.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5
Festuca idahoensis	8.9	6.8	4.3	5.5	16.1	2.5	5.6	4.2	6.7
Festuca scabrella	23.5	16.7	31.5	33.3	22.6	0.0	29.0	30.7	23.4
Koeleria cristata	3.4	3.7	2.1	2.6	4.3	0.0	2.5	4.8	2.9
Poa spp.	3.8	16.2	5.1	11.4	11.3	0.5	7.9	14.3	8.8
Stipa spp.	8.6	7.7	2.8	9.3	4.6	0.0	9.9	7.8	6.3
Other Grasses	3.4	0.4	0.7	5.5	3.2	0.0	1.1	1.4	2.0
Total Grass and Grasslike	69.8	72.4	58.7	81.9	78.5	8.8	83.1	83.9	67.1
Forbs and Bryophytes									
Achillea lanulosa	0.2	0.0	2.3	0.3	0.0	0.0	1.1	0.0	0.5
Aster campestris	0.0	0.0	0.3	0.0	0.1	1.9	0.0	0.0	0.3
Astragalus miser	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Balsamorhiza sagittata	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.7
Centaurea spp.	1.8	0.0	0.8	0.6	0.8	0.0	0.0	0.0	0.5
Erigeron compositus	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.3
Fragaria spp.	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.1
Gaillardia aristata	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.1
Geum spp.	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.2
Lupinus spp.	0.0	0.0	0.0	0.0	0.2	0.8	0.0	0.0	0.1
Medicago/Trifolium	2.5	2.2	2.3	0.2	0.7	44.0	0.4	0.0	6.5
Mustard family	0.2	0.0	0.7	0.6	0.0	0.0	0.0	0.0	0.2
Penstemon procerus	6.2	7.4	6.4	3.9	5.6	11.6	2.8	6.7	6.3
Phlox rigida	0.0	0.7	3.4	2.3	0.0	0.0	0.0	0.0	0.8
Potentilla hippiana	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.3
Other Forbs	2.0	3.5	0.0	1.3	0.8	10.8	0.8	1.1	2.5

Table 41. (continued)

Species	Jan	Feb	Mar	Apr	May	Jun	Nov	Dec	Mean
Forbs and Bryophytes (continued)									
Bryophytes	0.2	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.2
Total Forbs and Bryophytes	13.1	14.5	16.9	9.5	8.2	83.0	5.1	7.8	19.8
Trees and Shrubs									
Amelanchier alnifolia	0.0	0.0	0.2	0.0	0.3	0.0	0.8	1.9	0.4
Arctostaphylos uva-ursi	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.1
Berberis repens	11.3	6.1	5.6	5.1	0.8	0.0	4.2	1.3	4.3
Ceanothus velutinus	0.0	0.4	1.8	0.0	0.0	0.0	0.0	0.0	0.3
Chrysothamnus spp.	1.8	2.0	11.3	2.9	0.0	0.0	0.6	0.4	2.4
Pinus ponderosa	0.0	0.4	0.0	0.0	2.9	1.1	1.7	3.2	1.2
Populus tremuloides	0.4	0.0	0.0	0.0	0.8	0.0	1.4	0.4	0.4
Prunus virginiana	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.1
Pseudotsuga menziesii	2.2	0.9	0.0	0.0	0.0	0.0	1.7	1.1	0.7
Purshia tridentata	0.0	2.0	0.3	0.6	0.0	1.1	0.0	0.0	0.5
Rosa spp.	0.4	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.2
Salix spp.	0.0	1.3	3.3	0.0	0.0	3.6	0.0	0.0	1.0
Shepherdia canadensis	0.0	0.0	0.2	0.0	8.5	2.4	0.0	0.0	1.4
Symphoricarpos albus	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Other Shrubs	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.1
Total Trees and Shrubs	16.1	13.1	24.4	8.6	13.3	8.2	11.8	8.3	13.0

Table 42. Elk diets in the Combined Use Area at Skookumchuck Prairie in 1994.

Species	Jan	Feb	Mar	Apr	Jun	Oct	Nov	Dec	Mean
Grass and Grasslike									
Agrostis alba	1.0	0.8	0.0	1.7	0.6	0.0	2.4	1.1	1.3
Agropyron spp.	11.7	6.2	18.1	6.0	2.6	2.0	8.5	6.3	7.7
Bromus inermis	3.6	1.0	1.3	4.5	0.4	4.0	2.1	1.9	2.4
Bromus tectorum	1.1	0.0	1.7	0.0	4.7	0.0	0.5	1.1	1.8
Calamagrostis rubescens	1.7	0.0	0.0	0.6	0.0	0.0	1.6	0.5	1.1
Carex spp.	0.0	0.0	0.0	0.3	0.0	3.3	0.0	0.0	1.8
Dactylis glomerata	1.5	1.0	0.0	0.0	0.0	4.6	1.8	0.0	2.2
Festuca idahoensis	6.4	8.3	6.0	8.4	3.0	10.2	8.2	4.2	6.8
Festuca scabrella	22.5	51.9	34.3	31.3	14.3	16.5	27.5	29.3	28.5
Koeleria cristata	0.6	4.8	0.0	1.2	1.2	0.0	5.6	1.6	2.5
Poa spp.	6.4	9.8	5.5	7.5	9.1	8.9	13.7	15.3	9.5
Stipa spp.	6.1	1.8	2.6	10.4	3.8	1.3	10.8	6.3	5.4
Other Grasses	0.0	1.6	0.6	4.2	1.0	1.6	0.0	3.2	2.0
Total Grass and Grasslike	62.6	87.2	70.1	76.1	40.7	52.4	82.7	70.8	67.8
Forbs and Bryophytes									
Achillea lanulosa	0.0	0.0	1.2	0.6	0.0	0.2	1.1	0.8	0.8
Astragalus miser	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2
Balsamorhiza sagittata	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.9
Centaurea spp.	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.6
Compositae family	0.0	0.0	0.0	0.0	2.0	0.3	0.0	0.0	1.2
Gaillardia aristata	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	1.7
Geum spp.	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.7
Lupinus spp.	0.0	0.0	0.0	0.0	1.5	1.7	0.0	0.0	1.6
Medicago/Trifolium	0.8	2.0	1.4	0.0	16.3	0.3	0.0	0.1	3.5
Mustard family	0.2	0.0	0.7	0.3	0.0	0.0	0.0	0.0	0.4
Penstemon procerus	10.2	3.6	6.7	15.5	1.8	6.3	4.8	7.9	7.1
Phlox rigida	0.4	0.0	0.0	0.0	0.6	0.0	0.0	0.8	0.6
Potentilla hippiana	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.3
Taraxacum spp.	0.0	0.0	0.0	0.0	0.6	3.3	0.0	0.0	2.0
Verbascum thapsus	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	2.5
Other Forbs	3.0	0.6	0.2	0.9	3.1	6.3	1.7	1.3	2.1

Table 42. (continued)

Species	Jan	Feb	Mar	Apr	Jun	Oct	Nov	Dec	Mean
Forbs and Bryophytes (continued)									
Bryophytes	1.5	0.0	0.6	0.0	0.4	2.0	0.0	0.5	0.6
Total Forbs and Bryophytes	16.1	6.2	10.8	17.3	28.2	25.6	7.6	11.4	15.4
Trees and Shrubs									
Amelanchier alnifolia	0.4	1.2	0.0	0.0	0.0	0.0	0.0	0.8	0.8
Arctostaphylos uva-ursi	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0
Berberis repens	15.7	0.2	4.9	4.5	0.0	0.0	5.0	8.7	6.5
Ceanothus velutinus	0.0	0.0	0.4	0.0	0.0	1.3	0.0	0.0	0.9
Chrysothamnus spp.	0.4	0.0	11.1	2.1	0.0	0.0	0.0	0.0	4.5
Pinus ponderosa	0.0	0.6	0.7	0.0	7.0	0.3	3.4	4.2	2.7
Populus tremuloides	0.0	0.0	0.0	0.0	0.0	1.3	1.3	0.8	1.1
Prunus virginiana	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.3	2.3
Pseudotsuga menziesii	2.6	1.4	0.0	0.0	0.4	0.0	0.0	0.8	1.3
Purshia tridentata	0.8	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.6
Rosa spp.	0.0	1.6	0.0	0.0	0.6	0.0	0.0	0.0	1.1
Salix spp.	1.0	1.4	0.7	0.0	10.4	0.0	0.0	0.0	3.4
Shepherdia canadensis	0.0	0.0	0.0	0.0	10.7	13.5	0.0	0.0	12.1
Spiraea betulifolia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	2.2
Other Shrubs	0.0	0.2	0.9	0.0	0.0	1.3	0.0	0.0	0.8
Total Trees and Shrubs	20.9	6.6	19.1	6.6	31.1	22.0	9.7	17.8	16.7

Table 43. Elk diets at Peckhams Lake in 1994.

Species	Jan	Feb	Mar	Apr	May	Jun	Oct	Nov	Dec	Mean
Grass and Grasslike										
Agrostis alba	0.5	0.9	1.2	0.0	0.0	0.0	1.6	0.0	0.5	0.5
Agropyron spp.	6.0	7.7	5.3	7.5	9.1	2.0	12.9	5.1	12.9	7.6
Bromus inermis	24.2	6.8	9.8	14.6	8.0	3.5	2.2	10.7	4.6	9.4
Bromus tectorum	0.0	1.9	0.0	1.0	2.4	1.0	0.0	0.0	2.7	1.0
Calamagrostis rubescens	2.8	1.9	2.2	1.9	0.0	1.5	3.2	0.8	0.5	1.6
Carex spp.	3.3	11.2	17.7	6.5	1.0	6.4	5.2	7.9	2.7	6.9
Dactylis glomerata	21.7	15.3	6.3	9.6	5.6	4.5	6.8	10.2	0.8	9.0
Festuca idahoensis	4.1	3.9	2.5	5.9	6.6	13.9	3.5	2.0	8.7	5.7
Festuca scabrella	8.6	9.8	8.8	11.8	17.1	1.5	9.3	14.4	5.4	9.6
Koeleria cristata	0.0	1.1	0.4	2.2	0.0	2.0	0.0	1.9	0.3	0.9
Poa spp.	5.5	5.8	6.9	17.1	13.6	7.5	3.5	2.8	13.0	8.4
Stipa spp.	3.7	1.8	3.1	7.2	7.0	1.5	8.7	7.1	7.3	5.3
Other Grasses	1.2	0.0	2.6	3.4	0.0	5.5	1.9	2.0	2.4	2.1
Total Grass and Grasslike	81.6	68.1	66.8	88.7	70.4	50.8	58.8	64.9	61.8	68.0
Forbs and Bryophytes										
Achillea lanulosa	0.4	0.0	0.0	0.0	0.0	0.0	2.0	0.3	0.0	0.3
Antennaria dimorpha	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.1	0.0	0.2
Aster campestris	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
Astragalus miser	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.1
Balsamorhiza sagittata	0.0	0.0	0.0	0.0	0.7	0.5	3.0	0.7	0.0	0.5
Centaurea spp.	0.0	0.0	0.0	0.0	1.8	0.0	0.3	0.0	0.0	0.2
Compositae family	0.3	0.0	0.0	0.0	0.0	4.7	0.6	0.0	0.0	0.6
Gaillardia aristata	0.0	0.0	0.0	0.0	0.0	0.0	0.6	5.1	0.0	0.6
Lomatium spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.2
Lupinus spp.	0.0	0.0	0.0	0.6	0.3	2.5	0.0	0.0	0.0	0.4
Medicago/Trifolium	1.4	1.8	5.8	0.2	8.2	31.3	15.1	0.4	0.0	7.1
Mustard family	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Penstemon procerus	5.8	10.9	5.5	2.8	7.0	0.0	3.5	4.0	1.9	4.6
Phlox rigida	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.6	0.0	0.2
Sisyrinchium spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.1
Tragopogon spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0

Table 43. (continued)

Species	Jan	Feb	Mar	Apr	May	Jun	Oct	Nov	Dec	Mean
Forbs and Bryophytes (continued)										
Other Forbs	1.2	0.2	0.0	0.3	7.1	5.0	4.8	2.4	1.4	2.5
Bryophytes	0.0	0.3	0.6	0.0	0.0	3.0	0.0	0.0	0.0	0.4
Total Forbs and Bryophytes	9.3	13.2	11.9	3.9	26.1	48.0	31.4	16.6	3.3	18.2
Trees and Shrubs										
Amelanchier alnifolia	0.9	0.0	1.8	0.0	0.0	0.0	0.0	0.0	3.2	0.7
Arctostaphylos uva-ursi	0.0	0.0	0.0	0.9	0.0	0.0	1.3	0.0	0.0	0.2
Berberis repens	0.0	4.9	0.4	1.6	0.0	0.0	0.1	0.9	6.2	1.6
Chrysothamnus spp.	0.4	0.0	0.8	0.9	0.7	0.0	0.2	7.9	0.0	1.2
Pinus ponderosa	0.0	0.0	0.4	1.2	0.0	0.0	0.0	0.0	0.0	0.2
Populus tremuloides	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.3	0.0	0.4
Prunus virginiana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.1
Pseudotsuga menziesii	5.3	0.0	11.0	2.5	1.4	0.0	0.6	7.1	12.2	4.5
Purshia tridentata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.6
Ribes spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.3
Rosa spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Salix spp.	1.4	0.3	2.5	0.0	0.0	0.7	0.0	0.0	0.0	0.5
Shepherdia canadensis	0.0	0.0	0.8	0.0	0.0	0.5	0.1	0.0	4.1	0.6
Symphoricarpos albus	0.0	0.5	0.6	0.0	0.0	0.0	4.5	0.0	0.0	0.6
Other Shrubs	0.0	0.0	1.6	0.0	0.0	0.0	0.0	2.3	0.0	0.4
Conifer bark	0.9	13.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	1.7
Total Trees and Shrubs	8.9	18.7	21.3	7.1	2.1	1.2	9.8	18.5	34.6	13.6

Table 44. Elk diets at Premier Ridge in 1994.

Species	Jan	Feb	Mar	Apr	May	Jun	Oct	Nov	Dec	Mean
Grass and Grasslike										
Agrostis alba	2.5	2.5	0.6	0.6	0.0	0.0	0.7	0.7	3.4	1.2
Agropyron spp.	14.4	9.8	8.3	10.5	12.2	7.5	7.7	14.1	9.1	10.4
Bromus inermis	6.4	6.9	5.7	10.5	4.1	1.1	5.3	2.0	8.3	5.6
Bromus tectorum	0.0	1.1	5.4	0.0	0.3	1.5	0.0	0.0	2.9	1.2
Calamagrostis rubescens	5.5	1.4	2.2	1.4	2.4	0.0	5.5	3.2	0.0	2.4
Carex spp.	1.6	0.0	0.0	0.3	1.7	7.2	2.1	1.7	0.5	1.7
Dactylis glomerata	6.0	3.2	0.0	0.0	1.0	2.7	3.6	2.2	1.8	2.3
Festuca idahoensis	7.4	9.4	8.0	3.8	7.1	3.0	3.9	8.4	8.9	6.7
Festuca scabrella	16.0	20.6	22.2	29.7	24.1	0.9	20.5	28.6	7.3	18.9
Koeleria cristata	5.7	7.6	8.8	3.2	8.1	2.0	1.8	0.0	1.4	4.3
Poa spp.	8.7	10.5	16.1	4.4	22.7	8.3	7.3	8.2	30.9	13.0
Stipa spp.	6.2	5.3	2.5	8.1	4.8	1.2	4.3	2.0	10.2	5.0
Other Grasses	1.6	2.8	0.3	2.6	3.1	0.6	1.7	0.0	2.9	1.7
Total Grass and Grasslike	82.0	81.1	80.1	75.1	91.6	36.0	64.4	71.1	87.6	74.3
Forbs and Bryophytes										
Achillea lanulosa	0.0	0.0	0.7	0.1	0.0	0.0	0.1	1.0	0.0	0.2
Apocynum spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.1
Aster campestris	0.0	0.0	0.3	0.0	0.2	0.2	0.1	0.5	0.0	0.1
Astragalus miser	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.1
Balsamorhiza sagittata	0.3	0.0	0.0	1.2	0.2	6.7	3.7	1.2	0.0	1.5
Castilleja spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Centaurea spp.	1.2	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.3
Compositae family	0.0	0.0	0.3	0.0	0.0	0.7	0.0	0.7	0.0	0.2
Equisetum spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Gaillardia aristata	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.0	0.0	0.1
Lupinus spp.	0.0	0.0	0.0	0.0	0.3	0.9	0.6	0.0	0.0	0.2
Medicago/Trifolium	0.3	0.9	0.6	0.1	0.3	27.9	1.3	0.2	0.0	3.5
Mertensia spp.	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0
Mustard family	0.0	0.0	0.2	0.3	0.0	0.2	0.0	0.0	0.0	0.1
Penstemon procerus	1.8	2.3	1.9	6.1	2.0	0.7	2.7	5.2	2.3	2.8
Phlox rigida	0.7	0.0	0.0	5.0	0.0	0.0	0.9	0.0	0.0	0.7

Table 44. (continued)

Species	Jan	Feb	Mar	Apr	May	Jun	Oct	Nov	Dec	Mean
Forbs and Bryophytes (continued)										
Sisyrinchium spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.1
Tragopogon spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Verbascum thapsus	0.3	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.3
Other Forbs	1.1	0.5	0.9	1.3	0.3	4.1	1.1	1.0	1.8	1.3
Bryophytes	0.0	0.4	0.9	3.8	0.7	3.1	0.0	0.0	0.0	1.0
Total Forbs and Bryophytes	5.7	4.1	5.8	17.9	4.0	47.9	12.5	12.8	4.1	12.8
Trees and Shrubs										
Amelanchier alnifolia	2.5	0.4	1.3	0.0	0.0	0.7	0.0	0.0	2.3	0.8
Berberis repens	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0	0.6
Ceanothus velutinus	0.0	0.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Chrysothamnus spp.	0.0	0.5	1.2	2.0	0.0	0.0	3.6	0.0	0.0	0.8
Pinus ponderosa	0.0	0.4	0.0	2.6	0.0	0.0	0.0	0.0	4.8	0.9
Populus tremuloides	1.8	0.0	0.0	0.0	0.3	10.3	0.0	1.5	0.0	1.5
Prunus virginiana	0.0	0.0	0.3	0.0	1.0	0.0	0.0	0.0	0.0	0.1
Pseudotsuga menziesii	1.8	7.5	7.3	0.9	0.0	0.0	1.1	12.4	0.7	3.5
Purshia tridentata	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Ribes spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1
Rosa spp.	5.0	1.2	0.5	0.6	0.0	0.0	0.0	1.2	0.0	0.9
Salix spp.	0.9	0.7	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Shepherdia canadensis	0.3	2.7	0.0	0.0	3.1	3.3	11.9	1.0	0.0	2.5
Symphoricarpos albus	0.0	0.0	0.0	0.9	0.0	0.0	1.2	0.0	0.0	0.2
Other Shrubs	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.2
Total Trees and Shrubs	12.3	14.8	14.1	7.0	4.4	16.1	23.1	16.1	8.3	12.9

Table 45. Elk diets at Pickering Hills in 1994.

Species	Jan	Feb	Mar	Apr	Jun	Nov	Dec	Mean
Grass and Grasslike								
Agrostis alba	2.0	0.5	0.0	0.5	0.0	0.0	0.0	0.4
Agropyron spp.	3.5	4.8	9.4	6.0	2.4	9.6	6.5	6.0
Bromus inermis	7.0	6.9	3.1	7.4	6.4	1.4	11.8	6.3
Bromus tectorum	1.8	0.0	2.2	0.0	2.0	0.5	0.0	0.9
Calamagrostis rubescens	3.6	2.5	0.8	0.5	0.0	0.0	0.0	1.1
Carex spp.	0.0	0.4	2.0	2.2	0.0	0.5	0.8	0.8
Dactylis glomerata	1.5	0.0	3.3	6.0	6.3	1.4	21.9	5.8
Festuca idahoensis	5.5	3.9	0.4	3.0	1.2	6.2	4.5	3.5
Festuca scabrella	2.3	1.8	4.5	14.9	0.0	1.9	13.4	5.5
Koeleria cristata	0.0	2.7	1.6	1.5	0.0	0.0	0.0	0.8
Poa spp.	5.2	8.2	2.0	10.7	6.7	5.0	6.5	6.3
Stipa spp.	2.0	2.3	1.8	9.4	0.0	2.9	4.1	3.2
Other Grasses	1.6	2.5	0.0	0.8	0.0	0.0	2.4	1.0
Total Grass and Grasslike	36.0	36.5	31.1	62.9	25.0	29.4	71.9	41.8
Forbs and Bryophytes								
Achillea lanulosa	0.0	0.0	0.0	0.0	0.4	0.0	0.4	0.1
Aster campestris	0.1	0.0	0.4	0.0	0.0	0.4	0.0	0.1
Astragalus miser	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.4
Balsamorhiza sagittata	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1
Centaurea spp.	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Cirsium spp.	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.1
Compositae family	0.0	0.0	0.0	0.0	1.2	0.1	0.0	0.2
Epilobium spp.	0.0	0.0	0.0	0.0	3.6	0.5	0.0	0.6
Gaillardia aristata	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.2
Lupinus spp.	0.3	0.0	0.8	0.0	6.7	1.0	0.4	1.3
Medicago/Trifolium	0.7	0.0	3.9	0.1	26.9	0.0	1.8	4.8
Mustard family	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.1
Penstemon procerus	0.6	0.7	4.5	5.7	3.1	1.9	5.3	3.1
Potentilla hippiana	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.1
Verbascum thapsus	0.2	0.0	0.0	0.0	0.0	1.1	0.0	0.2
Other Forbs	1.0	1.3	2.2	1.7	5.5	2.0	1.2	2.1

Table 45. (continued)

Species	Jan	Feb	Mar	Apr	Jun	Nov	Dec	Mean
Forbs and Bryophytes (continued)								
Bryophytes	2.9	0.0	0.6	0.0	0.4	0.0	0.4	0.6
Total Forbs and Bryophytes	7.3	2.0	12.4	7.9	52.8	8.0	9.9	14.3
Trees and Shrubs								
Amelanchier alnifolia	0.7	2.1	0.0	0.8	1.2	1.9	0.0	1.0
Berberis repens	37.4	46.5	49.4	23.4	0.0	49.2	1.6	29.6
Ceanothus velutinus	0.7	0.2	0.2	0.0	0.0	5.5	0.0	0.9
Chrysothamnus spp.	0.6	0.0	0.8	0.0	0.0	0.0	0.0	0.2
Juniper	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pinus ponderosa	0.0	2.1	0.2	2.0	0.0	0.0	0.0	0.6
Populus tremuloides	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.3
Prunus virginiana	1.6	0.4	0.0	0.0	0.0	0.0	0.0	0.3
Pseudotsuga menziesii	11.4	8.0	4.9	0.8	0.8	0.7	15.4	6.0
Purshia tridentata	0.0	0.0	0.0	1.7	0.0	0.2	0.0	0.3
Ribes spp.	2.6	0.0	0.0	0.0	0.0	2.4	0.0	0.7
Salix spp.	0.4	2.0	0.6	0.0	6.7	0.0	0.0	1.4
Shepherdia canadensis	0.0	0.0	0.0	0.0	11.5	0.5	0.0	1.7
Symphoricarpos albus	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.3
Other Shrubs	1.0	0.2	0.4	0.5	0.0	0.0	0.0	0.3
Total Trees and Shrubs	56.7	61.5	56.5	29.2	21.8	62.6	17.0	43.6

Grasses were consistently important throughout all sampling periods and represented less than 30% of elk diet only in October in the Combined Use area at Skookumchuck Prairie in 1992 (Table 32). There appears to be more variability in monthly use of grasses by elk in 1993 than in 1992 as use ranged from about 20% to more than 80% (Table 36, 37, 38, 39, 40). In 1994, grasses only represented less than 25% of monthly diets during June in the Wildlife Only area at Skookumchuck Prairie (Table 41). Grasses were used least at all sites in June in 1994 (Table 41, 42, 43, 44, 45).

When use was averaged over all sampling periods different grass species were prominent in elk diets at each site. Rough fescue was the most important grass at both sites at Skookumchuck Prairie (Table 31, 32, 36, 37, 41, 42), bluegrasses were predominant at Premier Ridge (Table 34, 39, 44) and Pickering Hills (Table 35, 40, 45) and orchardgrass was eaten most at Peckhams Lake (Table 33, 38, 43). This likely reflects local availability.

The highest proportion of rough fescue in elk diets varied among sites and months. In 1992 at Premier Ridge, rough fescue composition exceeded 20% of elk diet in February, May, and July (Table 34). At Peckhams Lake and Pickering Hills, rough fescue occurred most in the diet in July and October exceeding 30% of diet composition in both months at Peckhams Lake and more than 40% in July at Pickering Hills. At Skookumchuck Prairie, rough fescue accounted for more than 45% of elk diet in April in the Wildlife Only area (Table 31), and it represented more than 40% of the diet in March, April, May and November in the Combined Use area (Table 32).

Rough fescue was not used to the same extent in 1993 as in 1992. It was, however, included in elk diets in all sampling periods at all sites except May at Peckhams Lake (Table 38). In 1993, elk ate rough fescue most in March, April, and December (Table 36, 37, 38, 39, 40). The highest use occurred in April (38.8%) in the Combined Use area at Skookumchuck Prairie (Table 37).

Rough fescue was the most important grass in elk diets in 1994, except at Pickering Hills (Table 41, 42, 43, 44, 45). At Skookumchuck Prairie (Table 41, 42) and at Premier Ridge (Table 44) elk use of rough fescue averaged >18% over the year. Moreover, diet composition of rough fescue exceeded 20% in every month sampled except June at all sites, January and December at Premier Ridge, and February in the Wildlife Only area at Skookumchuck Prairie (Table 41, 42, 43, 44, 45). Rough fescue was used in every month but June at Pickering Hills and in the Wildlife Only area at Skookumchuck Prairie (Table 41).

Bluegrasses and needlegrasses were used at all sites, but most consistently at Premier Ridge (Table 34, 39, 44) and Pickering Hills (Table 35, 40, 45). Diet composition of bluegrasses rarely exceeded 20% except in March at the Wildlife Only area and in January through May at Premier Ridge in 1992 (Table 31, 32, 33, 34, 35) and in May, 1994 at Premier Ridge (Table 44). Elk grazed bluegrasses in all months sampled on all five sites, but generally it occurred most in elk diets from November to May.

Idaho fescue, smooth brome grass, and wheatgrasses were also grazed by elk throughout the year (Table 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45). Orchardgrass was most important at Peckhams Lake (44.7% use in November 1993).

Similar to deer, elk grazed a wide variety of forbs on all sites (Table 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45). Except for small-flowered penstemon, however, almost all forbs averaged less than 1% of elk diet composition. In 1992, at Premier Ridge and Skookumchuck Prairie, this species was used most between February and May with slight differences among the three sites sampled (Table 31, 32, 40). In contrast, small-flowered

penstemon contributed most to elk diets in July, October and November at Peckhams Lake (Table 33) and Pickering Hills (Table 35).

Except at Pickering Hills, small-flowered penstemon averaged between 2.6% and 6.6% of elk diet over all sampling periods at all sites in 1993 (Table 40). This forb was used most in March, April, and December, including >10% in March, on both sites at Skookumchuck Prairie. Small-flowered penstemon was the most important native forb in elk diets in 1994 also, ranging between 2.8% at Premier Ridge and 7.1% in the Combined Use area at Skookumchuck Prairie (Table 41, 42, 43, 44, 45). This forb was used in all sampling periods, at all sites, except in June at Peckhams Lake (Table 43). In general, use of small-flowered penstemon was highest from November to April at all sites, except in the Wildlife Only area at Skookumchuck Prairie where it was used most in June (Table 41).

Balsamroot, common mullein, and horsetail were other prominent forbs in elk diet in 1993 (Table 36 - 40). Dandelion and brown-eyed Susan in the Combined Use area at Skookumchuck Prairie (Table 42), balsamroot at Premier Ridge (Table 44), and lupine species at Pickering Hills (Table 45) were included in 1994.

Alfalfa and clover were found in elk diets at all sites. Use exceeded 15% in 1992 in October at the Combined Use area at Skookumchuck Prairie and in April and May at Peckhams Lake (Table 31, 32). In 1993, these species were used most in December at Skookumchuck Prairie (Table 36, 37) and May at the other sites. Forage use on these ranged from >17% to >27% (Table 38, 39, 40). Elk used alfalfa and clover at all sites in 1994 (Table 41, 42, 43, 44, 45) at higher levels than in 1992 (Table 31, 32, 33, 34, 35) or 1993 (Table 35, 36, 37, 38, 40) except at Premier Ridge where elk ate more alfalfa in 1993 (Table 39). In June 1994, alfalfa and clover use ranged from >16% to 44.0% at all sites (Table 41, 42, 43, 44, 45). There was a corresponding decline in grass consumption at all sites in June so elk may be substituting alfalfa and clover for grasses during this period.

In 1992, on all sites except Premier Ridge, elk browsed most in December where shrub diet composition ranged from 40 - 63% (Table 31, 32, 33, 35). At Premier Ridge, elk ate shrubs most in May, July, and October (Table 34). The most important browse species for elk included Saskatoon, low Oregongrape, Douglas-fir, and soopolallie (Table 31, 32, 33, 34, 35).

Elk browsed less in 1993, than in 1992 or 1994. Use of browse species ranged from 18% at Premier Ridge (Table 39) to slightly more than 39% at Pickering Hills (Table 40) when averaged over all sampling periods. Browse was the most important component of elk diets in January and February at all sites (Table 36, 37, 38, 39, 40). Elk diet contained more than 20% browse in December at Premier Ridge, the Wildlife Only area at Skookumchuck Prairie, (Table 36) and at Pickering Hills (Table 40). Browse was also important in March elk diets at Pickering Hills.

Elk ate similar amounts of browse among sites in 1994, except at Pickering Hills (Table 45). While tree and shrub diet composition at Skookumchuck Prairie (Table 41, 42), Premier Ridge (Table 44) and Peckhams Lake (Table 43) was consistently about 13 - 17%, at Pickering Hills they comprised more than 43% of elk diet. The difference in browse diet composition at Pickering Hills resulted primarily from elk eating low Oregongrape. Elk browsed this low-growing shrub from >23% to nearly 50% in all sampling periods, except June and December. Indeed, in 1994, low Oregongrape averaged nearly 30% of elk diet at Pickering Hills over all sampling periods. Low Oregongrape was also important in December through January at Skookumchuck Prairie.

Averaged over all months and sampling periods, bitterbrush diet composition was less than 1% at Skookumchuck Prairie (Table 31, 32), Peckhams Lake (Table 33) and Premier Ridge in 1992 (Table 34). In contrast, bitterbrush was eaten by elk in all months except July and October at Pickering Hills with peak use of bitterbrush occurring in January, February and December (Table 35). In 1993, bitterbrush only exceeded 1% average use at both sites at Skookumchuck Prairie in 1993 (Table 36, 37). Bitterbrush did not occur as >1% in elk diets in any month except at Peckhams Lake (5.1% in December) and Pickering Hills (1.7% in April) in 1994.

Other important shrubs in elk diets were soopolallie, willow species, ponderosa pine, Saskatoon, Douglas-fir, and shiny-leaved spirea. In 1993, soopolallie was the most important browse species for elk at Premier Ridge (Table 39) and at Skookumchuck Prairie (Table 36, 37) where it ranged from 12% to almost 16% when averaged over all periods. Douglas-fir was the most important browse species in 1993 at Peckhams Lake (Table 38), while low Oregongrape and Douglas-fir were prominent in elk diets at Pickering Hills (Table 40). Douglas-fir diet composition exceeded 19% in January and February at Pickering Hills and Peckhams Lake, with >50% use in January at Peckhams Lake.

In 1994, rabbitbrush was included in elk diet at both sites at Skookumchuck Prairie (Table 41, 42) in March. Soopolallie was used in May, June, and October in both sites at Skookumchuck Prairie and at Pickering Hills (Table 45). Willow species were used at the same sites in June. Douglas-fir was eaten at all sites, but more frequently at Premier Ridge (Table 44), Peckhams Lake (Table 43), and Pickering Hills (Table 45). The only significant browsing on trembling aspen on any site in 1994 was in June at Premier Ridge.

Elk use of bryophytes rarely exceeded 1% at any site. Elk ate bryophytes most consistently at Premier Ridge (Table 34, 39, 44) where use exceeded 1.0% during several months in each year. In 1992 elk at Peckhams Lake ate 9.0% bryophytes in October (Table 33). Elk in the Combined Use area at Skookumchuck Prairie (Table 37), at Premier Ridge, and at Pickering Hills (Table 39) used >1% bryophytes in their diet in March and December, April, and January, respectively of 1993. Elk at Premier Ridge grazed bryophytes >3.0% in April and May of 1994 (Table 44). January, at Pickering Hills (Table 45) and in the Combined Use area at Skookumchuck Prairie (Table 42), was the only other sampling period in 1994 where bryophyte use exceeded 1.0%.

4.1.3 Cattle Diets

Cattle diets were less diverse than either elk or deer diets on all five sites (Table 46, 47, 48). Cattle grazed the most plant species at Pickering Hills in 1992, in the Cattle Only area in 1993, and at Skookumchuck Prairie and Premier Ridge in 1994. Cattle diets were the least diverse at Peckhams Lake in all years (Table 46, 47, 48).

A similar number of grass and forb species were grazed by cattle on both sites at Skookumchuck Prairie and at Premier Ridge, while at Peckhams Lake and Pickering Hills forbs were less important. Between three and eight shrub species were used at all sites (Table 46, 47, 48).

Grass and grasslike species were the predominant forage class at all sites (Table 46, 47, 48). Grasses comprised most of cattle diet composition ranging from nearly 60% at Skookumchuck Prairie in the Cattle Only area in 1992 to more than 90% at Peckhams Lake in **Table 46. Cattle dietary diversity by forage class on five sites in the East Kootenay region of southeastern British Columbia in 1992.**

Site	Grasses	Forbs	Shrubs	Total
Skookumchuck (Cattle)	9	16	6	31
Skookumchuck (Combined)	11	16	6	33
Peckhams Lake	14	6	4	24
Premier Ridge	14	7	7	28
Pickering Hills	13	13	11	37

Table 47. Cattle dietary diversity by forage class on five sites in the East Kootenay region of southeastern British Columbia in 1993.

Site	Grasses	Forbs	Shrubs	Total
Skookumchuck (Combined)	12	13	4	29
Skookumchuck (Cattle)	10	16	4	30
Peckhams Lake	12	6	3	21
Premier Ridge	12	9	5	26
Pickering Hills	11	5	7	23

Table 48. Cattle dietary diversity by forage class on five sites in the East Kootenay region of southeastern British Columbia in 1994.

Site	Grasses	Forbs	Shrubs	Total
Skookumchuck (Combined)	11	13	4	26
Skookumchuck (Cattle)	11	11	7	29
Peckhams Lake	12	8	3	23
Premier Ridge	13	14	5	32
Pickering Hills	12	6	8	26

1992 and 1993 (Table 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 62, 63). Fescue, wheatgrass, bluegrass, and needlegrass species were consistently important in cattle diets at all sites (Table 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 62, 63). Diet composition, however, was slightly different at each site. Cattle diets at Pickering Hills (Table 63) and Premier Ridge (Table 62) were similar with bluegrass and needlegrass species, Idaho fescue, and wheatgrass species composing the main portion of the grass component. Cattle at the Combined Use area at Skookumchuck Prairie (Table 59) ate more wheatgrasses, bluegrasses and rough fescue. Idaho fescue, needlegrasses, and cheatgrass were eaten in lesser quantities. In the Cattle Only area rough fescue was the dominant grass in cattle diet composition, accounting for slightly <25%, while >12% of diet was comprised of wheatgrasses. Bluegrass species, Idaho fescue, and needlegrass ranged between 5% and 9% of cattle diet in the Cattle Only area (Table 60). Cattle diet at Peckhams Lake (Table 61) had larger components of wheatgrasses, cheatgrass, and needlegrass species, all of which averaged between 12% and >18% of cattle diet. Bluegrasses and Idaho fescue each accounted for approximately 7% of diet. Use of bluegrasses in particular, averaged over 19% at both Skookumchuck Prairie sites (Table 54, 55) and at Pickering Hills in 1993 (Table 58). Wheatgrasses were used more at Skookumchuck Prairie (Table 54, 55) than at the secondary sites (Table 56, 57, 58), while needlegrasses were more prominent in cattle diets at Peckhams Lake (Table 56), Premier Ridge (Table 57), and Pickering Hills (Table 58).

At Skookumchuck Prairie in 1992, rough fescue averaged 11.1% and 7.6% in the Combined Use and Cattle Only areas, respectively (Table 49, 50). On the other three sites, rough fescue comprised less than 2% of cattle diets (Table 51, 52, 53). Rough fescue was grazed most at Skookumchuck Prairie (Table 54, 55), but was not a dominant species in cattle diets at any site in 1993. Idaho fescue was more prominent in cattle diets than rough fescue at all sites, where it ranged from 7.0% at the Combined Use area at Skookumchuck Prairie to 15.4% at Premier Ridge. Cattle ate both rough and Idaho fescue at all sites in 1994. Rough fescue dominated cattle diet composition at the Cattle Only area at Skookumchuck Prairie in 1994 (Table 59) and the proportion was nearly double that in the Combined Use area (Table 59, 60). Conversely, Idaho fescue was more common in diets at Premier Ridge, Peckhams Lake, and Pickering Hills (Table 61, 62, 63).

Averaged over both sampling periods, forbs occurred as 22.2% and 13.7% of cattle diet composition in the Cattle Only and Combined Use areas, respectively, at Skookumchuck Prairie in 1992 (Table 49, 50). On all other sites, forbs comprised less than 10% of cattle diet and most forb species occurred as less than 1% of cattle diet composition (Table 51, 52, 53). Forbs that occurred as more than 1% of cattle diet in 1992 included spreading dogbane, western meadow aster, timber milkvetch, low pussytoes, and small-flowered penstemon at Skookumchuck Prairie and Pickering Hills (Table 49, 50, 53), alfalfa/clover at Peckhams Lake (Table 56), cinquefoil species at Premier Ridge (Table 57), and, nodding onion, and knapweed at Pickering Hills (Table 58).

Forbs did not exceed 10% at any site in 1993 (Table 54, 55, 56, 57, 58). Forbs that exceeded 1% in cattle diets included timber milkvetch in the Cattle Only area (Table 54) and knapweed species in the Combined Use area (Table 55) at Skookumchuck Prairie, and alfalfa/clover at Peckhams Lake (Table 56). Small-flowered penstemon only appeared in cattle diets at Skookumchuck Prairie (Table 54, 55) where it accounted for <1%.

In 1994, the proportion of forbs in cattle diets ranged between 4.1% at Pickering Hills and 15.2% in the Combined Use area at Skookumchuck Prairie (Table 59, 60, 61, 62, 63).

Table 49. Cattle diets in the Cattle Only Area at Skookumchuck Prairie in 1992.

Species	Jun	Jul	Mean
Grass and Grasslike			
Agropyron spp.	13.0	11.4	12.2
Bromus inermis	6.0	2.7	4.4
Bromus tectorum	2.1	6.1	4.1
Festuca idahoensis	13.7	5.3	9.5
Festuca scabrella	6.5	8.7	7.6
Koeleria cristata	1.5	2.2	1.9
Poa spp.	13.7	10.7	12.2
Stipa spp.	10.9	5.8	8.4
Other Grasses	0.0	1.4	0.7
Total Grass and Grasslike	67.4	54.3	60.8
Forbs and Bryophytes			
Achillea millefolium	2.3	0.5	1.4
Antennaria dimorpha	0.8	1.2	1.0
Apocynum androsaemifolium	5.7	3.9	4.8
Aster campestris	2.1	0.6	1.4
Astragalus miser	1.8	0.0	0.9
Cirsium spp.	0.0	0.5	0.3
Erigeron compositus	0.0	0.5	0.3
Eriogonum umbellatum	0.0	1.0	0.5
Gaillardia aristata	0.0	0.5	0.3
Leptodactylon pungens	0.0	1.2	0.6
Lotus corniculatus	0.8	0.0	0.4
Medicago\Trifolium	0.3	0.0	0.2
Penstemon procerus	0.5	0.0	0.3
Potentilla spp.	1.0	0.0	0.5
Sisyrinchium angustifolium	0.8	0.0	0.4
Other Forbs	14.0	4.4	9.2
Total Forbs and Bryophytes	30.1	14.3	22.2

Table 49. (continued)

Species	Jun	Jul	Mean
Trees and Shrubs			
Amelanchier alnifolia	0.0	3.9	2.0
Populus tremuloides	0.0	0.5	0.3
Purshia tridentata	0.5	22.7	11.6
Rosa spp.	0.5	2.9	1.7
Salix spp.	1.6	0.0	0.8
Other Shrubs	0.0	0.7	0.4
Total Trees and Shrubs	2.6	30.7	16.6

Table 50. Cattle diets in the Combined Use Area at Skookumchuck Prairie in 1992.

Species	Jun	Jul	Mean
Grass and Grasslike			
Agropyron spp.	17.7	7.2	12.5
Agrostis alba	0.5	3.4	1.9
Bromus inermis	2.3	0.7	1.5
Bromus tectorum	17.7	4.6	11.2
Calamagrostis rubescens	0.0	1.5	0.8
Festuca idahoensis	8.2	10.1	9.2
Festuca scabrella	4.5	17.7	11.1
Koeleria cristata	2.3	0.6	1.5
Poa spp.	20.4	12.9	16.7
Stipa spp.	6.8	13.3	10.1
Other Grasses	0.0	2.7	1.4
Total Grass and Grasslike	80.4	74.7	77.5
Forbs and Bryophytes			
Achillea millefolium	0.9	1.3	1.1
Antennaria dimorpha	0.0	3.0	1.5
Apocynum androsaemifolium	0.0	0.7	0.4
Aster campestris	0.2	0.4	0.3
Astragalus miser	1.6	0.0	0.8
Balsamorhiza sagittata	0.6	0.0	0.3
Erigeron compositus	0.0	0.3	0.2
Eriogonum umbellatum	0.0	0.4	0.2
Lepidium densiflorum	0.0	0.4	0.2
Lomatium triternatum	0.7	0.7	0.7
Lotus corniculatus	0.7	0.0	0.4
Penstemon procerus	1.1	0.0	0.6
Potentilla spp.	0.9	0.0	0.5
Solidago spathulata	0.0	0.4	0.2
Other Forbs	8.9	3.6	6.3
Bryophytes	0.5	0.0	0.3
Total Forbs and Bryophytes	16.1	11.2	14.0

Table 50. (continued)

Species	Jun	Jul	Mean
Trees and Shrubs			
Amelanchier alnifolia	0.2	1.0	0.6
Pinus ponderosa	0.0	1.5	0.8
Purshia tridentata	0.0	10.1	5.1
Rosa spp.	0.0	0.3	0.2
Salix spp.	3.4	0.0	1.7
Other Shrubs	0.0	1.2	0.6
Total Trees and Shrubs	3.6	14.1	9.0

Table 51. Cattle diets at Peckhams Lake in 1992.

Species	May	Jun	Mean
Grass and Grasslike			
Agropyron spp.	17.0	28.3	22.7
Agrostis alba	2.7	7.3	5.0
Bromus inermis	7.0	0.0	3.5
Bromus tectorum	9.4	8.4	8.9
Calamagrostis rubescens	1.1	3.1	2.1
Carex spp.	0.4	0.4	0.4
Dactylis glomerata	4.0	0.0	2.0
Festuca idahoensis	16.2	10.7	13.5
Festuca scabrella	3.4	3.4	3.4
Juncus spp.	0.4	0.0	0.2
Koeleria cristata	0.0	1.5	0.8
Poa spp.	12.6	10.1	11.4
Stipa spp.	11.7	18.5	15.1
Other Grasses	0.7	4.6	2.7
Total Grass and Grasslike	86.6	96.3	91.3
Forbs and Bryophytes			
Achillea millefolium	0.7	0.0	0.4
Astragalus miser	0.5	0.0	0.3
Eriogonum umbellatum	0.0	0.4	0.2
Medicago\Trifolium	5.1	0.7	2.9
Other Forbs	1.7	0.4	1.1
Bryophytes	4.7	0.0	2.4
Total Forbs and Bryophytes	12.7	1.5	7.1
Trees and Shrubs			
Pinus ponderosa	0.5	0.0	0.3
Rosa spp.	0.0	1.7	0.9
Shepherdia canadensis	0.0	0.1	0.1
Other Shrubs	0.0	0.4	0.2
Total Trees and Shrubs	0.5	2.2	1.4

Table 52. Cattle diets at Premier Ridge in 1992.

Species	May	Jun	Mean
Grass and Grasslike			
Agropyron spp.	13.1	17.4	15.3
Agrostis alba	3.0	2.8	2.9
Bromus inermis	7.4	3.2	5.3
Bromus tectorum	9.3	10.9	10.1
Calamagrostis rubescens	0.0	0.8	0.4
Carex spp.	0.3	0.0	0.1
Dactylis glomerata	0.3	0.5	0.4
Festuca idahoensis	18.6	13.7	16.2
Festuca scabrella	1.3	2.3	1.8
Juncus spp.	0.0	1.1	0.5
Koeleria cristata	5.2	1.7	3.5
Poa spp.	18.1	14.6	16.4
Stipa spp.	12.3	14.5	13.4
Other Grasses	0.0	1.5	0.8
Total Grass and Grasslike	88.9	85.0	86.9
Forbs and Bryophytes			
Aster campestris	0.0	0.1	0.1
Astragalus miser	0.8	0.0	0.4
Lepidium densiflorum	0.3	0.0	0.2
Oxytropis campestris	0.0	0.6	0.3
Potentilla spp.	1.1	0.8	1.0
Other Forbs	2.8	1.7	2.3
Bryophytes	0.6	0.0	0.3
Total Forbs and Bryophytes	5.6	3.2	4.4
Trees and Shrubs			
Amelanchier alnifolia	0.3	0.0	0.2
Ceanothus velutinus	0.0	0.3	0.2
Chrysothamnus nauseosus	0.3	0.0	0.2
Purshia tridentata	2.1	8.7	5.4

Table 52. (continued)

Species	May	Jun	Mean
Trees and Shrubs (continued)			
Rosa spp.	1.1	0.9	1.0
Shepherdia canadensis	1.8	1.1	1.5
Other Shrubs	0.0	0.8	0.4
Total Trees and Shrubs	5.6	11.8	8.7

Table 53. Cattle diets at Pickering Hills in 1992.

Species	Aug	Sep	Mean
Grass and Grasslike			
Agropyron spp.	25.0	14.2	19.6
Agrostis alba	3.6	4.2	3.9
Bromus inermis	4.8	7.5	6.2
Bromus tectorum	1.4	5.7	3.6
Calamagrostis rubescens	2.0	0.0	1.0
Carex spp.	1.8	0.0	0.9
Dactylis glomerata	1.2	0.0	0.6
Festuca idahoensis	8.5	8.3	8.4
Festuca scabrella	0.4	1.0	0.7
Koeleria cristata	0.0	3.8	1.9
Poa spp.	16.1	11.6	13.9
Stipa spp.	14.5	14.4	14.5
Other Grasses	1.4	4.3	2.9
Total Grass and Grasslike	80.7	75.0	77.9
Forbs and Bryophytes			
Allium cernuum	1.4	0.0	0.7
Antennaria dimorpha	0.0	0.5	0.3
Apocynum androsaemifolium	0.0	0.2	0.1
Aster campestris	0.0	0.1	0.1
Balsamorhiza sagittata	0.8	0.0	0.4
Centaurea spp.	0.0	2.1	1.1
Equisetum spp.	0.6	0.0	0.3
Eriogonum umbellatum	0.0	1.4	0.7
Lotus corniculatus	0.4	0.0	0.2
Medicago\Trifolium	1.0	0.0	0.5
Penstemon procerus	3.2	0.0	1.6
Potentilla spp.	0.2	0.0	0.1
Other Forbs	4.5	1.2	2.9
Total Forbs and Bryophytes	12.1	5.6	8.9

Table 53. (continued)

Species	Aug	Sep	Mean
Trees and Shrubs			
Amelanchier alnifolia	0.0	0.4	0.2
Berberis repens	0.4	7.8	4.1
Ceanothus velutinus	0.8	0.0	0.4
Pinus ponderosa	0.8	1.2	1.0
Purshia tridentata	1.4	0.4	0.9
Ribes spp.	0.0	6.6	3.3
Rosa spp.	0.0	1.2	0.6
Salix spp.	2.0	0.0	1.1
Shepherdia canadensis	1.4	1.0	1.2
Symphoricarpus albus	0.0	0.7	0.4
Other Shrubs	0.0	0.2	0.1
Total Trees and Shrubs	5.8	19.5	12.7

Table 54. Cattle diets in the Cattle Only Area at Skookumchuck Prairie in 1993.

Species	Aug	Sep	Mean
Grass and Grasslike			
Agrostis alba	3.6	1.7	2.7
Agropyron spp.	13.6	20.7	17.1
Bromus inermis	1.7	5.0	3.4
Bromus tectorum	0.0	3.9	2.0
Calamagrostis rubescens	0.6	3.6	2.1
Dactylis glomerata	0.6	0.0	0.3
Festuca idahoensis	15.8	7.6	11.7
Festuca scabrella	5.5	5.3	5.4
Koeleria cristata	8.6	7.6	8.1
Poa spp.	18.3	20.7	19.5
Stipa spp.	15.8	10.8	13.3
Total Grass and Grasslike	84.2	86.9	85.5
Forbs and Bryophytes			
Achillea lanulosa	0.4	0.6	0.5
Achillea millefolium	0.0	0.6	0.3
Antennaria dimorpha	1.0	0.6	0.8
Aster campestris	0.3	0.1	0.2
Astragalus spp.	0.1	3.6	1.9
Balsamorhiza sagittata	0.6	0.0	0.3
Centaurea spp.	0.0	0.6	0.3
Leptodactylon spp.	0.8	0.0	0.4
Lomatium triternatum	0.4	0.0	0.2
Lotus spp.	0.2	0.0	0.1
Lupinus spp.	0.0	0.1	0.1
Medicago/Trifolium	0.2	0.0	0.1
Mustard family	0.1	0.0	0.1
Penstemon spp.	1.3	0.0	0.7
Potentilla spp.	0.3	0.0	0.1
Other Forbs	1.7	2.8	2.3
Total Forbs and Bryophytes	7.3	9.0	8.1

Table 54. (continued)

Species	Aug	Sep	Mean
Trees and Shrubs			
Chrysothamnus spp.	1.0	2.2	1.6
Purshia tridentata	6.1	2.0	4.0
Rosa spp.	0.6	0.0	0.3
Other Shrubs	0.6	0.0	0.3
Total Trees and Shrubs	8.2	4.2	6.2

Table 55. Cattle diets in the Combined Use Area at Skookumchuck Prairie in 1993.

Species	Aug	Sep	Mean
Grass and Grasslike			
Agrostis alba	5.9	2.6	4.2
Agropyron spp.	19.3	22.5	20.9
Bromus inermis	7.8	3.6	5.7
Bromus tectorum	0.9	1.4	1.2
Calamagrostis rubescens	1.3	1.9	1.6
Dactylis glomerata	0.0	2.2	1.1
Festuca idahoensis	7.8	6.2	7.0
Festuca scabrella	4.6	8.4	6.5
Koeleria cristata	4.8	8.9	6.8
Poa spp.	21.5	17.0	19.2
Stipa spp.	7.2	12.7	9.9
Other Grasses	0.7	1.1	0.9
Total Grass and Grasslike	81.5	88.6	85.0
Forbs and Bryophytes			
Achillea lanulosa	0.0	1.2	0.6
Antennaria dimorpha	0.0	0.1	0.1
Aster campestris	0.7	1.1	0.9
Astragalus spp.	0.0	0.6	0.3
Centaurea spp.	2.3	1.7	2.0
Erigeron compositus	0.7	0.0	0.3
Leptodactylon spp	0.0	1.9	1.0
Lomatium triternatum	0.0	0.7	0.4
Medicago/Trifolium	0.1	0.0	0.1
Mustard family	0.0	0.2	0.1
Penstemon spp.	1.5	0.0	0.8
Potentilla spp.	0.5	0.4	0.5
Other Forbs	3.3	1.4	2.3
Total Forbs and Bryophytes	9.0	9.3	9.2

Table 55. (continued)

Species	Aug	Sep	Mean
Trees and Shrubs			
Amelanchier alnifolia	0.0	1.0	0.5
Populus tremuloides	0.7	0.0	0.3
Purshia tridentata	7.8	0.8	4.3
Other Shrubs	0.7	0.0	0.3
Total Trees and Shrubs	9.1	1.8	5.5

Table 56. Cattle diets at Peckhams Lake in 1993.

Species	Aug	Sep	Mean
Grass and Grasslike			
Agrostis alba	7.7	7.9	7.8
Agropyron spp.	13.2	12.3	12.8
Bromus inermis	6.8	15.2	11.0
Bromus tectorum	6.8	7.3	7.0
Calamagrostis rubescens	4.3	5.4	4.8
Dactylis glomerata	13.4	5.4	9.4
Festuca idahoensis	7.1	4.4	5.8
Festuca scabrella	5.1	0.3	2.7
Koeleria cristata	3.1	2.2	2.7
Poa spp.	11.7	11.1	11.4
Stipa spp.	11.7	12.0	11.9
Other Grasses	1.4	6.0	3.7
Total Grass and Grasslike	92.3	89.6	90.9
Forbs and Bryophytes			
Achillea lanulosa	0.3	0.0	0.2
Astragalus spp.	0.0	1.0	0.5
Balsamorhiza sagittata	1.0	0.0	0.5
Medicago/Trifolium	3.6	5.4	4.5
Verbascum spp.	0.0	0.3	0.2
Other Forbs	0.6	1.6	1.1
Total Forbs and Bryophytes	5.5	8.3	6.9
Trees and Shrubs			
Pinus ponderosa	0.0	0.6	0.3
Purshia tridentata	0.4	0.0	0.2
Salix spp.	0.9	0.6	0.8
Total Trees and Shrubs	1.3	1.2	1.3

Table 57. Cattle diets at Premier Ridge in 1993.

Species	Aug	Sep	Mean
Grass and Grasslike			
Agrostis alba	7.3	11.0	9.2
Agropyron spp.	12.6	12.9	12.8
Bromus inermis	4.0	4.3	4.2
Bromus tectorum	1.1	7.5	4.3
Calamagrostis rubescens	0.5	1.6	1.1
Dactylis glomerata	1.1	8.6	4.9
Festuca idahoensis	22.9	7.8	15.4
Festuca scabrella	1.1	0.0	0.6
Koeleria cristata	7.5	3.6	5.6
Poa spp.	17.7	16.7	17.2
Stipa spp.	8.9	8.3	8.6
Other Grasses	1.6	3.5	2.6
Total Grass and Grasslike	86.3	85.8	86.1
Forbs and Bryophytes			
Antennaria dimorpha	0.5	1.1	0.8
Astragalus spp.	0.1	0.0	0.1
Balsamorhiza sagittata	0.0	0.1	0.1
Compositae family	0.5	0.0	0.3
Erigeron compositus	0.0	1.4	0.7
Eriogonum sulphurescens	0.0	1.1	0.6
Lomatium triternatum	0.8	0.0	0.4
Medicago/Trifolium	0.7	0.1	0.4
Other Forbs	1.4	1.9	1.7
Total Forbs and Bryophytes	4.0	5.7	4.9

Table 57. (continued)

Species	Aug	Sep	Mean
Trees and Shrubs			
Pinus ponderosa	0.0	0.8	0.4
Purshia tridentata	6.7	6.3	6.5
Salix spp.	0.0	0.3	0.2
Shepherdia canadensis	2.2	0.5	1.4
Other Shrubs	0.8	0.0	0.4
Total Trees and Shrubs	9.7	7.9	8.8

Table 58. Cattle diets at Pickering Hills in 1993.

Species	Aug	Sep	Mean
Grass and Grasslike			
Agrostis alba	5.7	7.6	6.7
Agropyron spp.	15.8	6.5	11.2
Bromus inermis	2.2	3.9	3.1
Bromus tectorum	1.5	0.5	1.0
Calamagrostis rubescens	4.0	5.3	4.7
Festuca idahoensis	11.4	12.9	12.2
Festuca scabrella	0.8	3.0	1.9
Koeleria cristata	3.2	2.8	3.0
Poa spp.	23.0	24.0	23.5
Stipa spp.	11.6	16.0	13.8
Other Grasses	1.5	2.3	1.9
Total Grass and Grasslike	80.7	84.8	82.7
Forbs and Bryophytes			
Antennaria dimorpha	0.5	0.9	0.7
Eriogonum sulphurescens	0.3	0.9	0.6
Lomatium triternatum	0.8	0.0	0.4
Medicago/Trifolium	1.0	0.0	0.5
Other Forbs	1.0	3.0	2.0
Total Forbs and Bryophytes	3.6	4.8	4.2
Trees and Shrubs			
Amelanchier alnifolia	0.3	1.2	0.8
Berberis repens	8.4	5.1	6.8
Populus tremuloides	0.0	0.5	0.3
Purshia tridentata	4.7	2.6	3.7
Ribes spp.	1.5	0.0	0.8
Shepherdia canadensis	0.8	0.7	0.8
Other Shrubs	0.0	0.3	0.2
Total Trees and Shrubs	15.7	10.4	13.1

Table 59. Cattle diets in the Cattle Only Area at Skookumchuck Prairie in 1994.

Species	Jun	Jul	Mean
Grass and Grasslike			
Agrostis alba	0.9	1.4	1.2
Agropyron spp.	12.8	12.6	12.7
Bromus inermis	3.5	4.3	3.9
Bromus tectorum	1.6	2.9	2.3
Calamagrostis rubescens	0.4	0.0	0.2
Festuca idahoensis	5.9	9.1	7.5
Festuca scabrella	27.0	21.9	24.5
Koeleria cristata	1.2	0.0	0.6
Poa spp.	8.9	7.4	8.2
Stipa spp.	4.1	6.6	5.4
Other Grasses	0.7	2.5	1.6
Total Grass and Grasslike	67.0	68.7	67.8
Forbs and Bryophytes			
Achillea lanulosa	0.9	0.4	0.7
Aster campestris	0.1	0.2	0.2
Astragalus spp.	0.2	1.3	0.8
Erigeron compositus	0.0	0.4	0.2
Fragaria spp.	0.4	0.0	0.2
Gaillardia spp.	1.1	1.3	1.2
Geum spp.	4.1	0.0	2.1
Lupinus spp.	0.0	1.4	0.7
Medicago/Trifolium	0.4	0.2	0.3
Penstemon spp.	1.1	0.0	0.6
Other Forbs	4.3	4.3	4.3
Total Forbs and Bryophytes	12.6	9.5	11.1

Table 59. (continued)

Species	Jun	Jul	Mean
Trees and Shrubs			
Amelanchier alnifolia	1.4	0.4	0.9
Ceanothus velutinus	0.7	0.0	0.4
Pinus ponderosa	0.4	0.0	0.2
Purshia tridentata	11.9	11.1	11.5
Rosa spp.	0.5	0.4	0.5
Salix/Populus	4.4	6.6	5.5
Other Shrubs	0.0	3.3	1.7
Total Trees and Shrubs	19.3	21.8	20.6

Table 60. Cattle diets in the Combined Use Area at Skookumchuck Prairie in 1994.

Species	Jun	Jul	Mean
Grass and Grasslike			
Agrostis alba	3.8	1.1	2.5
Agropyron spp.	23.5	8.8	16.2
Bromus inermis	5.3	1.1	3.2
Bromus tectorum	9.4	4.1	6.8
Calamagrostis rubescens	0.6	2.7	1.7
Festuca idahoensis	7.8	8.1	8.0
Festuca scabrella	7.8	14.9	11.4
Koeleria cristata	1.9	2.6	2.3
Poa spp.	15.0	9.0	12.0
Stipa spp.	6.9	10.4	8.7
Other Grasses	1.3	2.7	2.0
Total Grass and Grasslike	83.3	65.5	74.4
Forbs and Bryophytes			
Achillea lanulosa	1.3	1.0	1.2
Apocycynum spp.	0.0	0.7	0.4
Astragalus spp.	0.6	2.7	1.7
Balsamorhiza sagittata	0.0	0.1	0.1
Fragaria spp.	0.0	0.2	0.1
Gaillardia spp.	1.1	2.3	1.7
Lithospermum ruderae	0.2	0.0	0.1
Lotus spp.	0.0	0.2	0.1
Lupinus spp	0.0	0.7	0.4
Medicago/Trifolium	0.0	3.3	1.7
Penstemon spp.	1.4	0.0	0.7
Viola spp.	0.0	0.9	0.5
Other Forbs	5.6	8.1	6.9
Total Forbs	10.2	20.2	15.2

Table 60. (continued)

Species	Jun	Jul	Mean
Trees and Shrubs			
Pinus ponderosa	0.8	0.5	0.7
Purshia tridentata	1.9	4.8	3.4
Salix/Populus	3.8	8.1	6.0
Other Shrub	0.0	0.9	0.5
Total Trees and Shrubs	6.5	14.3	10.4

Table 61. Cattle diets at Peckhams Lake in 1994.

Species	Jun	Jul	Mean
Grass and Grasslike			
Agrostis alba	6.3	3.1	4.7
Agropyron spp.	20.7	15.9	18.3
Bromus inermis	7.1	8.5	7.8
Bromus tectorum	5.3	26.8	16.1
Calamagrostis rubescens	2.2	2.7	2.5
Dactylis glomerata	0.0	6.6	3.3
Festuca idahoensis	11.4	4.4	7.9
Festuca scabrella	1.0	0.0	0.5
Koeleria cristata	0.4	0.5	0.5
Poa spp.	9.8	4.4	7.1
Stipa spp.	12.2	14.5	13.4
Other Grasses	4.9	2.2	3.6
Total Grass and Grasslike	81.3	89.6	85.5
Forbs and Bryophytes			
Achillea lanulosa	0.0	1.9	1.0
Astragalus spp.	0.6	0.2	0.4
Fragaria spp.	0.2	0.0	0.1
Lotus spp.	0.2	0.2	0.2
Lupinus spp.	1.4	0.0	0.7
Medicago/Trifolium	13.0	0.7	6.9
Taraxacum spp.	0.0	0.7	0.4
Other Forbs	2.9	3.6	3.3
Total Forbs	18.3	7.3	12.8
Trees and Shrubs			
Berberis repens	0.2	0.0	0.1
Salix spp.	0.0	3.1	1.6
Spiraea betulifolia	0.2	0.0	0.1
Total Trees and Shrubs	0.4	3.1	1.8

Table 62. Cattle diets at Premier Ridge in 1994.

Species	May	Jun	Mean
Grass and Grasslike			
Agrostis alba	2.7	2.1	2.4
Agropyron spp.	15.0	11.9	13.5
Bromus inermis	2.8	6.2	4.5
Bromus tectorum	4.2	7.1	5.6
Calamagrostis rubescens	0.5	0.4	0.5
Carex spp.	0.2	0.0	0.1
Dactylis glomerata	1.0	0.5	0.8
Festuca idahoensis	14.9	19.8	17.3
Festuca scabrella	1.8	3.9	2.9
Koeleria cristata	2.3	2.3	2.3
Poa spp.	20.4	17.9	19.2
Stipa spp.	18.6	8.8	13.7
Other Grasses	3.7	2.1	2.9
Total Grass and Grasslike	88.1	83.0	85.6
Forbs and Bryophytes			
Achillea lanulosa	1.5	0.3	0.9
Antennaria dimorpha	0.0	0.7	0.4
Aster campestris	0.1	0.0	0.1
Astragalus spp.	0.4	1.4	0.9
Balsamorhiza sagittata	0.6	0.0	0.3
Fragaria spp.	0.1	0.0	0.1
Gaillardia spp.	0.4	0.8	0.6
Geum spp.	0.0	0.8	0.4
Lupinus spp.	0.6	0.7	0.7
Medicago/Trifolium	1.3	1.7	1.5
Penstemon spp.	0.0	0.4	0.2
Taraxacum spp.	0.0	2.0	1.0
Other Forbs	2.7	2.0	2.4
Bryophytes	0.5	0.3	0.4
Total Forbs and Bryophytes	8.2	11.1	9.7

Table 62. (continued)

Species	May	Jun	Mean
Trees and Shrubs			
Amelanchier alnifolia	0.5	0.4	0.5
Purshia tridentata	0.0	3.1	1.6
Prunus spp.	0.0	0.4	0.2
Salix spp.	1.0	0.4	0.7
Shepherdia canadensis	2.2	1.6	1.9
Total Trees and Shrubs	3.7	5.9	4.8

Table 63. Cattle diets at Pickering Hills in 1994.

Species	Aug	Sep	Mean
Grass and Grasslike			
Agrostis alba	0.0	2.1	1.1
Agropyron spp.	6.0	8.1	7.1
Bromus inermis	9.0	3.1	6.1
Bromus tectorum	1.9	3.3	2.6
Calamagrostis rubescens	7.5	3.9	5.7
Carex spp.	0.0	3.3	1.7
Festuca idahoensis	9.3	11.4	10.4
Festuca scabrella	1.1	0.6	0.9
Koeleria cristata	1.9	0.0	1.0
Poa spp.	16.4	22.5	19.5
Stipa spp.	21.7	13.6	17.7
Other Grasses	5.6	3.1	4.4
Total Grass and Grasslike	80.4	75.0	77.7
Forbs and Bryophytes			
Achillea lanulosa	0.4	0.0	0.2
Aster campestris	0.4	0.0	0.2
Gaillardia spp.	0.0	0.8	0.4
Penstemon spp.	0.0	0.6	0.3
Verbascum spp.	0.4	0.0	0.2
Other Forbs	2.8	2.8	2.8
Total Forbs and Bryophytes	4.0	4.2	4.1

Table 63. (continued)

Species	Aug	Sep	Mean
Trees and Shrubs			
Berberis repens	13.5	7.8	10.7
Pinus ponderosa	1.0	0.6	0.8
Prunus spp.	0.0	2.5	1.3
Purshia tridentata	0.0	2.3	1.2
Rosa spp.	0.0	1.2	0.6
Salix/Populus	1.1	4.8	3.0
Shepherdia canadensis	0.0	1.4	0.7
Other Shrubs	0.0	0.2	0.1
Total Trees and Shrubs	15.6	20.8	18.2

Cattle at Pickering Hills grazed the least number of forbs (Table 58). This variation in the proportion of forbs in the diet likely resulted from availability as cattle grazed Pickering Hills in August and September after most forbs became senescent. At Peckhams Lake cattle ate eight forb species but alfalfa and clover comprised >50% of their diet (Table 61). Forb species which comprised more than 1% of cattle diet in 1994 include; timber milkvetch, brown-eyed Susan and old man's whiskers at Skookumchuck Prairie (Table 59, 60), dandelion at Premier Ridge (Table 62), and common yarrow at Peckhams Lake (Table 61). Small-flowered penstemon was not grazed by cattle in significant amounts in 1994 at any site (Table 59, 60, 61, 62, 63).

Browse composition of cattle diets ranged from <2% at Peckhams Lake in all years, to 20.6% in the Cattle Only area at Skookumchuck Prairie in 1994 (Table 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 62, 63). Browse was used least by cattle at Skookumchuck Prairie and Peckhams Lake (Table 49, 50, 51) compared to forbs and grasses in 1992. At Premier Ridge in 1992 and 1993 (Table 52, 57), Pickering Hills in all years (Table 53, 58, 63), and in the Cattle Only area at Skookumchuck Prairie in 1994, however, the proportion of shrubs in cattle diets slightly exceeded forbs.

Bitterbrush comprised more than 20% of cattle diet at Skookumchuck Prairie in July 1992. On all other sites bitterbrush composition ranged from 5 - 10% of cattle diet, except at Peckhams Lake where it was not browsed at all. At all sites in 1993, bitterbrush was used more in the first half of the grazing period than in the second half (Table 54, 55, 56, 57, 58). Bitterbrush was used at all sites in 1994, except Peckhams Lake, but it only exceeded 4% of cattle diet in the Cattle Only area at Skookumchuck Prairie (Table 59, 60, 61, 62, 63).

Individual browse species generally occurred as less than 1% of cattle diet. Exceptions include; low Oregongrape at Pickering Hills in all years (Table 53, 58, 63), rabbitbrush at the Cattle Only area at Skookumchuck Prairie in 1993 (Table 54), willow and aspen (>5% and 6% respectively) in the Cattle Only and Combined Use areas at Skookumchuck Prairie (Table 59, 60) in 1994, and chokecherry at Pickering Hills (Table 63) and soopolallie at Premier Ridge in 1994 (Table 62).

Cattle diet at Pickering Hills contained >18% browse in 1994, with low Oregongrape, comprising >50% of the browse eaten (Table 63). Similarly, in the Cattle Only area at Skookumchuck Prairie, bitterbrush exceeded 11% of cattle diet (Table 59).

Bryophytes appeared infrequently in cattle diets. Bryophytes were only eaten to any degree at Peckhams Lake in 1992 where cattle used nearly 5% in May (Table 25).

4.1.4 Dietary Overlap at Skookumchuck Prairie

Dietary Overlap - 1992

Cattle, deer, and elk diets all overlapped in the Combined Use area at Skookumchuck Prairie in 1992. Nearly 50% of the plant species eaten by cattle were the same as those eaten by deer (Table 64). In contrast, 43% of the species eaten by cattle and elk were eaten in common. The greatest overlap in diet, however, was between deer and elk where 65% of the species eaten were in common (Table 65).

Additionally, within each ungulate species, some diet overlap existed between grazing periods. While this may not indicate interspecific competition, what it does show is that deer, elk, and cattle have a degree of fidelity to the same forage species between seasons, among years, and among sites. For example, in the Combined Use area at Skookumchuck Prairie,

winter 1991/92 deer diet was positively correlated ($p < 0.05$) with spring deer diet, but was negatively correlated

Table 64. Number of common and different species in cattle diets compared to elk and deer in the Combined Use Area at Skookumchuck Prairie in 1992.

		Grasses	Forbs	Shrubs	Total	%
Deer	Common	10	11	5	26	51
	Different	3	13	9	25	49
Elk	Common	10	8	5	23	43
	Different	3	18	10	31	57

Table 65. Number of common and different species in deer and elk diets in the Combined Use Area at Skookumchuck Prairie in 1992.

	Grasses	Forbs	Shrubs	Total	%
Common	11	13	13	37	65
Different	2	16	2	20	35

with summer deer diet ($p < 0.05$). Spring elk diet was positively correlated ($p < 0.05$) with summer and fall elk diets ($p < 0.05$) (Table 66).

Direct competition between deer, elk, and cattle was only possible in June and July in the Combined Use area at Skookumchuck Prairie in 1992 (Table 14, 32, 50). During this period, there was considerable diet separation. Grasses, for example, comprised only 16% of deer diet but nearly 80% of cattle diet. Nearly 50% of deer diet was composed of forbs while the proportion of forbs in cattle diet equaled about 10%. Similarly, deer in summer in the Combined Use area browsed (28.2%), double the amount in cattle diets (14.0%). Deer and cattle diets were not correlated ($p < 0.05$) in any time period (Table 66).

Summer elk and summer cattle diets were correlated ($p < 0.20$), but poorly so, at the Combined Use area at Skookumchuck Prairie (Table 66) even though grasses comprised nearly 80% of both species diet (Table 32, 50). The most important species eaten in common included wheatgrasses, Idaho fescue, rough fescue, bluegrasses and needlegrasses. However, elk concentrated on rough fescue and bluegrasses while cattle diets contained approximately equal amounts of the grass species listed above. Similarly, elk and deer diets were not significantly correlated ($p < 0.05$) in the summer grazing period with elk eating primarily grasses while deer fed on forbs and browse (Table 66).

Indirect competition may occur among deer, elk, and cattle depending upon how the foraging behavior of each animal species affects forage availability for the other species during a later grazing periods. For example, summer foraging by cattle may reduce availability of forage for deer and elk in the fall and winter, particularly if there is little opportunity for regrowth after cattle grazing.

At Skookumchuck Prairie, the greatest potential for indirect competition appears to be between cattle and elk for wheatgrasses, Idaho fescue, rough fescue, bluegrasses, and needlegrasses (Table 32, 50). These species were prominent in summer cattle diet, and fall and winter elk diets. In contrast, there were only minor dietary overlaps between cattle and deer for grasses in the same two periods.

Of all forbs, small-flowered penstemon occurred in deer and elk diets most consistently with the greatest overlap occurring in October (Table 14, 32). Summer cattle grazing on forbs likely had little influence on forb availability for deer and elk in fall and winter.

Browse comprised less than 10% of summer cattle diet (Table 50). Bitterbrush was the dominant species eaten but it only accounted for slightly more than 5% of cattle diet composition. The greatest dietary overlap for shrubs occurred between deer and elk in December when browse comprised nearly 99% and 41% of their diets respectively (Table 14, 32). Saskatoon, Douglas-fir, bitterbrush, and soopolallie were also eaten in common between deer and elk.

Apparently summer cattle diets do not overlap significantly with fall and winter deer diets. Although summer cattle diets, and fall and winter elk diets contain several common species, cattle diet was only weakly correlated ($p < 0.20$) with fall elk diet (Table 32, 50, 66). Fall and winter deer and elk diets were not correlated ($p > 0.05$) despite both species eating the same forbs in October and the same shrubs in December (Table 14, 32, 66).

Just as summer or fall grazing by cattle may influence forage availability for wildlife, so too can spring grazing by wildlife affect forage availability for cattle. Indeed, the largest overlap occurred for grasses (Table 64). Rough fescue, in particular comprised more than 40% of spring elk diet and 11% of summer cattle diet (Table 14, 32). It represented less than 2% of deer diet

Table 66. Summary of Spearman rank correlation coefficients in the Combined Use Area at Skookumchuck Prairie in 1992.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer deer	Summer elk	Summer cattle	Fall deer	Fall elk	Winter ² deer	Winter ² elk
Winter ¹ deer	1.000	0.106	0.443 ^a	-0.123	-0.410 ^a	-0.313	-0.264	-0.098	0.226	0.358 ^c	
Winter ¹ elk		1.000	0.137	0.573 ^a	-0.279	0.309 ^b	0.288 ^c	-0.192	0.222		0.347 ^b
Spring deer			1.000	0.028	-0.222	-0.151	-0.102	0.125	-0.001		
Spring elk				1.000	-0.352	0.445 ^a	0.489 ^a	-0.274	0.375 ^a		0.439 ^a
Summer deer					1.000	-0.206	-0.267	0.084	0.019		
Summer elk						1.000	0.305 ^c	-0.165	0.359 ^b		0.370 ^a
Summer cattle							1.000	-0.266	0.286 ^c	-0.326 ^b	0.194
Fall deer								1.000	0.021		
Fall elk									1.000		0.262 ^c
Winter ² deer										1.000	
Winter ² elk											1.000

^a p<0.05

^b p<0.10

^c p<0.20

¹ winter 1991/92

² winter 1992/93

during the same period (Table 14). Wheatgrasses, Idaho fescue, bluegrasses, and needlegrasses were also prominent spring forages for elk and summer forages for cattle.

Although forbs averaged more than 25% and 10% of spring deer and elk diets (Table 14, 32), this likely had little influence on summer use of forbs by cattle. The eight forbs common to all diets provided a small proportion of wildlife diet. The highest dietary overlap for forbs occurred between deer and elk for small-flowered penstemon (Table 14, 32).

Spring browse use by deer represented >50% of deer diet composition (Table 14). In contrast, shrubs occurred less than 10% in elk diets (Table 32). The greatest overlap in summer cattle diet and spring deer diet was for bitterbrush. Saskatoon appeared in spring elk and deer diets, but accounted for <1% of cattle diet. All other shrubs were incidental in cattle diet (Table 50).

Winter 1991/92 ($p < 0.20$) and spring elk ($p < 0.05$) diets, however, exhibited a significant positive correlation with summer cattle diets (Table 66). The most important overlap was for wheatgrasses, Idaho fescue, rough fescue, bluegrasses, and needlegrasses. Although spring deer diets included increased amounts of grasses and forbs they were not correlated with summer cattle diets or with spring elk diets.

At Skookumchuck Prairie the three-way exclosure allows comparison of diets when there is spatial as well as temporal separation. Wildlife diets in the Combined Use area and the Wildlife Only area were positively correlated ($p < 0.05$) (Table 67) in all periods, with the exception of the winter elk diets ($p < 0.10$). Additionally, cattle diets were positively correlated ($p < 0.05$) between the Combined Use and the Cattle Only areas (Table 67). Winter 1991/92 diets and winter 1992/1993 were positively correlated for both deer and elk in the Wildlife Only area (Table 67).

When the diets of cattle in the Cattle Only and wildlife in the Wildlife Only areas were compared, only spring elk diet and summer cattle diet were positively correlated ($p < 0.10$) (Table 67). From the data collected in 1992 at Skookumchuck Prairie, it appears there is a degree of dietary overlap between cattle, deer, and elk. Although these ungulate species ate between 43% and 65% plant species in common (Table 64) only four Spearman's rank correlation comparisons of direct or indirect dietary competition indicated positively correlated diets. Winter 1991/92 ($p < 0.20$), spring 1992 elk diets ($p < 0.05$), and fall 1992 elk diets ($p < 0.20$) proved to be positively correlated to a significant degree with summer cattle diets (Table 66). The overlap occurred mainly in the grasses; wheatgrasses, rough fescue, Idaho fescue, bluegrasses, and needlegrasses. Also, winter elk and spring deer diets were positively correlated ($p < 0.05$) (Table 66).

Dietary Overlap - Skookumchuck Prairie - 1993

Because the cattle were grazed on a fall rotation in 1993 (Table 5), cattle diet composition and dietary overlaps with deer and elk were expected to differ from 1992. Moreover, higher precipitation in 1993 compared to 1992 (Table 3, 4) likely affected forage availability. Cattle and deer diets in the Combined Use area at Skookumchuck were more similar in 1992 (Table 64) than in 1993 (Table 68). Indeed, >50% of their diets contained similar species in 1992, compared to only slightly >30% in 1993 (Table 64, 68). In contrast, cattle and elk ate slightly >50% species in common in 1993, with only one grass species that was not eaten in common (Table 37, 55). Deer and elk diets in 1993 contained approximately equal numbers of grass, forb, and shrub species eaten in common and eaten differently (Table

68) in contrast to 1992 (Table 69), where most of the grass and shrub species in deer and elk diets were eaten in common.

Table 67. Summary of Spearman rank correlation coefficients in the Cattle Only and Wildlife Only Areas at Skookumchuck Prairie in 1992.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Winter ² deer	Winter ² elk	Summer cattle
Wildlife Only							
Winter ¹ deer	1.000				0.351 ^c		-0.238
Winter ¹ elk		1.000				0.116	0.012
Spring deer			1.000				-0.172
Spring elk				1.000			0.289 ^c
Winter ² deer					1.000		-0.296
Winter ² elk						1.000	0.132
Cattle Only							
Summer cattle							0.315 ^a
Combined Use							
Winter ¹ deer	0.532 ^a						
Winter ¹ elk		0.315 ^b					
Spring deer			0.439 ^a				
Spring elk				0.596 ^a			

^a p<0.05

^b p<0.10

^c p<0.20

¹ winter 1991/92

² winter 1992/93

Table 68. Number of common and different species in cattle diets compared to elk and deer in the Combined Use Area at Skookumchuck Prairie in 1993.

		Grasses	Forbs	Shrubs	Total	%
Deer	Common	7	5	3	15	33
	Different	5	14	12	31	67
Elk	Common	12	7	2	21	54
	Different	1	8	9	18	46

Table 69. Number of common and different species in deer and elk diets in the Combined Use Area at Skookumchuck Prairie in 1993.

	Grasses	Forbs	Shrubs	Total	%
Common	7	7	8	22	52
Different	6	7	7	20	48

In the Combined Use area, spring elk diets were positively correlated ($p < 0.05$) with both winter 1992/93 elk and summer 1993 cattle diets (Table 70). Similarly, summer cattle diets were positively correlated ($p < 0.05$) with 1993/94 elk diets. Even though cattle were grazed until the end of September at Skookumchuck Prairie, elk and cattle diets were positively correlated from winter of 1992/93 through to winter 1993/94 (Table 70).

Grass species such as wheatgrasses, smooth brome grass, Idaho fescue, rough fescue, bluegrasses, and needlegrasses were major components of spring and summer elk and cattle diets (Table 37, 55) in 1993, as well as in 1992 (Table 32, 50). Elk used $< 13\%$ rough fescue in 1993 in contrast to nearly 30% in 1992 (Table 32, 37).

Summer cattle diet and winter 1993/94 elk diet were positively correlated in 1993 (Table 70), whereas in 1992 summer cattle diet was not correlated with winter 1992/93 elk diet (Table 66). Although the same grass species continued to be important in the diets of both species, average winter elk grazing of rough fescue, ($> 37\%$), was much higher in 1993/94 than in 1992/93 (12%). Additionally, soopolallie, which was not browsed in 1993/94, averaged 21% of elk diet in the previous winter (Table 32). Summer cattle diet was negatively correlated ($p < 0.05$) with winter deer diet of 1992/93 ($p < 0.05$).

Diets among sites at Skookumchuck Prairie were similar again in 1993. Comparison of deer and elk diets between the Combined Use and Wildlife Only areas revealed positive correlations ($p < 0.05$) in all comparisons except between spring deer diets (Table 71). Cattle diets were also significantly ($p < 0.05$) similar ($p < 0.05$) between the Cattle Only and the Combined Use areas (Table 71).

Since diets of deer and elk in the Wildlife Only area, and cattle in Cattle Only area were comparable to those of deer, elk, and cattle in the Combined Use area, similar relationships could be expected when wildlife diets in the Wildlife Only and cattle diets in the Cattle Only areas were compared. Indeed, spring elk diet in the Wildlife Only area was positively correlated with summer cattle diet in the Cattle Only area, while summer cattle diet was positively correlated ($p < 0.05$) with elk diet in the winter of 1993/94 (Table 71). Winter deer and winter and spring elk diets from 1992/93 and 1993/94 were positively correlated ($p < 0.05$) between the Combined Use and Wildlife Only areas (Table 71).

Dietary Overlap - 1994 - Skookumchuck Prairie

Cattle were grazed at Skookumchuck Prairie in spring in 1994, but the turn-out date in 1994 was July compared to June as in 1992 (Table 5). This, later turn-out date, in addition to the extremely dry weather during the cattle grazing period may have affected cattle diets and resulted in less diet overlap with elk, in particular, in 1994 (Table 3, 4). Indeed, the number of common species in deer, elk, and cattle diets was lower than in 1992 (Table 64) or 1993 (Table 68). Both deer and elk ate slightly $< 50\%$ plant species in common, but used approximately the same number of grasses, forbs, and shrubs (Table 72). Deer and elk, however, ate more species in common than 1992 and 1993; slightly more than 80% (Table 73).

Spring elk diet in 1994, was positively correlated to winter 1993/94 elk diet ($p < 0.05$) and to summer cattle diet ($p < 0.20$). Elk diets from the winter of 1993/94 and winter 1994/95 were also positively correlated (Table 74). Summer cattle diet was positively correlated to winter 1993/94 elk diet ($p < 0.10$) and to 1994/95 winter diet ($p < 0.20$). Wheatgrass species, smooth brome grass, Idaho fescue, rough fescue, bluegrass species, and needlegrass species again dominated diets of both ungulate species (Table 42, 60). Winter 1994/95 elk diets also contained

Table 70. Summary of Spearman rank correlation coefficients in the Combined Use Area at Skookumchuck Prairie in 1993.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer cattle	Winter ² deer	Winter ² elk
Winter ¹ deer	1.000	0.199	0.273	-0.402 ^b	-0.396 ^a	0.269 ^c	
Winter ¹ elk		1.000	0.203	0.422 ^a	0.177		0.315 ^c
Spring deer			1.000	-0.314	-0.209		
Spring elk				1.000	0.483 ^a		0.673 ^a
Summer cattle					1.000	-0.197	0.437 ^a
Winter ² deer						1.000	
Winter ² elk							1.000

^a p<0.05

^b p<0.10

^c p<0.20

¹winter 1992/93

²winter 1993/94

Table 71. Summary of Spearman rank correlation coefficients in the Cattle Only and Wildlife Only Areas at Skookumchuck Prairie in 1993.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Winter ² deer	Winter ² elk	Summer cattle
Wildlife Only							
Winter ¹ deer	1.000			-0.300	0.241		-0.433 ^a
Winter ¹ elk		1.000				0.321	0.160
Spring deer			1.000				-0.333
Spring elk				1.000			0.441 ^a
Winter ² deer					1.000		-0.508 ^a
Winter ² elk						1.000	0.431 ^a
Cattle Only							
Summer cattle							0.757 ^a
Combined Use							
Winter ¹ deer	0.941 ^a						
Winter ¹ elk		0.665 ^a					
Spring deer			0.243	-0.196			
Spring elk			-0.318	0.784 ^a			

^a p<0.05

¹winter 1992/93

²winter 1993/94

Table 72. Number of common and different species in cattle diets compared to elk and deer in the Combined Use Area at Skookumchuck Prairie in 1994.

		Grasses	Forbs	Shrubs	Total	%
Deer	Common	9	6	3	18	43
	Different	2	12	10	24	57
Elk	Common	10	7	3	20	44
	Different	2	12	11	25	56

Table 73. Number of common and different species in deer and elk diets in the Combined Use Area at Skookumchuck Prairie in 1994.

	Grasses	Forbs	Shrubs	Total	%
Common	11	11	13	35	81
Different	1	6	1	8	19

Table 74. Summary of Spearman rank correlation coefficients in the Combined Use Area at Skookumchuck Prairie in 1994.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer elk	Summer cattle	Fall deer	Fall elk	Winter ² deer	Winter ² elk
Winter ¹ deer	1.000	0.075	0.098	-0.089	0.010	-0.096	0.233	-0.112	0.311 ^c	
Winter ¹ elk		1.000	-0.208	0.726 ^a	0.199	0.318 ^b	-0.064	0.182		0.682 ^a
Spring deer			1.000	-0.292 ^c	0.246	-0.307 ^b	-0.192	-0.326 ^b		
Spring elk				1.000	0.119	0.296 ^c	-0.127	0.140		0.663 ^a
Summer elk					1.000	0.061	-0.073	0.038		0.150
Summer cattle						1.000	-0.088	0.048	0.055	0.312 ^c
Fall deer							1.000	-0.145	0.110	-0.229
Fall elk								1.000	-0.003	0.109
Winter ² deer									1.000	0.214
Winter ² elk										1.000

^a p<0.05

^b p<0.10

^c p<0.20

¹winter 1993/94

²winter 1994/95

more bitterbrush and small-flowered penstemon than did summer cattle diets. Elk and deer diets in the Wildlife Only and Combined Use areas were positively correlated ($p < 0.05$) for all periods (Table 75). Furthermore, cattle diets in the Cattle Only and Combined Use areas were also positively correlated ($p < 0.05$). Summer cattle diet in the Cattle Only area was only positively correlated ($p < 0.10$) with winter elk diet in the Wildlife Only area (Table 75).

Winter 1993/94 and winter 1994/95 elk diets were positively correlated ($p < 0.05$) at both the Wildlife Only and Combined Use areas. Winter 1993/94 and winter 1994/95 deer diet from the Combined Use area were also positively correlated (Table 74). In contrast, 1993/94 and winter 1994/95 deer diets in the Wildlife Only area were not correlated (Table 75). Although many of the same species were eaten, it appears deer in the Wildlife Only area made less use of buckbrush, Douglas-fir, and bitterbrush, and higher use of ponderosa pine in 1993/94 as compared to 1994 (Table 18, 19, 23, 24).

4.1.5 Dietary Overlap at Premier Ridge, Peckhams Lake, and Pickering Hills

Diet Overlap - 1992

Cattle, deer and elk diets all overlapped at Premier Ridge, Peckhams Lake and Pickering Hills (Table 76, 77, 78, 79, 80, 81). At the three secondary locations the number of common species in deer and cattle diets ranged from about 32% at Peckhams Lake to slightly more than 44% at Pickering Hills (Table 79, 80, 81). The number of forage species common to elk and cattle diets was highest at Pickering Hills ($>55\%$) and lowest at Peckhams Lake ($<39\%$). On all sites except Pickering Hills, however, there were fewer species in common in elk and cattle diets than were different (Table 76, 78, 80).

Except at Pickering Hills, deer and elk diets were most similar on the secondary locations. Elk and cattle, and, deer and elk shared nearly the same number of species in their diets at Pickering Hills (>50) (Table 80, 81). In contrast, at Premier Ridge and Peckhams Lake, nearly 60% and 70%, respectively of the plant species in deer and elk diets were common (Table 77, 79).

Dietary overlap must be examined among all species and grazing periods to determine the sequential pattern of use on the secondary sites where there was no three-way exclosure, like at Skookumchuck Prairie, and therefore no spatial separation. Deer, elk, and cattle have a degree of fidelity in their diet among seasons, years, and sites. This may be a factor in inter-specific competition.

Winter deer diets were positively correlated with spring and winter 92/93 deer diets at Premier Ridge (Table 82) and Pickering Hills (Table 84) but not at Peckhams Lake (Table 83). Deer at Peckhams Lake grazed alfalfa and clover as the principal component in their spring diet. The principal species eaten in common during these periods were Douglas-fir, Saskatoon, small-flowered penstemon, and rough fescue (Table 15, 16, 17, 20, 21, 22). Douglas-fir averaged 31% of diet at Premier Ridge and 63% at Peckhams Lake. Browsing patterns on Douglas-fir were probably related to availability. Deer tended to make more use of bitterbrush during the winter and soopolallie in spring.

Winter elk diets were positively correlated with spring elk diets at Premier Ridge ($p < 0.05$), Peckhams Lake ($p < 0.10$) and Pickering Hills ($p < 0.05$), summer elk diet at Premier Ridge ($p < 0.10$), fall diets at Premier Ridge ($p < 0.05$) and Peckhams Lake ($p < 0.10$), and winter 1992/93 diets ($p < 0.05$) at Premier Ridge and Pickering Hills (Table 82, 83, 84). In all periods, at all sites, wheatgrasses, smooth bromegrass, Idaho fescue, rough fescue, bluegrasses, and

Table 75. Summary of Spearman rank correlation coefficients in the Cattle Only and Wildlife Only Areas at Skookumchuck Prairie in 1994.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer deer	Summer elk	Winter ² deer	Winter ² elk	Summer cattle
Wildlife Only									
Winter ¹ deer	1.000						-0.026		-0.444 ^a
Winter ¹ elk		1.000						0.563 ^a	0.263
Spring deer			1.000						-0.243
Spring elk				1.000					0.173
Summer deer					1.000				-0.282
Summer elk						1.000			-0.322 ^b
Winter ² deer							1.000		-0.064
Winter ² elk								1.000	0.368 ^b
Cattle Only									
Summer cattle									0.879 ^a
Combined Use									
Winter ¹ deer	0.522 ^a								
Winter ¹ elk		0.752 ^a							
Spring deer			0.399 ^a						
Spring elk				0.820 ^a					

^a p<0.05

^b p<0.10

¹winter 1993/94

²winter 1994/95

Table 76. Number of common and different species in cattle diets compared to elk and deer at Premier Ridge in 1992.

		Grasses	Forbs	Shrubs	Total	%
Deer	Common	12	4	6	22	36
	Different	2	29	8	39	64
Elk	Common	12	5	5	22	42
	Different	1	20	9	30	58

Table 77. Number of common and different species in deer and elk diets at Premier Ridge in 1992.

	Grasses	Forbs	Shrubs	Total	%
Common	12	19	11	42	58
Different	1	24	5	30	42

Table 78. Number of common and different species in cattle diets compared to elk and deer at Peckhams Lake in 1992.

		Grasses	Forbs	Shrubs	Total	%
Deer	Common	12	4	3	19	32
	Different	1	29	10	40	68
Elk	Common	12	4	3	19	39
	Different	1	17	12	30	61

Table 79. Number of common and different species in deer and elk diets at Peckhams Lake in 1992.

	Grasses	Forbs	Shrubs	Total	%
Common	12	18	14	44	70
Different	0	17	2	19	30

Table 80. Number of common and different species in cattle diets compared to elk and deer at Pickering Hills in 1992.

		Grasses	Forbs	Shrubs	Total	%
Deer	Common	10	7	10	27	44
	Different	2	26	6	34	56
Elk	Common	12	9	10	31	55
	Different	1	17	6	24	45

Table 81. Number of common and different species in deer and elk diets at Pickering Hills in 1992.

	Grasses	Forbs	Shrubs	Total	%
Common	10	12	14	36	53
Different	3	24	5	32	47

Table 82. Summary of Spearman rank correlation coefficients at Premier Ridge in 1992.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer deer	Summer elk	Summer cattle	Fall deer	Fall elk	Winter ² deer	Winter ² elk
Winter ¹ deer	1.000	-0.299 ^a	0.406 ^a	-0.134	-0.213	-0.138	-0.299 ^a	-0.426 ^a	0.209	0.495 ^a	0.027
Winter ¹ elk		1.000	0.345 ^b	0.672 ^a	-0.389 ^a	0.327 ^b	0.458 ^a	-0.486 ^a	0.466 ^a	-0.329 ^c	0.625 ^a
Spring deer			1.000	0.447 ^a	-0.216	0.186	0.125	-0.333 ^a	0.175	0.304 ^c	0.563 ^a
Spring elk				1.000	-0.414 ^a	0.335 ^b	0.321 ^c	-0.466 ^a	0.312 ^b	-0.256	0.598 ^a
Summer deer					1.000	-0.279 ^b	-0.282 ^c	-0.121	-0.501 ^a	-0.125	-0.359 ^a
Summer elk						1.000	0.203	-0.351 ^a	0.416 ^a	-0.155	0.243 ^c
Summer cattle							1.000	-0.419 ^a	0.241 ^c	0.243	0.309 ^c
Fall deer								1.000	-0.453 ^a	-0.370 ^a	-0.469 ^a
Fall elk									1.000	-0.261	0.245 ^c
Winter ² deer										1.000	-0.243 ^c
Winter ² elk											1.000

^a p<0.05

^b p<0.10

^c p<0.20

¹winter 1991/92

²winter 1992/93

Table 83. Summary of Spearman rank correlation coefficients at Peckhams Lake in 1992.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer deer	Summer elk	Summer cattle	Fall deer	Fall elk	Winter ² deer	Winter ² elk
Winter ¹ deer	1.000	-0.243 ^c	0.118	-0.187	-0.125	-0.428 ^a	-0.554 ^a	-0.050	-0.356 ^b	0.101	-0.225
Winter ¹ elk		1.000	0.063	0.304 ^b	-0.330 ^a	0.230	0.380 ^b	-0.456 ^a	0.349 ^b	-0.047	0.196
Spring deer			1.000	0.172	-0.236 ^c	-0.043	-0.080	-0.133	0.074	0.016	-0.022
Spring elk				1.000	-0.211 ^c	0.351 ^a	0.415 ^a	-0.324 ^a	0.415 ^a	-0.159	0.081
Summer deer					1.000	-0.346 ^a	-0.213	0.113	-0.287 ^b	-0.171	-0.358 ^a
Summer elk						1.000	0.390 ^b	-0.340 ^a	0.666 ^a	-0.295 ^c	0.253 ^c
Summer cattle							1.000	-0.271 ^b	0.343 ^c	-0.368 ^b	0.056
Fall deer								1.000	-0.327 ^a	-0.149	-0.453 ^a
Fall elk									1.000	-0.130	0.324 ^b
Winter ² deer										1.000	-0.021
Winter ² elk											1.000

^a p<0.05

^b p<0.10

^c p<0.20

¹winter 1991/92

²winter 1992/93

Table 84. Summary of Spearman rank correlation coefficients at Pickering Hills in 1992.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer deer	Summer elk	Summer cattle	Fall deer	Fall elk	Winter ² deer	Winter ² elk
Winter ¹ deer	1.000	-0.060	0.402 ^b	-0.176	-0.545 ^a	-0.495 ^a	-0.324	-0.340	-0.537 ^a	0.360 ^c	-0.022
Winter ¹ elk		1.000	-0.045	0.558 ^a	-0.542 ^a	0.055	0.494 ^a	-0.378 ^a	0.078	0.187	0.433 ^a
Spring deer			1.000	-0.068	-0.410 ^a	-0.363	-0.200	-0.253	-0.428 ^a	0.411 ^a	-0.086
Spring elk				1.000	-0.446 ^a	0.391 ^a	0.548 ^a	-0.258	0.379 ^a	0.168	0.545 ^a
Summer deer					1.000	-0.489 ^a	-0.404 ^a	-0.177	-0.293	-0.556 ^a	-0.461 ^a
Summer elk						1.000	0.317 ^c	-0.322	0.455 ^a	-0.213	0.067
Summer cattle							1.000	-0.329 ^b	0.391 ^a	0.024	0.309 ^b
Fall deer								1.000	-0.163	-0.316	-0.287
Fall elk									1.000	-0.400 ^a	-0.021
Winter ² deer										1.000	0.518 ^a
Winter ² elk											1.000

^a p<0.05

^b p<0.10

^c p<0.20

¹ winter 1991/92

² winter 1992/93

needlegrasses comprised the largest proportions of elk diet (Table 33, 34, 35). Similarly, small-flowered penstemon was eaten at all sites but never exceeded 5% of elk diet (Table 33, 34, 35, 43, 44, 45). Douglas-fir, soopolallie, and low Oregongrape, especially at Pickering Hills (Table 35) were common browse species. This common use of forage and browse species by elk is another example of diet fidelity.

In general, spring deer diets were not positively correlated ($p > 0.20$) with deer diets in other periods. In fact, many negative correlations were found (Table 82, 83, 84). At Premier Ridge and Pickering Hills spring deer diet correlated positively with winter 1992/93 deer diets (Table 82, 84). Deer ate more grasses, in particular bluegrasses, Idaho fescue, rough fescue, orchardgrass, and smooth brome grass in the spring period and less browse (Table 16, 17, 21, 22). Forbs were also more important in the spring period.

In contrast, spring elk diets were positively correlated with summer, fall, and winter 1992/93 elk diets at Premier Ridge (Table 82) and Pickering Hills (Table 84), and with summer and fall elk diets at Peckhams Lake (Table 83). Grasses represented the highest proportion of diet composition particularly, wheatgrass species, smooth brome grass, Idaho fescue, rough fescue, bluegrass species, and needlegrass species. Additionally, alfalfa and clover, small-flowered penstemon, saskatoon, and Douglas-fir were used most consistently at Peckhams Lake (Table 33), small-flowered penstemon, saskatoon, and soopolallie were important diet components at Premier Ridge (Table 34), while small-flowered penstemon, saskatoon, low Oregongrape, ponderosa pine, Douglas-fir, and bitterbrush were prominent in elk diets at Pickering Hills (Table 35). Low Oregongrape comprised more than 25% of elk diet in all periods except April, July, and October.

Considerable diet overlap only occurred between deer and elk at Premier Ridge (Table 82) and Pickering Hills (Table 84). At Premier Ridge spring deer diet was positively correlated ($p < 0.05$) with both spring elk and winter 1992/93 elk diets. In spring deer ate grasses favoured by elk, especially bluegrass species, as well as small-flowered penstemon. In the winter both species still ate bluegrass species and small-flowered penstemon, but elk diet composition of soopolallie and Douglas-fir increased in particularly in winter 1992/93 (Table 34, 39). In the winter 1992/93 grazing period deer and elk diets were positively correlated at Pickering Hills (Table 84). Elk and deer diet composition of browse was generally highest during winter for both ungulate species. Species included; low Oregongrape, Douglas-fir, and saskatoon. Diet composition of these three species totaled 51% and 37%, respectively for elk and deer (Table 17, 22, 35, 40).

Direct competition among deer, elk and cattle was possible at Premier Ridge and Peckhams Lake in May and June, 1992 (Table 15, 16, 33, 34, 51, 52) when all three ungulates occupied these sites. The greatest potential for competition existed between elk and cattle. On both sites, Kentucky bluegrass was the principal species eaten in common by elk and cattle (Table 33, 34, 51, 52). Summer elk and cattle diets were positively correlated at Peckhams Lake ($p < 0.05$) but not at Premier Ridge (Table 82). Considerable diet separation was evident at Premier Ridge. For example, rough fescue comprised nearly 20% of elk diet on both sites during April, and on Premier Ridge only in May, but accounted for <5% of cattle diets. Similarly, Idaho fescue contributed nearly 20% to cattle diets on both sites but this species represented <10% of elk diets (Table 34, 52). Even though cattle and elk shared several grass species, the extent of direct competition during this period is difficult to assess since 50% of the elk had departed from the winter range by May 5, with the final departure on May 28 (Jamieson and Hebert 1993).

Like cattle diet, elk diet was considerably different than deer diet during July being dominated by grasses, compared to forbs and browse by deer (Table 15, 33). No direct competition was evident between cattle and deer at either Premier Ridge or Peckhams Lake in May, 1992. At Premier Ridge, nearly 75% of deer diet consisted of forbs and browse (Table 16) whereas cattle diet was dominated by grasses (>85%) (Table 52). This trend was even more evident at Peckhams Lake where forbs and browse accounted for nearly 95% of deer diet while cattle ate mostly grasses (>85%) during May (Table 15, 51). Indeed, elk and deer diets during this period were negatively correlated at both sites (Table 83).

Indirect competition may occur among deer, elk, and cattle depending upon how the foraging behavior of each animal species affects forage availability for the other species during another period of use. For example, summer forage use by cattle may reduce availability of forage for deer and elk in the fall and winter grazing periods, particularly if there is little opportunity for regrowth after cattle grazing. Just as summer or fall grazing by cattle may influence forage availability for wildlife, so too can spring grazing by wildlife affect forage availability for cattle.

The greatest potential for indirect competition at Premier Ridge, Peckhams Lake, and Pickering Hills appears to be between cattle and elk. Competition was unlikely between cattle and deer on these sites because so few species were used in common in 1992 (Table 76, 78, 80). Both winter and spring elk diets were positively correlated with summer cattle diet at all sites (Table 82, 83, 84). Like at Skookumchuck Prairie, wheatgrasses, Idaho fescue, rough fescue, bluegrasses, and needlegrasses comprised a large proportion of cattle diet on all sites in May and June and all of them occurred in elk diets in January through May in 1992 (Table 33, 34, 35, 51, 52, 53). Additionally, summer elk diet was correlated with summer cattle diet at Peckhams Lake and Pickering Hills (Table 83, 84).

Similar foraging patterns by elk were observed at Peckhams Lake and Premier Ridge in 1992 (Table 33, 34). Rough fescue and bluegrasses combined accounted for >30% of elk diet in April and May at Premier Ridge and >30% of their diet at Peckhams Lake in April. On both sites, cattle ate less rough fescue than in the Cattle Only area (>8%) (Table 49) and Combined Use area (>17% of diet in July) (Table 50) at Skookumchuck Prairie. Other species eaten by elk in April and May, and used by cattle in May, June and July included; wheatgrasses, smooth brome, Idaho fescue, bluegrasses and needlegrasses (Table 33, 34, 51, 52). Likely elk grazing on these species restricted availability for cattle in the spring and early-summer grazing periods.

Forbs comprised more than 14% and 11% of elk diets at Premier Ridge in April and May (Table 34) respectively, and 19% and 25% of deer diets in the same months. Use by deer and elk likely had little influence on summer grazing of forbs by cattle at Premier Ridge. Only seven forbs that were eaten by deer and elk in April and May occurred in cattle diets in May and June, and most of these comprised a small proportion of deer and elk diet (Table 16, 34, 52). Trends at Peckhams Lake were different with even fewer forb species eaten by cattle (Table 51). However, elk and especially deer made extensive use of alfalfa/clover in this period (Table 15, 33).

At Peckhams Lake, elk shifted from grasses to forbs as the main component of their diet in May (Table 33). Indeed, total grass in the elk diet declined from about 65% in April to 37% in May and while forbs increased from less than 30% to more than 50% of elk diet. The major substitution appears to be for rough fescue which declined from 18.0% in April to 1.6% in May. Nearly half of the forbs in the May diet, however, consisted of alfalfa and clover (Table 33). In July, alfalfa and clover had declined to 1.5% while rough fescue had increased to 30.5% of the

elk diet. In contrast to elk, grasses and forbs comprised nearly 90% and 10%, respectively of cattle diet during May at Peckhams Lake.

Although browse appeared considerably less in deer diets in March, April and May compared to December, January, and February, this forage group still averaged over 60% of deer diet at Premier Ridge (Table 16). At Peckhams Lake, browse declined from >90% of deer diet in December to average 9% in April and May (Table 13). Shrubs occurred <10% in elk diets on all three sites during April and May (Table 33, 34, 35). The greatest overlap with May/June cattle diet at Premier Ridge was for bitterbrush (Table 20, 25). This species averaged more than 5.0% in cattle diet but it only accounted for 2.4% of the April deer diet at Premier Ridge. All other shrubs were incidental in cattle diet and use by wildlife in the spring period likely did not affect their use by cattle in spring and summer.

Cattle grazed Pickering Hills in August and September 1992. Similar to all other sites, spring elk diets were most similar to the forages selected by cattle in summer and fall (Table 84). Spring elk diet and summer cattle diets were positively correlated ($p < 0.05$). Except for bluegrasses, low Oregon grape, and currant, deer and cattle diets did not overlap significantly and were not correlated. Cattle ate all of the seven grasses eaten by elk in April and May. Despite this overlap, however, it is unlikely that spring forage use by elk limited forage availability for cattle in late summer and fall on this site. The summer experienced in the Trench in 1992 was wetter than average (Table 3, 4), and cattle grazed during the dormant period for grasses.

Indirect competition between cattle, and deer and elk in the fall and winter 1992/93 grazing periods was evaluated at all sites. Summer cattle diets were positively correlated with fall and winter 1992/93 elk diets at Premier Ridge ($p < 0.20$) and Pickering Hills ($p < 0.05$ and $p < 0.10$, respectively), and with fall elk diet at Peckhams Lake ($p < 0.20$) (Table 82, 83, 84). In contrast, summer cattle diets were negatively correlated with fall deer diets at all sites, and with winter 1992/93 deer diet at Peckhams Lake ($p < 0.20$).

Wheatgrasses, smooth brome, Idaho fescue, rough fescue, bluegrasses, and needlegrasses again comprised the major portion of summer cattle and fall elk diets at all sites, and summer cattle diets and winter 1992/93 elk diets (Table 33, 34, 35, 51, 52, 53) at Premier Ridge and Pickering Hills. At Peckhams Lake in the winter 1992/93 period elk diets contained more low Oregon grape, Douglas-fir, currant, and willow, and fewer grasses.

Cattle were grazed in May and June at Premier Ridge and Peckhams Lake in 1992. Despite the similarities between cattle and elk diets for grass, the extent to which spring cattle grazing affected fall and winter forage availability for elk in 1992 was likely low. Above normal precipitation in June (59.3 mm) and July (77.0 mm) provided adequate soil moisture for plant regrowth on both sites (Table 3, 4).

Elk and cattle diets are dominated by the same grass species on Premier Ridge as on Skookumchuck Prairie (Table 32, 34, 50, 52); wheatgrass species, smooth brome grass, Idaho fescue, rough fescue, bluegrass species, and needlegrass species. Indeed, these species comprised over 70% of elk diet in the winter and spring periods and nearly 70% in the cattle grazing period (Table 20, 26, 38). Although summer cattle diet and fall elk diet were positively correlated ($p < 0.20$), elk diet was broader during this period consisting of forbs such as balsamroot, and browse species such as rabbitbrush and ponderosa pine (Table 34, 52, 85).

Except for bitterbrush at Premier Ridge, there was little diet overlap between cattle with deer and elk for forbs and browse. Similar to Skookumchuck Prairie, the greatest dietary

overlaps at Peckhams Lake occurred between deer and elk for Douglas-fir in November and December (Table 15, 33).

The highest potential for indirect competition between cattle and wildlife in 1992 occurred at Pickering Hills. Cattle grazed this deer and elk winter range in August and September. Again, grasses dominated the cattle diet (nearly 80%) with wheatgrasses, Idaho fescue, bluegrasses and needlegrasses providing most of the forage (Table 53). All of these species were eaten by elk from October to December. Needlegrass accounted for >10% of deer diet in December (Table 21). Indeed, summer cattle diets were positively correlated with both fall ($p<0.05$) and winter ($p<0.10$) elk diets (Table 84). Cattle use of forbs and browse on this site, however, probably had little influence on elk and deer fall and winter foraging patterns.

In 1992, there was potentially indirect competition between all species in one period or another at all sites. The spring wildlife grazing period overlapped somewhat at Premier Ridge and Peckhams Lake, while the fall cattle grazing period led directly into the fall wildlife period at Pickering Hills. Indeed, some degree of overlap appears to be almost continuous between elk and cattle throughout the year at Premier Ridge. Additionally, deer diets in spring were positively correlated with spring elk diet (Table 84). This high degree of diet similarity implies that ungulates, in particular elk and cattle, could be placing the condition of the range at risk with continuous defoliation of preferred species.

Diet Overlap - 1993

Cattle, deer, and elk diets all overlapped at Premier Ridge, Peckhams Lake, and Pickering Hills in 1993 (Table 85, 86, 87, 88, 89, 90). Cattle grazed at all sites in fall 1993 (Table 5) so there is the potential for different relationships between cattle, deer, and elk diets.

The range in the number of common plant species in the diets of cattle, deer, and elk was relatively consistent at all sites in 1993. Cattle and deer ate between 33% and 42% species in common while cattle and elk ate between 37% and 40% in common (Table 85, 87, 89). The greatest number of species eaten in common in 1993 was between deer and elk (Table 86, 88, 90).

At all sites the number of species cattle ate in common with deer and elk had similar patterns. Cattle ate from 8 to 10 grass species in common with deer, and 9 to 10 grass species in common with elk at the three sites (Table 85, 87, 89). In contrast, cattle ate from 12 to 20, and 12 to 15 different forb species than deer and elk, respectively.

No direct competition between cattle, deer, and elk occurred in 1993 during the growing season as cattle were not turned-out until late-summer and early-fall. Some direct competition was possible in the fall when wildlife begin to return to the winter range. Jamieson and Hebert (1993) reported that 50% of elk reached the Premier Ridge winter range on November 3, 1993, while 50% of elk in the Bull River herd did not reach the winter range until November 27, 1993. Cattle grazed Premier Ridge from August 1 to August 22 in 1993, Peckhams Lake from September 1 to September 15 (Table 5), so some direct competition was possible on these sites, but cattle grazing likely had little impact on deer and elk foraging behavior as wildlife numbers were low during these periods.

Although inter-specific competition was possible between deer and elk at all sites (Table 91, 92, 93), Spearman's rank correlation indicated that deer and elk diets were only positively correlated in the winter 1992/93 period at Pickering Hills ($p<0.05$) (Table 93) and were similar in the spring period at Premier Ridge ($p<0.20$) (Table 91). At Pickering Hills deer and elk diets primarily in the use of Douglas-fir and low Oregon grape (Table 33, 39). Deer ate >20%

Table 85. Number of common and different species in cattle diets compared to elk and deer at Premier Ridge in 1993.

		Grasses	Forbs	Shrubs	Total	%
Deer	Common	10	4	4	18	42
	Different	2	14	9	25	58
Elk	Common	11	3	4	18	37
	Different	2	20	9	31	63

Table 86. Number of common and different species in deer and elk diets at Premier Ridge in 1993.

	Grasses	Forbs	Shrubs	Total	%
Common	11	11	11	33	70
Different	2	9	3	14	30

Table 87. Number of common and different species in cattle diets compared to elk and deer at Peckhams Lake in 1993.

		Grasses	Forbs	Shrubs	Total	%
Deer	Common	8	5	3	16	36
	Different	3	15	11	29	64
Elk	Common	11	5	3	19	37
	Different	2	18	12	31	63

Table 88. Number of common and different species in deer and elk diets at Peckhams Lake in 1993.

	Grasses	Forbs	Shrubs	Total	%
Common	8	13	13	34	63
Different	5	12	3	20	27

Table 89. Number of common and different species in cattle diets compared to elk and deer at Pickering Hills in 1993.

		Grasses	Forbs	Shrubs	Total	%
Deer	Common	9	3	5	17	33
	Different	3	20	12	35	67
Elk	Common	10	1	6	17	40
	Different	3	16	7	26	60

Table 90. Number of common and different species in deer and elk diets at Pickering Hills in 1993.

	Grasses	Forbs	Shrubs	Total	%
Common	11	15	13	39	75
Different	2	9	2	13	25

Table 91. Summary of Spearman rank correlation coefficients at Premier Ridge in 1993.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer cattle	Winter ² deer	Winter ² elk
Winter ¹ deer	1.000	0.017	0.502 ^a	0.035	-0.230	0.452 ^a	-0.108
Winter ¹ elk		1.000	0.249	0.383 ^a	0.315 ^c	0.232	0.539 ^a
Spring deer			1.000	0.250 ^c	-0.175	0.578 ^a	0.178
Spring elk				1.000	0.307 ^b	0.378 ^a	0.580 ^a
Summer cattle					1.000	0.006	0.430 ^a
Winter ² deer						1.000	0.246
Winter ² elk							1.000

Table 92. Summary of Spearman rank correlation coefficients at Peckhams Lake in 1993.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer cattle	Winter ² deer	Winter ² elk
Winter ¹ deer	1.000	0.032	0.150	-0.002	-0.279 ^c	0.103	-0.117
Winter ¹ elk		1.000	-0.003	0.182	0.026	0.087	0.386 ^b
Spring deer			1.000	0.124	-0.048	0.237 ^c	0.121
Spring elk				1.000	0.555 ^a	0.196	0.630 ^a
Summer cattle					1.000	-0.275 ^c	0.228
Winter ² deer						1.000	0.222
Winter ² elk							1.000

^a p<0.05^b p<0.10^c p<0.20¹ winter 1992/93² winter 1993/94

Table 93. Summary of Spearman rank correlation coefficients at Pickering Hills in 1993.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer cattle	Winter ² deer	Winter ² elk
Winter ¹ deer	1.000	0.518 ^a	0.070	0.101	-0.015	0.174	0.169
Winter ¹ elk		1.000	-0.032	0.371 ^a	0.388 ^a	-0.020	0.601 ^a
Spring deer			1.000	0.087	-0.084	0.110	-0.217
Spring elk				1.000	0.551 ^a	-0.345 ^a	0.442 ^a
Summer cattle					1.000	-0.345 ^a	0.357 ^b
Winter ² deer						1.000	0.101
Winter ² elk							1.000

^a p<0.05

^b p<0.10

¹winter 1992/93

²winter 1993/94

Douglas-fir in November, 1992 (Table 17) and January and February in 1993 (Table 22), and >10% low Oregon grape in November and December, 1992, and January, 1993. Elk diet averaged >20% for Douglas-fir and ranged from 7% to 16% for low Oregon grape (Table 35, 40). Deer and elk also ate Saskatoon, current, soopolallie, and willow/aspen species in common. Browse use by deer and elk was somewhat different on buckbrush and bitterbrush. Elk only browsed buckbrush in December, 1992 (10.6%) and did not browse bitterbrush >4% during winter 1992/93. Deer ate >9% buckbrush in November, January, and February and >15% bitterbrush during the same months.

Deer and elk spring diets were positively correlated ($p < 0.20$) at Premier Ridge in 1993 (Table 91). This positive correlation likely resulted from the increase in deer dietary composition of grasses but the correlation was low as deer were still browsing Douglas-fir and bitterbrush, as a dominant part of their diet. Total diet composition of these two species was 64.0% in March and 52.9% in April (Table 21).

Some dietary overlap occurred within species, but between grazing periods. At Premier Ridge winter 1992/93 period deer diet was positively correlated ($p < 0.05$) with both spring and winter 1993/94 deer diets (Table 91). Spring deer diets were positively correlated with winter 1993/94 deer diets at Premier Ridge ($p < 0.05$) and Peckhams Lake ($p < 0.20$). Deer diets from different periods at Premier Ridge were positively correlated mainly because deer browsed Douglas-fir, bitterbrush, buckbrush, soopolallie, and small-flowered penstemon between these grazing periods (Table 16, 21, 26). Deer at Peckhams Lake also ate a small number of species in common. Douglas-fir, was browsed >51% and >20% in March and April, respectively (Table 20), and from 35 to 55% in the winter 1993/94 period (Table 20, 25). Alfalfa/clover, small-flowered penstemon, and orchardgrass were also eaten between grazing periods at Peckhams Lake in 1993 (Table 20, 25).

In contrast to winter 1992/93 deer diets, winter 1992/93 elk diets, were positively correlated with winter 1993/94 elk diets at all sites (Table 91, 92, 93), and with spring elk diet at Premier Ridge (Table 91) and Pickering Hills (Table 93). In addition, spring elk diets were positively correlated with winter 1993/94 elk diets at all sites (Table 91, 92, 93). Again, as in 1992, elk are expressing diet fidelity. At Premier Ridge elk ate mostly grasses during these periods. Wheatgrass, bluegrass, and needlegrass species, plus rough fescue, Idaho fescue, smooth brome grass, and orchardgrass were the common grass species (Table 34, 39, 44). Willow, aspen, soopolallie, and Douglas-fir were browse eaten by elk in all periods. Alfalfa/clover was eaten in the spring period, while small-flowered penstemon was eaten in both winter periods and in spring (Table 34, 39, 44). At Pickering Hills (Table 35, 40, 45) elk ate the same grass and shrub genera in the winter and spring periods as did elk at Premier Ridge. Elk also browsed low Oregon grape and currant species in both periods. The most important differences between winter 1992/93 and winter 1993/94 diets, compared to spring elk diet in 1993 was in the diet composition of browse among periods. In particular, elk browsed Douglas-fir between 8% and 21% in their winter 1992/93 and winter 1993/94 diet but Douglas-fir was not present in spring diets (Table 35, 40, 45). Moreover, alfalfa and clover were only found in spring diets. At both Premier Ridge and Pickering Hills, Saskatoon comprised up to 12% in the winter but rarely occurred in spring diets (Table 34, 35, 39, 40, 44, 45).

In 1993, cattle grazed in late summer or fall at all sites (Table 5) and inter-specific competition was possible between cattle and elk. Winter 1992/93 elk diets were positively correlated with summer cattle diets at Premier Ridge ($p < 0.20$) and Pickering Hills ($p < 0.05$) (Table 91, 93). Spring elk diet was positively correlated with summer cattle diets at all sites

(Table 91, 92, 93). As in 1992, cattle and elk ate wheatgrass, bluegrass, and needlegrass species, plus rough fescue, Idaho fescue, smooth brome grass, and orchardgrass in common. Although winter 1992/93 elk diet and summer cattle diet contain the same grass species at Peckhams Lake, the diets are not correlated because elk ate less grass in winter while diet composition of Douglas-fir averaged 20.0% (Table 33, 38).

Summer cattle diet was only positively correlated to winter 1993/94 elk diet at Premier Ridge ($p < 0.05$) and Pickering Hills ($p < 0.10$). Cattle and elk both ate >10% Idaho fescue, wheatgrass and bluegrass species at Premier Ridge (Table 39, 44, 57). They also ate smooth brome grass and needlegrass species in common. Winter 1993/94 elk diets contained 16% rough fescue (Table 39, 44) while rough fescue was <1% of summer cattle diet (Table 57). Browse averaged 10% of elk diet in December to February of 1992/93 (Table 38, 56) and >8% of cattle diet (Table 57), but elk browsing was distributed over 6 species, while cattle browsed primarily bitterbrush (7%) (Table 57).

At Pickering Hills summer cattle and winter 1993/94 elk diets were positively correlated ($p < 0.10$) but their use differed on several key species (Table 93). Wheatgrass, bluegrass, needlegrass species, and Idaho fescue, comprised 57% of summer cattle diet (Table 58), while these species combined, averaged slightly >18% of winter 1993/94 elk diet (Table 40, 45). Elk browsed low Oregon grape (>23% to >46%), Douglas-fir (8% to 17%), and currant species (>18% in January), to account for an average of 55% of their diet (Table 40, 45). Cattle ate <8.0% combined of these three species (Table 58).

At Peckhams Lake summer cattle diet was positively correlated with both spring elk diet ($p < 0.05$) and winter 1993/94 elk diet ($p < 0.05$) (Table 92). Cattle diets at Peckhams Lake comprised >11% each of smooth brome grass, wheatgrass, bluegrass, and needlegrass species, as well as more than 6% of bentgrass, cheatgrass, orchardgrass and Idaho fescue (Table 56). Elk concentrated on a smaller number of species, in particular, orchardgrass and smooth brome grass which averaged >20% and >13%, respectively over the winter 1993/94 period (Table 38, 43). Similar amounts of wheatgrasses, Idaho fescue, rough fescue, bluegrasses and alfalfa/clover were also important in winter elk diet at Peckhams Lake (Table 38, 43).

Summer cattle and winter 1993/94 deer diets were negatively correlated at Peckhams Lake (Table 92) and Pickering Hills (Table 93). As mentioned above, cattle diets at Peckhams were comprised mainly of smooth brome grass, wheatgrass, bluegrass, and needlegrass species, as well as bentgrass, cheatgrass, orchardgrass and Idaho fescue. In contrast Douglas-fir comprised >35% in the winter of 1993/94 (Table 20, 25). Both small-flowered penstemon and alfalfa/clover averaged >10% of deer diet composition in winter 1993/94 (Table 20, 25).

At Pickering Hills cattle ate mainly wheatgrass, bluegrass, and needlegrass species, in addition to Idaho fescue while deer focused on low Oregon grape and Douglas-fir. These latter two species together averaged >34% of winter 1993/94 diet. Cattle and deer both ate bitterbrush, with deer eating slightly more, averaging 7.3% over all sampling periods. Cattle diet composition averaged <4% bitterbrush (Table 58).

Diet Overlap - 1994

In 1994 cattle were grazed at Premier Ridge (early-spring), at Peckhams Lake (early-summer), and at Pickering Hills (in late-summer)(Table 5). Cattle, deer, and elk diets all overlapped at these sites (Table 94, 95, 96, 97, 98, 99).

The number of species common to both deer and cattle diets ranged from 35% to 50% at Premier Ridge and Pickering Hills (Table 94, 98). Common species in elk and cattle diets were about equal at Premier Ridge (Table 94) and Pickering Hills (Table 98) and lowest at Peckhams Lake (Table 96). Cattle and deer ate 7 to 11 grass species in common at these sites.

Cattle and elk ate the same grass species, with the exception of sedges at Peckhams Lake and orchardgrass at Premier Ridge and Pickering Hills (Table 43, 44, 45, 61, 62, 63). Cattle and deer ate 3 to 7 forbs in common, while cattle and elk showed a similar trend (Table 94, 96, 98). Moreover, the numbers of common and different shrubs in cattle diet, compared with deer and elk diet, followed a similar pattern on all sites. (Table 94, 96, 98).

As in 1992 and 1993, deer and elk diets in 1994 were the most similar regarding the number of species eaten in common. The number of species eaten in common ranged from 62% at Peckhams Lake to 71% at Premier Ridge (Table 95, 97, 99).

Deer diets overlapped the most between grazing periods at Premier Ridge (Table 100). Winter 1993/94 deer diet was positively correlated ($p < 0.05$) with spring, fall, and winter 1994 deer diets. At Peckhams Lake winter 1993/94 deer diet was only positively correlated with spring deer diet (Table 101), while at Pickering Hills winter 1993/94 deer diet was only positively correlated with deer diet in winter 1994/95 (Table 102).

Spring deer diets were positively correlated with winter 1994/95 deer diets at all sites, and with fall deer diet at Premier Ridge only (Table 100). Fall deer diet was also positively correlated with winter 1994 deer diet at Premier Ridge.

Species dominating deer diet composition at Premier Ridge included Douglas-fir, bitterbrush, soopolallie, and small-flowered penstemon. Indeed, these four species were eaten in all sampling periods. Douglas-fir and bitterbrush in particular were the dominant species in almost all periods (Table 26). Although deer focused their browsing on a small number of shrubs at Peckhams Lake and Pickering Hills, diets were more diverse than at Premier Ridge. In addition to Douglas-fir and bitterbrush, soopolallie, ponderosa pine, low Oregongrape, Saskatoon, small-flowered penstemon, alfalfa/clover, orchardgrass, and rough fescue were important species at these two sites but their composition in deer diet varied (Table 25, 27) and thus diets were less similar between periods than at Premier Ridge.

Winter 1993/94 elk diets were positively correlated with spring, fall, and winter 1994 elk diets at all sites, except at Pickering Hills (Table 100, 101, 102). Spring diets also consistently showed positive correlations with elk diets in later grazing periods at all sites. As in 1992 and 1993 (Table 100, 101, 102), grasses were the most important component of elk diet, particularly wheatgrass species, smooth brome grass, Idaho fescue, rough fescue, bluegrass species, and needlegrass species. In addition to the grass species; alfalfa/clover, small-flowered penstemon, Saskatoon, and Douglas-fir were used most consistently by elk at Peckhams Lake (Table 43). Small-flowered penstemon, Saskatoon, and soopolallie were important at Premier Ridge (Table 44), while small-flowered penstemon, Saskatoon, low Oregongrape, ponderosa pine, Douglas-fir, and bitterbrush were prominent at Pickering Hills (Table 45). Summer elk diets were not positively correlated with either spring, or winter 1994 elk diets at any site (Table 100, 101, 102). Summer and fall elk diets were positively correlated at Peckhams Lake (Table 101),

Table 94. Number of common and different species in cattle diets compared to elk and deer at Premier Ridge in 1994.

		Grasses	Forbs	Shrubs	Total	%
Deer	Common	11	7	4	22	50
	Different	1	10	11	22	50
Elk	Common	11	8	5	24	48
	Different	0	15	11	26	52

Table 95. Number of common and different species in deer and elk diets at Premier Ridge in 1994.

	Grasses	Forbs	Shrubs	Total	%
Common	11	11	12	34	71
Different	1	10	3	14	29

Table 96. Number of common and different species in cattle diets compared to elk and deer at Peckhams Lake in 1994.

		Grasses	Forbs	Shrubs	Total	%
Deer	Common	10	7	3	20	43
	Different	2	14	10	26	57
Elk	Common	11	4	2	17	37
	Different	1	15	13	29	63

Table 97. Number of common and different species in deer and elk diets at Peckhams Lake in 1994.

	Grasses	Forbs	Shrubs	Total	%
Common	11	9	11	31	62
Different	1	13	5	19	38

Table 98. Number of common and different species in cattle diets compared to elk and deer at Pickering Hills in 1994.

		Grasses	Forbs	Shrubs	Total	%
Deer	Common	7	3	5	15	35
	Different	5	15	8	28	65
Elk	Common	11	5	6	22	52
	Different	1	10	9	20	48

Table 99. Number of common and different species in deer and elk diets at Pickering Hills in 1994.

	Grasses	Forbs	Shrubs	Total	%
Common	8	12	13	33	69
Different	4	8	3	15	31

Table 100. Summary of Spearman rank correlation coefficients at Premier Ridge in 1994.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer elk	Summer cattle	Fall deer	Fall elk	Winter ² deer	Winter ² elk
Winter ¹ deer	1.000	0.246	0.491 ^a	0.118	-0.050	0.083	0.466 ^a	0.058	0.515 ^a	0.246
Winter ¹ elk		1.000	0.020	0.568 ^a	0.084	0.465 ^a	-0.211	0.444 ^a	-0.275	0.679 ^a
Spring deer			1.000	-0.061	-0.116	-0.087	0.363 ^b	-0.101	0.286 ^c	0.038
Spring elk				1.000	-0.012	0.396 ^a	-0.274	0.416 ^a	-0.287	0.562 ^a
Summer elk					1.000	0.177	0.102	0.105	-0.235	-0.007
Summer cattle						1.000	-0.203	0.182	-0.283	0.343 ^b
Fall deer							1.000	-0.204	0.416 ^b	-0.157
Fall elk								1.000	-0.248	0.433 ^a
Winter ² deer									1.000	-0.134
Winter ² elk										1.000

^a p<0.05

^b p<0.10

^c p<0.20

¹winter 1993/94

²winter 1994/95

Table 101. Summary of Spearman rank correlation coefficients at Peckhams Lake in 1994.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer deer	Summer elk	Summer cattle	Fall deer	Fall elk	Winter ² deer	Winter ² elk
Winter ¹ deer	1.000	0.222	0.503 ^a	0.196	-0.229	-0.035	-0.269	0.147	0.050	0.127	0.018
Winter ¹ elk		1.000	0.249	0.739 ^a	-0.411 ^b	0.242	0.059	0.081	0.381 ^b	0.014	0.549 ^a
Spring deer			1.000	0.296 ^c	-0.054	0.207	-0.128	-0.116	0.043	0.336 ^b	0.068
Spring elk				1.000	-0.052	0.417 ^a	0.381 ^b	0.029	0.418 ^a	0.129	0.631 ^a
Summer deer					1.000	0.167	-0.377 ^c	-0.222	-0.053	-0.177	-0.237
Summer elk						1.000	0.265	0.021	0.284 ^c	-0.182	0.062
Summer cattle							1.000	0.039	0.427 ^a	-0.078	0.154
Fall deer								1.000	0.194	-0.153	-0.005
Fall elk									1.000	-0.063	0.158
Winter ² deer										1.000	-0.015
Winter ² elk											1.000

^a p<0.05

^b p<0.10

^c p<0.20

¹ winter 1993/94

² winter 1994/95

Table 102. Summary of Spearman rank correlation coefficients at Pickering Hills in 1994.

	Winter ¹ deer	Winter ¹ elk	Spring deer	Spring elk	Summer elk	Summer cattle	Fall deer	Winter ² deer	Winter ² elk
Winter ¹ deer	1.000	-0.103	0.274	-0.154	-0.323	-0.306	-0.189	0.459 ^a	-0.100
Winter ¹ elk		1.000	0.050	0.416 ^a	-0.176	0.420 ^a	-0.359 ^a	-0.045	0.526 ^a
Spring deer			1.000	0.099	-0.117	0.069	0.098	0.426 ^a	0.065
Spring elk				1.000	-0.111	0.280	-0.396 ^a	-0.276	0.702 ^a
Summer elk					1.000	-0.153	-0.053	-0.447 ^a	-0.043
Summer cattle						1.000	-0.272	-0.319 ^a	0.197
Fall deer							1.000	-0.130	-0.419 ^a
Winter ² deer								1.000	-0.158
Winter ² elk									1.000

^a p<0.05

¹ winter 1993/94

² winter 1994/95

although not at Premier Ridge (Table 100).

The most important difference, at all sites, between summer elk diet and elk diets in other periods, appears to be the elk diet composition of alfalfa/clover in the summer period. Elk grazing of these domestic forbs in June ranged between 27% at Pickering Hills and 31% at Peckhams Lake (Table 43, 44, 45). Fall elk diet and winter 1994 elk diet were only positively correlated ($p < 0.05$) at Premier Ridge (Table 100). The largest differences in fall and winter 1994 elk diets at Peckhams Lake was in the use of alfalfa (15.1%) in October and Douglas-fir (12.2%) in December, 1994.

In 1994, only one incidence of significant dietary overlap was found between deer and elk, on all sites, and during all grazing periods. Deer and elk diets were positively correlated ($p < 0.20$) at Peckhams Lake (Table 101) in the spring period mainly because deer increased use of grasses in spring, particularly orchardgrass, and because of the common use by deer and elk of small-flowered penstemon, alfalfa/clover, and Douglas-fir (Table 25, 43).

Dietary overlap was possible in 1994 between deer, elk, and cattle at Premier Ridge in May and June, and in June at Peckhams Lake. At Peckhams Lake cattle were not turned-out until June 25 so direct competition was likely not a factor in diet selection by any species. Summer cattle and elk diets were not positively correlated at either site (Table 100, 101). Although they ate the same grass species in common, elk diet composition at all sites was $>25\%$ alfalfa and clover, while cattle diets contained $<7\%$ at either site. Alfalfa/clover were not eaten by cattle at Pickering Hills (Table 63). Deer and cattle diets did not overlap substantially between winter, spring, and summer at any site. Deer and elk spring diets were positively correlated at Peckhams Lake, but not deer and cattle diets (Table 101).

The greatest possibility for indirect competition between the winter, spring, and summer periods occurred between elk and cattle. Winter elk diets were positively correlated with summer cattle diets at all sites in 1994 (Table 100, 101, 102). Wheatgrasses, Idaho fescue, rough fescue, smooth brome grass, cheatgrass, bluegrasses, and needlegrasses were important forages for elk in 1994, comprising between 26% and 64% of winter 1993/94 elk diets at Pickering Hills and Premier Ridge (Table 39, 40, 44, 45), respectively. These same species accounted for 64% and 77% of summer cattle diets at the same sites (Table 62, 63).

Spring elk diets and summer cattle diets were positively correlated at both Premier Ridge ($p < 0.05$) and Peckhams Lake ($p < 0.10$), but not at Pickering Hills (Table 100, 101, 102). Elk and cattle diets were dominated by the same grass species as above at all sites. Elk, however, relied on low Oregon grape for $>35\%$ of both their winter and spring diets at Pickering Hills (Table 40, 45). Additionally, cattle did not graze the Pickering Hills site until July 26 in 1994 (Table 5).

Indirect competition was also possible between summer cattle diets, and deer and elk diets in the fall and winter. Cattle diets, however, were not correlated with deer diets during either fall or winter at any site. Cattle diets were positively correlated with winter 1994/95 elk diet at Premier Ridge ($p < 0.10$) (Table 100) and fall elk diet ($p < 0.05$) at Peckhams Lake (Table 101). The same grass species were present in both cattle and elk diets during all foraging periods and at all sites (Table 43, 44, 45, 61, 62, 63). At Premier Ridge, summer cattle and winter elk diet composition of wheatgrasses, smooth brome grass, and bluegrasses averaged $>36\%$ of both diets. Fall elk and summer cattle diets differed at Premier Ridge primarily in the dietary composition of rough fescue ($>21\%$ and $<3\%$, respectively) and Idaho fescue ($>6\%$ and $>17\%$, respectively). In December, 1994 elk diet at Peckhams Lake comprised 54% of the principal grass species; wheatgrasses, smooth brome grass, orchardgrass, Idaho fescue, rough

fescue, bluegrasses, and needlegrasses (Table 43). Elk diet also contained 28% browse species, in particular Douglas-fir (10%). Browse species were not included in cattle diets at Peckhams Lake in 1994 (Table 61).

Summer cattle diets were not correlated with winter 1994 elk diet at Pickering Hills (Table 102). Although both species ate wheatgrasses, smooth brome grass, fescues, bluegrasses, and needlegrasses, the principal species in elk diet was low Oregon grape (Table 57). Low Oregon grape provided 25% of elk diet in the 1994 winter period, while cattle ate 11% of this species (Table 63).

4.1.6 Dietary Diversity - 1992 to 1994 - All Sites

The Shannon-Weiner Diversity Index (SWDI) is calculated on a combination of the abundance of species in the diet as well as the number of species in the diet. A low SWDI with a high number of species indicates that ungulate is concentrating its foraging on a relatively few number of species. A high SWDI indicates that the ungulate distributes its foraging more evenly over the full range of species in the diet. The SWDI of most cattle, deer, and elk seasonal diets commonly ranged between 2.0 and 2.9 with 20 to 27 species eaten (Table 103, 104, 105, 106, 107). However, the lowest SWDI value was calculated for fall deer diet at Premier Ridge in 1994 where deer ate 9 species and the index was 1.1 (Table 108), while the highest value was spring deer diet at Peckhams Lake in 1993, where deer ate 29 species (SWDI=3.1) (Table 106), and spring elk diet at Premier Ridge (29 species, SWDI=3.1) (Table 106).

In general, at all sites, winter deer diets were the least diverse. Although they ranged from 1.5 at Peckhams Lake (20 species) in 1992, to 2.6 at Premier Ridge (28 species) in 1993/94, most winter deer diets had indices less than 2.0 and were comprised of less than 20 species (Table 103, 104, 105, 106, 107). Spring deer diet was commonly the most diverse of all ungulate diets in all periods and at all sites. Deer commonly ate 20 to 30 species during spring and SWDIs varied from a low of 2.1 to a high of 3.1, but usually ranged from 2.4 to 2.9 (Table 103, 104, 105, 106, 107).

Trends in dietary diversity for elk did not follow the same pattern as deer. Indeed, elk diets were less diverse in spring and summer. For example, in the Combined Use Area at Skookumchuck Prairie, spring elk diet SWDIs ranged from 2.2 to 2.4 (16 to 21 species) (Table 103, 105, 107). At Peckhams Lake in 1993, however, spring elk diet SWDI equaled 3.0 (29 species), and at Premier Ridge (29 species) the SWDI equaled 3.1 (Table 106). These diets were among the most diverse diets in all years, for all sites, and for all ungulate species (Table 103, 104, 105, 106, 107, 108).

Fall and winter elk diets in general, are the most diverse, but they can also be quite narrow. In 1992, at all sites, except fall elk diet at Peckhams Lake, the SWDI for elk fall and winter 1992/93 elk diets ranged between 2.7 and 3.0 (21 to 28 species) (Table 103, 104). In contrast, for fall elk diet at Peckhams Lake in 1992, and winter 1993/94 diet at both Skookumchuck Prairie sites, Peckhams Lake, and Pickering Hills, the SWDI ranged from 2.1 to 2.4 (19 to 24 species) (Table 105, 106). Variation can occur within years and sites also. In 1994, the SWDI for winter elk diet at the Wildlife Only and Combined Use areas at Skookumchuck Prairie equaled 2.4 with 19 and 21 species eaten, respectively, while the SWDI's for fall elk diet in the Combined Use area, and at Peckhams Lake ranged between 2.7 and 3.0 (23 to 25 species) (Table 107, 108).

Table 103. Shannon-Weiner Diversity Index for deer, elk, and cattle diets at Skookumchuck Prairie in 1992.

File Name	Number of species (S)	Abundance (N)	Shannon-Weiner Index
Combined Use Area			
Winter 92 Deer	18	98	2.2
Winter 92 Elk	26	97	2.7
Spring Deer	26	96	3.0
Spring Elk	21	99	2.2
Summer Cattle	24	104	2.7
Summer Deer	22	96	2.6
Summer Elk	21	99	2.4
Fall Deer	22	99	2.5
Fall Elk	27	98	2.8
Winter 92/93 Deer	12	100	1.7
Winter 92/93 Elk	24	101	2.8
Cattle Only			
Summer Cattle	22	99	2.7
Wildlife Only			
Winter 92 Deer	21	100	2.5
Winter 92 Elk	22	100	2.7
Spring Deer	25	98	2.8
Spring Elk	25	99	2.7
Winter 92/93 Deer	13	101	1.9
Winter 92/93 Elk	22	97	2.7

Table 104. Shannon-Weiner diversity index for deer, elk, and cattle diets at Premier Ridge, Peckhams Lake, and Pickering Hills in 1992.

Site	Number of species (S)	Abundance (N)	Shannon-Weiner Index
Premier Ridge			
Winter 92 Deer	16	98	2.3
Winter 92 Elk	22	101	2.4
Spring Deer	28	96	2.8
Spring Elk	20	95	2.5
Summer Deer	27	104	2.6
Summer Elk	30	102	2.9
Summer Cattle	16	95	2.3
Fall Deer	29	102	2.9
Fall Elk	28	101	3.0
Winter 92/93 Deer	18	99	1.9
Winter 92/93 Elk	23	98	2.8
Peckhams Lake			
Winter 92 Deer	17	97	1.5
Winter 92 Elk	23	96	2.8
Spring Deer	27	101	2.4
Spring Elk	27	100	2.9
Summer Deer	26	99	2.8
Summer Elk	20	98	2.4
Summer Cattle	16	98	2.3
Fall Deer	30	101	2.8
Fall Elk	21	101	2.5
Winter 92/93 Deer	20	102	1.5
Winter 92/93 Elk	25	98	2.7

Table 104. (continued)

Site	Number of species (S)	Abundance (N)	Shannon-Weiner Index
Pickering Hills			
Winter 92 Deer	12	99	1.6
Winter 92 Elk	21	98	2.0
Spring Deer	21	102	2.6
Spring Elk	24	99	2.7
Summer Deer	16	100	2.3
Summer Elk	19	101	2.1
Summer Cattle	26	99	2.7
Fall Deer	20	96	2.6
Fall Elk	22	99	2.8
Winter 92/93 Deer	19	96	2.3
Winter 92/93 Elk	25	100	2.8

Table 105. Shannon-Weiner Diversity Index for deer, elk, and cattle diets at Skookumchuck Prairie in 1993.

File Name	Number of species (S)	Abundance (N)	Shannon-Weiner Index
Combined Use			
Winter 92/93 Deer	12	100	1.7
Winter 92/93 Elk	24	101	2.8
Spring Deer	15	101	2.0
Spring Elk	18	100	2.4
Summer Cattle	20	98	2.5
Winter 93/94 Deer	24	85	2.7
Winter 93/94 Elk	21	99	2.3
Cattle Only			
Summer Cattle	17	98	2.4
Wildlife Only			
Winter 92/93 Deer	13	101	1.9
Winter 92/93 Elk	22	97	2.7
Spring Deer	23	98	2.5
Spring Elk	23	105	2.7
Winter 93/94 Deer	16	98	2.3
Winter 93/94 Elk	21	101	2.6

Table 106. Shannon-Weiner diversity index for deer, elk, and cattle diets at Premier Ridge, Peckhams Lake, and Pickering Hills in 1993.

Site	Number of species (S)	Abundance (N)	Shannon-Weiner Index
Premier Ridge			
Winter 92/93 Deer	18	99	1.9
Winter 92/93 Elk	23	98	2.8
Spring Deer	18	98	2.1
Spring Elk	29	121	3.1
Summer Cattle	18	100	2.5
Winter 93/94 Deer	27	98	2.6
Winter 93/94 Elk	23	96	2.7
Peckhams Lake			
Winter 92/93 Deer	20	102	1.5
Winter 92/93 Elk	25	98	2.7
Spring Deer	30	103	2.7
Spring Elk	29	97	3.0
Summer Cattle	16	99	2.6
Winter 93/94 Deer	17	98	2.0
Winter 93/93 Elk	19	97	2.5
Pickering Hills			
Winter 92/93 Deer	19	96	2.3
Winter 92/93 Elk	25	100	2.8
Spring Deer	29	99	3.1
Spring Elk	29	99	3.0
Summer Cattle	21	103	2.5
Winter 93/94 Deer	22	97	2.1
Winter 93/93 Elk	24	101	2.4

Table 107. Shannon-Weiner Diversity Index for deer, elk, and cattle diets at Skookumchuck Prairie in 1994.

File Name	Number of species (S)	Abundance (N)	Shannon-Weiner Index
Combined Use			
Winter 93/94 Deer	24	85	2.7
Winter 93/94 Elk	25	101	2.6
Spring Deer	22	101	2.6
Spring Elk	16	100	2.2
Summer Elk	23	101	2.7
Summer Cattle	22	96	2.6
Fall Deer	20	104	2.0
Fall Elk	23	99	2.7
Winter 94 Deer	22	102	2.7
Winter 94 Elk	19	100	2.4
Cattle Only			
Summer Beef	19	103	2.6
Wildlife Only			
Winter 93/94 Deer	16	98	2.3
Winter 93/94 Elk	22	96	2.6
Spring Deer	21	99	2.3
Spring Elk	22	99	2.5
Summer Deer	18	101	2.4
Summer Elk	19	102	2.1
Winter 94 Deer	21	96	2.4
Winter 94 Elk	21	100	2.4

Table 108. Shannon-Weiner diversity index for deer, elk, and cattle diets at Premier Ridge, Peckhams Lake, and Pickering Hills in 1994.

Site	Number of species (S)	Abundance (N)	Shannon-Weiner Index
Premier Ridge			
Winter 93/94 Deer	28	99	2.6
Winter 93/94 Elk	23	96	2.7
Spring Deer	24	98	2.5
Spring Elk	21	98	2.5
Summer Elk	25	101	2.6
Summer Cattle	21	99	2.5
Fall Deer	9	94	1.1
Fall Elk	24	100	2.8
Winter 94 Deer	18	97	2.1
Winter 94 Elk	24	101	2.6
Peckhams Lake			
Winter 93/94 Deer	17	98	2.0
Winter 93/94 Elk	19	97	2.5
Spring Deer	25	100	2.4
Spring Elk	23	99	2.8
Summer Deer	15	98	1.7
Summer Elk	22	106	2.5
Summer Beef	16	99	2.4
Fall Deer	21	104	2.4
Fall Elk	23	98	2.8
Winter 94 Deer	22	99	2.3
Winter 94 Elk	25	101	3.0
Pickering Hills			
Winter 93/94 Deer	22	97	2.1
Winter 93/94 Elk	24	101	2.4
Spring Deer	21	98	2.4
Spring Elk	18	98	2.3
Summer Elk	19	89	2.5
Summer Cattle	20	100	2.5
Fall Deer	18	102	2.4
Winter 94 Deer	15	99	2.0
Winter 94 Elk	21	101	2.6

Throughout the three year study, cattle diets were quite consistent, with SWDI's ranging between 2.3 and 2.8, and the number of species in the diet varying from 16 to 23 species. Generally, when the number of species eaten was less than 20, the SWDI still remained within the above range suggesting that cattle are less selective grazers than elk and deer.

4.1.7 Discussion - Dietary Overlap - All Sites - 1992-1994

Competition for food only exists if: 1) cattle and wildlife use the same area, 2) forage availability is limiting, and 3) cattle, deer, and elk are using the same forage plants (Smith and Julander 1953). Cattle, deer, and elk were present on the four sites studied. These sites were chosen because they represented areas considered to be critical wildlife winter range, which were located within a range unit using a cattle grazing rotation. Cattle, deer, and elk diets have been determined during all respective grazing periods and dietary overlap, as one criteria of competition, has been addressed by this portion of the study. Except for periods of common use in the spring and fall, where direct competition was possible, indirect competition is probably the most important on these sites.

Indirect competition may occur among deer, elk, and cattle depending upon how the foraging behavior of each animal species affects forage availability for the other species during another period of use. For example, summer forage use by cattle may reduce availability of forage for deer and elk in the fall and winter grazing periods, particularly if there is little opportunity for regrowth after cattle grazing. Just as summer or fall grazing by cattle may influence forage availability for wildlife, so too can spring grazing by wildlife affect forage availability for cattle. Additionally, direct or indirect competition may exist between deer and elk, and indirect competition may occur with deer or elk between grazing periods.

Cattle, deer, and elk diets were quite broad over the course of the 3 year study with elk and deer eating between 31 to 63 species during the year. However, in any particular grazing season, foraging seems to be limited to about 18 to 25 species, with as few as 9 to 11 species in winter deer diets (Table 103 to 108), and as many as 31 in spring elk and deer diets (Table 103 to 108). Cattle ate up to 37 species at Pickering Hills in 1992, but more commonly they foraged on 16 to 22 species (Table 103, 104, 105, 106, 107, 108). In Colorado, Hansen and Reid (1975) found elk annual diets over the course of the year contained 46 species but varied from a winter low number of 14 species, to autumn diets which contained 23 species. Mule deer diets contained the lowest number of species in winter (17) and the highest in summer (22). Cattle diets were compared in the same study and were found to contain 7 to 10 species between June and September, narrower than in this study. In Oregon, Sheehy (1987) found summer cattle diets to contain 33 forage species while fall diets contained 19. Elk diets contained 30 and 35 species in winter and spring respectively, while 33 forage species were identified in the seasonal diets of deer. These seasonal diets for cattle, elk, and deer were broader than in this study (Table 103 - 108). Miller and Krueger (1976) also found cattle ate 16 species during mid-summer grazing on a pasture that contained bunchgrass, forest, and seeded clear-cut plant communities. Holechek et al. (1981) found cattle used 13 species while grazing ponderosa pine and Douglas-fir associated forest communities in Oregon. These results are consistent with this work.

In Colorado, Hansen and Reid (1975) calculated SWDI's for cattle diets to range from 1.25 to 1.74, lower than in this study (Table 103 to 108), but reflecting that cattle are less selective foragers than other ungulates, as I have shown. Winter deer diets were generally the least diverse and spring diets were the most diverse. Deer diets in this study were more diverse

than in Hansen and Reid (1975) who found deer diet SWDI's ranged from 0.67 to 2.04. SWDI values for elk diets were also lower in Colorado than in the East Kootenay, ranging from 0.91 to 2.02 (Hansen and Reid 1975).

Deer diet composition was dominated by browse species in all periods in this study. Grasses and forbs were eaten most in spring. Kufeld et al. (1973) reviewed 99 mule deer diet studies and found winter deer diets averaged 74% browse species. Of these which occurred in this study, poplar and bitterbrush were classified as heavily eaten; while Saskatoon, bearberry, low Oregongrape, buckbrush, rabbitbrush, ponderosa pine, Douglas-fir, currant, rose, willow, soopolallie, and snowberry were classified as light to heavy use depending on season. Our study found Douglas-fir to be the most commonly used browse species, with bitterbrush being locally important at Premier Ridge, Pickering Hills and Skookumchuck Prairie, and low Oregongrape at Pickering Hills. Saskatoon, buckbrush, and ponderosa pine were also important browse species for deer at these sites. Demarchi and Demarchi (1967) concluded Douglas-fir was the main winter browse species for white-tailed deer in the East Kootenay, but the use of bitterbrush was relatively low.

Dawson et al. (1990), working in the Cariboo region of B.C., found that Douglas-fir foliage from trees 40 - 48 cm dbh was eaten more readily by deer than foliage from trees of <30 cm dbh. Douglas-fir trees <6 cm dbh were virtually unbrowsed. Kufeld et al. (1973) also found that relatively few forb species were reported heavily eaten by deer. Penstemon species and alfalfa/clover species were included in this group. Their results agree with this study. Other forb species categorized as heavily eaten by Kufeld et al. (1973) were only minor components of deer diets in this study. The most common grass species reported by Kufeld et al. (1973) included wheatgrass species, cheatgrass, Idaho fescue, and bluegrasses. These species are all included in deer diet in this study.

In this study, elk were primarily grazers, with grass and grasslike species ranging to >90% of diet composition in some months. Generally, forbs comprised a larger proportion of elk diet in spring and early summer, and shrubs comprised a greater proportion of elk diet in the December through February period. Kufeld (1973), reviewed elk diets from 48 studies. This review concluded that in winter elk concentrate on grasses or shrubs for food depending on availability. Grasses comprised between 63% and 100% for elk diet on six studies in Montana. Conversely, three studies from Manitoba, Idaho, and New Mexico reported shrub use ranging from 62% to 95%, respectively. Similarly, grass in spring and fall elk diets averaged 87% and 74% respectively. During summer elk food habits shifted to forbs (Kufeld 1973). Miller and Vavra (1982) summarized five studies in the Blue Mountains of Oregon on pine/bunchgrass seeded clearcuts, and forested range, and found grass in elk diet averaged from 51% to 81% in the winter, 61% to 91% in spring, and 19% to 45% in summer. Work by these authors confirm the results in this study.

Cattle diets were dominated by grasses, with diet composition ranging between 60% and >90% during the three year study. In Oregon Miller and Krueger (1976) found grasses, as a percentage of diet composition, ranged between 66.0% in early- summer to 90.0% in late-summer when cattle grazed on grassland, while in the forested communities cattle diet composition of grasses ranged from 46.0% in early-summer to 69.0% in late- summer. Sheehy (1987), working in northeastern Oregon, found that grass and grasslike species comprised >90% of cattle diet during summer.

The most important conclusion regarding dietary overlap at Skookumchuck Prairie, Premier Ridge, Peckhams Lake, and Pickering Hills appears to be the repeated use, sometimes

by more than one ungulate species of a limited number of key forage and browse species in all grazing periods (Table 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 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, 59, 60, 61, 62, 63). In this study, in all periods, at all sites, the major species in elk and cattle diets were wheatgrasses, smooth brome grass, Idaho fescue, rough fescue, bluegrasses, and needlegrasses. Additionally, orchardgrass was very important in elk diets, especially at Peckhams Lake. Small-flowered penstemon and alfalfa/clover were eaten by elk at all sites.

Douglas-fir, soopolallie, and low Oregon grape, especially at Pickering Hills (Table 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45) were common elk browse species. Cattle browsing was site-specific, but bitterbrush was the most commonly browsed shrub. Other species, however, such as rabbitbrush, soopolallie, and low Oregon grape also were important in cattle diets (Table 49, 50, 51, 52, 53, 54, 55, 56, 57, 59, 60, 61, 62, 63). Bitterbrush occurred in cattle and elk diets, but its proportion of diet composition, for both cattle and elk, was generally low.

Bitterbrush likely is a more important browse species for deer in the East Kootenay than for elk and cattle. Indeed, bitterbrush averaged 20% of annual deer diet at the Combined Use area at Skookumchuck Prairie in 1992 and contributed to nearly 40% of deer diet on the site in November (Table 13). Similar results occurred on other sites in other years (Table 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27). Burrell (1982), in eastern Washington, quantified winter mule deer diets on sites with high, medium, and low bitterbrush availability. Diets contained 23 species, but the bulk of the diets was made up of bitterbrush, buckwheat, balsamroot, and lupine. Diet composition of bitterbrush varied proportionately with the amount present on the three sites. Bitterbrush consumption declined in all areas as winter progressed. Burrell (1982) hypothesized the decrease was due to availability, which had also declined over the winter. Similar to this study, Hansen and Reid (1975), in Colorado, found that deer, elk, and cattle diets generally focused on a small number of key species although the specific species mix in the diet varied among seasons. Elk used 3 to 5 species at >10% in any season, including 46% to 60% use of fescue, bluegrass, and needlegrass combined in spring and summer respectively. Cattle used fescues (16 - 32%) and bluegrasses (11 - 25%), but needlegrasses were used very little, because oatgrasses and blue grama were more readily available. Deer diets reported by Hansen and Reid (1975) were structurally very similar to those recorded in this study. In their study, big sagebrush comprised almost 50% of deer diet in winter, spring, and fall. Although big sagebrush does not occur in the East Kootenay, deer similarly focused on a single or few species such as Douglas-fir at all sites, bitterbrush and Saskatoon at Skookumchuck Prairie and Premier Ridge, and low Oregon grape and buckbrush at Pickering Hills. In southwest Alberta, Berg and Hudson (1982) found deer ate nearly 90% Douglas-fir averaged between January and May.

This study has demonstrated that cattle, deer, and elk exhibit diet fidelity between years, seasons, and sites. A small number of key forage and browse species comprise the diets of each ungulate species, and subsequent diet overlap can result when these species are eaten in common. This conclusion is supported by the number of positively correlated seasonal cattle, deer, and elk diets. Rank correlation indicates that from one foraging period to another, (or from one ungulate species to another) the ranking of species in the diet are similar. For a single ungulate species a positive correlation from one period to another may indicate "fidelity" in foraging behavior. These positive correlations, combined with dietary diversity and diet

composition data, suggest that generally, elk, deer, and cattle ranked their choice of forage plants relatively consistently and often over a narrow range of forages available.

The greatest potential for indirect competition appears to be between cattle and elk. Competition was unlikely between cattle and deer on these sites because so few species were used in common. In fact, in many periods, deer and cattle diets were negatively correlated and therefore significantly different (Table 65, 66, 70, 71, 74, 75, 82, 83, 84, 91, 92, 93, 100, 101, 102). Although cattle grazed in the spring in 1992 and 1994, and the fall in 1993, at Skookumchuck Prairie, Premier Ridge, and Peckhams Lake, for the purpose of this discussion cattle diets are referred to as summer diets, except when reference is made to a specific grazing period (Table 5). All cattle grazing periods at Pickering Hills were between July 10 and September 4.

In this study, we found spring elk diets were commonly positively correlated with summer cattle diets at all sites. Timing of cattle grazing, however, may have effected the relationship between winter elk diets and summer cattle diets. In 1992 and 1994, when cattle were spring grazed (Table 5), both winter and spring elk diets were positively correlated with summer cattle diets at all sites, except for winter elk diet at Peckhams Lake in 1994 (Table 101), and spring elk diet at Pickering Hills in 1994 (Table 102). In contrast, in 1993 when cattle were fall grazed (Table 5), both winter and spring elk diets were positively correlated with summer cattle diets at Premier Ridge and Pickering Hills, while at Skookumchuck Prairie and Peckhams Lake only spring elk diets were positively correlated with summer cattle diets.

At Premier Ridge and Pickering Hills the cattle grazed until August 22 and August 10, respectively in 1993 (Table 5), whereas cattle were grazed until September 30 and September 15 at Skookumchuck Prairie and Peckhams Lake, respectively. These data indicate that elk and cattle diets are more likely to be positively correlated when there is a shorter interval of time between grazing periods. Sheehy (1987) noted that winter elk diets in Oregon had the highest overlap with summer cattle diet, and that spring elk diet had the highest overlap with fall cattle diet. Berg and Hudson (1982), in southwest Alberta, found spring cattle diets and winter/spring elk diets both comprised >85% rough fescue. Kasworm et al. (1985), in north central Montana, found that both elk and bighorn winter diets were similar to summer cattle diets.

Elk winter diets may also be affected by weather patterns restricting access to forage plants. Weather data (Table 4) indicate that the mean temperature in the winter 1992/93 was colder than the climatic normals from 1955 to 1992. This may have affected elk foraging patterns in 1992/93. For example, winter 1992/93 elk diets at Peckhams Lake and in the Combined Use area at Skookumchuck Prairie averaged 40% to 45% browse, principally Douglas-fir and soopolallie (Table 32, 33, 37, 38). Cattle and elk ate the same grass species, but cattle did not use browse to nearly the same extent (Table 55, 56). Kufeld's (1973) review of elk diets, concluded that elk select grasses or shrubs in winter diets depending on availability.

In general, spring elk diets were positively correlated with cattle diets whether cattle were grazed in spring or fall. Winter elk diets are more likely to be positively correlated with cattle diets if cattle are grazed in the spring or summer, rather than fall. However, in this study positive correlations between summer cattle diets, and fall elk diets were not found as consistently as in the above periods. Peckhams Lake was the only site where summer cattle grazing was positively correlated with fall elk diet in both 1992 ($p < 0.20$), and 1994 ($p < 0.05$) (Table 83, 101). Despite some differences in the ranking of forage species, the common use of domestic species in particular, constituted significant dietary overlap (Table 33, 43, 51, 61).

Summer cattle grazing was positively correlated with fall elk diet at Skookumchuck Prairie ($p < 0.20$), Premier Ridge ($p < 0.20$), and Pickering Hills ($p < 0.05$) in 1992 only (Table 66, 82, 84). The difference at Premier Ridge in 1994 partially resulted from elk eating more browse, especially soopolallie, but more of the difference was due to different use levels on grass species. Although cattle and elk used wheatgrass species, smooth brome grass, Idaho fescue, rough fescue, bluegrass species, and needlegrass species in common, elk diet composition was dominated by rough fescue, while cattle diet was more evenly distributed among the grasses listed above (Table 44, 62).

It is possible that human disturbance during hunting season caused some variation in wildlife diet. Kufeld et al. (1988) concluded that hunting female mule deer did not cause deer movement, in terms of distance or to leave their home ranges, but did cause deer to seek more adequate cover. Morgantini and Hudson (1984) reported that displacement of elk from traditional winter range to a forested habitat during a January to February hunting season in Alberta, also resulted in a significant change in diet. Pre- and post-season diets were based on almost 90% rough fescue and less than 5% browse, while in elk diets during the season, rough fescue was reduced to less than 35.0% and use of wild rye (Elymus innovatus), sedges, and bearded wheatgrass (Agropyron subsecundum) increased from 4.3% to 28.3% and browse was more than 28.0%.

In central Arizona, Wallace and Krausman (1987) also report spatial separation between cattle and wildlife when they are on ponderosa pine - bunchgrass range at the same time. Elk use shifted to more closed forest after the introduction of cattle. Frisina (1992) noted that when there was temporal separation between elk and cattle, elk would avoid areas with a depleted standing crop, except when elk were grazing regrowth from an earlier cattle grazing period. Frisina (1992) hypothesized that livestock have a greater influence on elk distribution, when cattle removed vegetation during the growing season, than social intolerance of cattle by elk.

Perhaps the principal concern of wildlife interests regards the effect of summer cattle grazing on the availability of forage for wildlife in the following winter. Premier Ridge was the only site where summer cattle diets consistently correlated positively with elk diet in the following winter in 1992, 1993, and 1994 (Table 82, 91, 100). Foraging patterns are very similar with both cattle and elk over the three years. Cattle and elk used relatively equal amounts of wheatgrasses, smooth brome grass, bluegrasses, and needlegrasses, while using the fescues, bitterbrush, and soopolallie somewhat differently (Table 34, 39, 44, 52, 57, 62). Sheehy (1987), working in northeastern Oregon, found that grass and grasslike species comprised >90% of cattle diet during summer and >80% of elk diet in winter and spring. The principal species in cattle diet were Idaho fescue, bluebunch wheatgrass, and Kentucky bluegrass. Elk diet composition in winter and spring was dominated by elk sedge, Idaho fescue, and bluebunch wheatgrass (Sheehy 1987). Ponderosa pine, low Oregon grape, and bitterbrush were browse species found in winter and spring elk diets but not in summer cattle diets.

Premier Ridge may be an example of a site which is selected by elk primarily for terrain features. Sheehy (1987) used Spearman's rank correlation to discern relationships between ungulate diets and plant communities. Summer cattle diets had the highest correlations with the meadow and Idaho fescue - biscuit scabland community, while fall diets were most highly correlated with the buckwheat - bluegrass and the Idaho fescue - bluebunch wheatgrass community. Winter elk diets were correlated most strongly with the forest community types and the snowberry - Idaho fescue shrub type. Spring elk diets were the highest correlations with the snowberry - Idaho fescue shrub type and the Idaho fescue - bluebunch wheatgrass

community. Sheehy and Vavra (1996) used diet information from Sheehy (1987), plant community type, and terrain features to identify ungulate selection of foraging areas. They found terrain features; distance to the ecotone between steppe and forest, and elevation, were the most important in the selection of foraging areas. Cattle preferred Idaho fescue - annual grass communities at medium distance from the forest edge and at moderate elevation. Elk preferred bluebunch wheatgrass - annual grass and Idaho fescue - bluebunch wheatgrass communities near the forest edge at higher elevations. Plant communities accounted for only a small percentage of the variation in ungulate selection of foraging areas. Sheehy and Vavra (1996) concluded that ungulates do not select for plant communities, but for specific plants. Terrain features appear to be factors influencing location of plant communities. Hudson et al. (1976) studied occupational patterns of elk, bighorn sheep, mule and white-tailed deer, and cattle at Premier Ridge. Elk in winter used open forest and shrub communities with good stands of bunchgrass, while in the spring, aspect became more important as elk sought southwesterly exposures, but elk were observed to remain at higher elevations. They concluded that activities of grazing cattle during the previous summer were not significantly associated with wildlife distribution.

At Skookumchuck Prairie, Pickering Hills and Peckhams Lake, the relationship between summer cattle diets and winter elk diets was not as clearly defined as at Premier Ridge. Summer cattle diets were positively correlated with winter elk diets at Skookumchuck Prairie in 1993/94 ($p < 0.05$) and 1994/95 ($p < 0.20$), but not in 1992/93 (Table 65, 70, 74). Summer cattle diets and winter elk diets were positively correlated at Pickering Hills in 1992/93 ($p < 0.10$) and 1993/94 ($p < 0.10$), but not in 1994/95 (Table 84, 93, 102). Summer cattle diet and winter elk diet were not positively correlated in any year at Peckhams Lake (Table 83, 92, 101).

Summer cattle and winter elk diets were not positively correlated at Skookumchuck Prairie in 1992/93 due mainly to higher use of wheatgrasses and cheatgrass by cattle, and soopolallie by elk (Table 66). Cattle were gathered on July 15 in 1992, whereas in 1993 and 1994, cattle remained at the site until September 30 and August 10, respectively. When the cattle grazing period is later in the grazing season, such as in 1993 and 1994, summer cattle diet and winter elk diet are more likely to be positively correlated.

Cattle and elk diets at Pickering Hills did not positively correlate when diet composition between these species exhibited different use patterns on a small number of species. Cattle and elk used relatively equal portions of wheatgrass species, smooth brome grass, bluegrass species, and needlegrass species, while using the fescues, and in this case low Oregon grape and Douglas-fir somewhat differently (Table 35, 40, 45, 53, 58, 63). Although cattle were grazed in mid-summer to late-summer during this study, lack of moisture in the July to September period in 1994 (Table 3,4) may have resulted lack of regrowth on grass species and caused elk to browse more during the winter 1994/95.

At Peckhams Lake, in each year, differential use of 3 to 6 forage and browse species resulted in summer cattle diets and winter elk diets being different, despite the common use of 11 to 13 species. In particular, cheatgrass, orchardgrass, and Douglas-fir were used differently. In general, elk and cattle eat the same grass species, subject to availability. The shorter the time interval between grazing periods, the more likely it is that cattle and elk diets will be positively correlated. In winter elk diet is based on grasses, subject to availability. When grass availability is limited elk browse more, and also graze native perennial forbs.

Comparisons of deer and elk diets in one grazing period with diets in later periods indicate this is another type of diet overlap. Fidelity of elk and deer diet composition between

periods may not indicate that competition exists, as forage must also be in short supply (Smith and Julander 1953). However, together with cattle grazing, their combined use may impact key forage and browse species and contribute to downward trends in the composition of the plant community.

Deer diets were generally similar in winter and spring. From 1992 to 1994, winter deer diets generally were positively correlated with spring deer diets, particularly at Premier Ridge and Pickering Hills (Table 82, 84, 91, 93, 100, 102). Winter and spring deer diets only overlapped in the Combined Use Area at Skookumchuck Prairie in 1992 (Table 66), and at Peckhams Lake in 1994 (Table 101). Spring deer diets overlapped with diets in the following winter at all sites except Skookumchuck Prairie. (Table 82, 83, 84, 91, 92, 100, 101, 102). In Colorado, Hansen and Reid (1975) found that winter and spring deer diets were similar in that the bulk of their diets were composed of the same three shrubs and one grass species.

However, spring deer diets were not positively correlated with any other periods except fall diet at Premier Ridge in 1994 and were negatively correlated with summer and fall diets in many cases (Table 100). Hansen and Reid (1975) calculated 'trophic diversity' using the Shannon-Weiner Diversity Index (SWDI) to measure the breadth of diets. Deer diets were less diverse than elk or cattle diets primarily because deer concentrated their foraging on few species. They reported SWDI's for deer diets ranging from 0.67 to 2.04, less than in this study (Table 103, 104, 105, 106, 107, 108).

Elk diets consistently overlapped between foraging periods indicating a high degree of fidelity in their diet. Winter elk diets were positively correlated with elk diets in the spring, summer, fall, and the following winter in many cases. At Premier Ridge, Peckhams Lake, and Pickering Hills in 1992 winter elk diets were positively correlated with spring elk diets at all sites, summer elk diet at Premier Ridge, fall diets at Premier Ridge and Peckhams Lake, and winter 1992/93 diets at Premier Ridge and Pickering Hills (Table 82, 83, 84). Elk diets at Skookumchuck Prairie were also very consistent between winter diet and diet in later periods, especially in 1992 when all diet comparisons were positively correlated (Table 66). Similar trends between winter elk diet and diets in succeeding periods were noted in 1993 and 1994 at all sites (Table 66, 70, 74, 82, 83, 84, 91, 92, 93, 100, 101, 102). Hudson et al. (1976), working at Premier Ridge, concluded that elk were widely distributed and able to exploit areas not effectively utilized by coexisting species.

Spring elk diets also showed consistent positive correlations with elk diets in later grazing periods at all sites. Summer and fall elk diets exhibited less consistent positive correlations with diets in other periods (Table 66, 70, 74, 82, 83, 84, 91, 92, 93, 100, 101, 102). In Colorado, Hansen and Reid (1975) reported Shannon-Weiner Diversity Index values for elk diets of 0.91 in June and 1.5 in October. Typically, elk diet SWDI values in summer and fall in the East Kootenay ranged between 2.0 and 3.0 (Table 103, 104, 105, 106, 107, 108). Sheehy (1987), working in Oregon, compared seasonal deer, elk, and cattle diets and found the highest diet overlap was between winter and spring elk diets. Hudson et al. (1976) noted, "Elk are recognized widely to be catholic in their habitat use behavior, adapting successfully to a wide variety of environments".

In this study, in all years, grasses were most important for elk particularly wheatgrasses, smooth brome grass, Idaho fescue, rough fescue, bluegrasses, and needlegrasses. In addition to the grass species; alfalfa/clover, small-flowered penstemon, Saskatoon, and Douglas-fir were used most consistently by elk at Peckhams Lake (Table 33, 38, 43), small-flowered penstemon, Saskatoon, and soopolallie were important at Premier Ridge (Table 34, 39, 44), while small-

flowered penstemon, Saskatoon, low Oregon grape, Ponderosa pine, Douglas-fir, and bitterbrush were prominent at Pickering Hills (Table 35, 40, 45). Hansen and Reid (1975) in Colorado, also noted diet consistency for elk between periods, especially for grasses. Bluegrasses were used throughout the year, fescues in spring through fall, and needlegrasses from winter to summer. Miller and Vavra (1982) reviewed data from five cattle, deer, and elk grazing studies. They noted consistent use of bluebunch wheatgrass and Idaho fescue, in particular in elk diets, in consecutive sampling periods from early winter to through to late spring.

Diet overlap between deer and elk occurs on some sites and in some years. Spring deer diets were positively correlated with spring elk diet at Premier Ridge (Table 82, 91) in 1992 and 1993, and at Pickering Hills in 1994 (Table 102). When deer and elk diets overlap in spring it is due to increased amounts of grasses and forbs in spring deer diet composition (Table 16, 21, 34, 39). Also in 1992, spring deer diet and winter 1992/93 elk diet significantly overlapped at Premier Ridge (Table 82). In this case, elk browsed more in winter 1992/93. This may be due to forage availability as winter 1992/93 was colder than the long-term average or the other winter periods in this study. During early and late winter on five winter range areas in Oregon, Skovlin and Vavra (1979) found that competition between deer and elk is not normally high. Grass comprised 60.0% and 33.0% of elk and deer diets respectively, while shrubs made up less than 5.0% of elk diet and 25.0% of deer diet. They also observed, however, that shrub use by both deer and elk was less than on other big-game ranges throughout the inter-mountain west (Skovlin and Vavra 1979).

Diet overlap as a condition of competition, does exist on the sites in this study. Although deer diets had many species in common with cattle or elk diets, few positive correlations existed between deer diets, and cattle and elk diets. The most important area of potential competition is between cattle and elk. Diet overlap is common between winter and spring elk diets, and summer cattle diets. Summer cattle diets overlap with fall and winter elk diets, although not as consistently. The timing of cattle grazing appears to be an important variable. The shorter the interval between cattle and elk grazing the same site, the more likely the diets were to be positively correlated.

The consequences of the relationships described above have managerial and biological implications;

1. to avoid sequential grazing and browsing on species preferred by cattle and elk, cattle grazing should be timed such that cattle do not graze critical winter and spring ranges either in early spring or late fall
2. to avoid sequential grazing and browsing of favoured species by deer and elk, use on critical winter and spring range should better distributed by creating other foraging areas which are attractive to deer and elk
3. adequate amounts of forage should be left on critical winter range sites - elk will graze preferentially, but will switch to browse species if grasses become less available
4. weather conditions affect both forage production and forage availability
5. the diet composition of an "effective" animal unit month (AUM) for deer, elk, and cattle can be calculated for each site, grazing period, and ungulate species based on seasonal diets.
6. carrying capacity can be more realistically estimated by calculating "effective carrying capacity" - the product of the ungulate species' "effective" AUM for a particular grazing period and the availability of those plant species on that site during that period
7. the effect diet overlap has on the current plant communities influences the attainability of potential desired plant communities.

However, the fact that two diets are correlated does not mean that grazing by one animal influences forage use by another. Smith and Julander's (1953) definition of competition requires that forage also be in short supply.

4.2 Forage Production and Use by Wildlife and Cattle

4.2.1 Comparison of Annual Standing Crop and Total Standing Crop

At Skookumchuck Prairie Annual Standing Crop (ASC) of ungrazed forage ranged from 604 kg/ha in the Wildlife Only Area to 704 kg/ha in the Cattle Only Area (Table 109, Figure 7). Total Standing Crop (TSC), ranged from 689 kg/ha in the Combined Use Area to 746 kg/ha in the Wildlife Only Area. Both Total Standing Crop and Annual Standing Crop were generally higher on the secondary sites than at Skookumchuck Prairie (Table 109, Figure 8). Total Standing Crop varied from slightly less than 2300 kg/ha on the New Seeding at Peckhams Lake to 829 kg/ha at Premier Ridge. Annual Standing Crop ranged from 2137 kg/ha at the Old Seeding at Peckhams Lake to 665 kg/ha at Premier Ridge.

In 1992, at Skookumchuck Prairie, only the Wildlife pasture showed significant differences between ASC and TSC ($p < 0.10$). At the secondary sites, significant differences ($p < 0.05$) were only measured at Premier Ridge (Table 109).

At Skookumchuck Prairie in 1993, TSC ranged from 722 kg/ha in the Cattle Only Area to >1100 kg/ha in the Wildlife Only Area (Table 110, Figure 9) and ASC produced similar totals. Premier Ridge and Pickering Hills exhibited similar trends in forage standing crop with the TSC values approaching 1100 kg/ha and ASC equaling approximately 1000 kg/ha (Table 110, Figure 10). At Peckhams Lake, the ASC exceeded 2000 kg/ha and 2200 kg/ha at the Old and New Seedings, respectively and the TSC was >3005 kg/ha at the New Seeding and >4200 kg/ha at the Old Seeding (Table 110, Figure 10). ASC and TSC were not significantly different ($p > 0.20$) at Skookumchuck Prairie, Premier Ridge or Pickering Hills. However, significant differences between ASC and TSC were found at both the New Seeding ($p < 0.10$) and the Old Seeding ($p < 0.05$) at Peckhams Lake.

At Skookumchuck Prairie in 1994, ASC ranged from 730 kg/ha in the Cattle Only Area to nearly 1000 kg/ha in the Wildlife Only Area. TSC was slightly higher than ASC in the Combined Use and Cattle Only Areas, and lower than ASC in the Wildlife Only Area (Table 111, Figure 11). At the secondary sites, the ASC ranged from >800 kg/ha at Premier Ridge to >1300 kg/ha at the Old Seeding at Peckhams Lake (Table 111, Figure 12). Only the ASC and TSC at the Old Seeding at Peckhams Lake were significantly different ($p < 0.20$).

Analysis of Variance

At Skookumchuck Prairie there was no significant difference between ASC and TSC, or in production among the Combined Use, Cattle Only, and Wildlife Only Areas when the data for all years and sites were combined. However, the significant Year by Graze interaction indicates that differences in production among 1992, 1993, and 1994 were dependent on differences in standing crop production in the Combined Use, Cattle Only, and Wildlife Only Areas (Table 112).

Averaged over all years, TSC exceeded ASC by more than 35% at Peckhams Lake

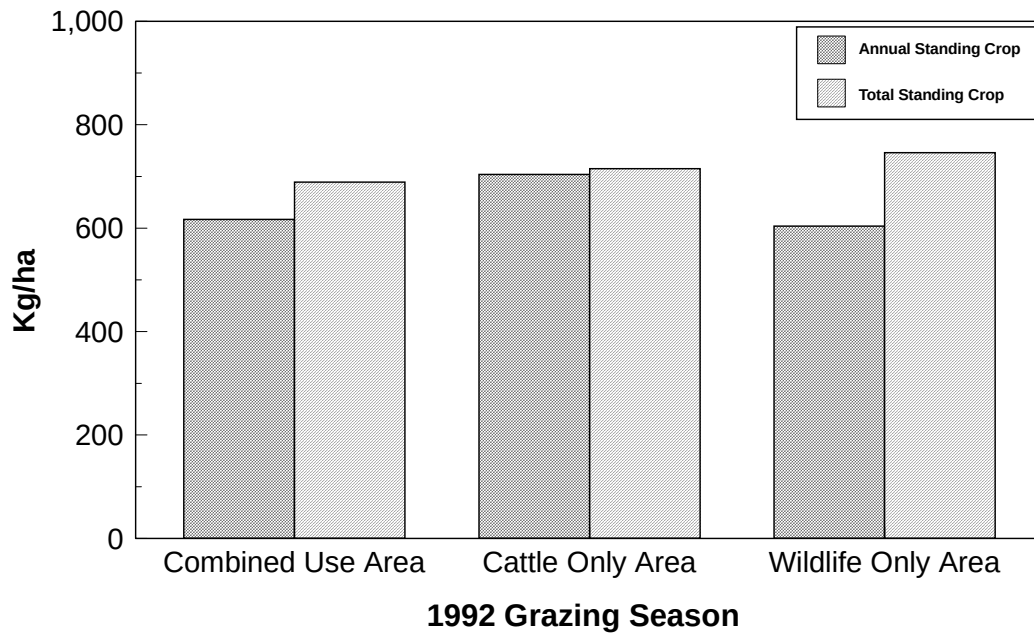


Figure 7. Annual standing crop and total standing crop at Skookumchuck Prairie in 1992.

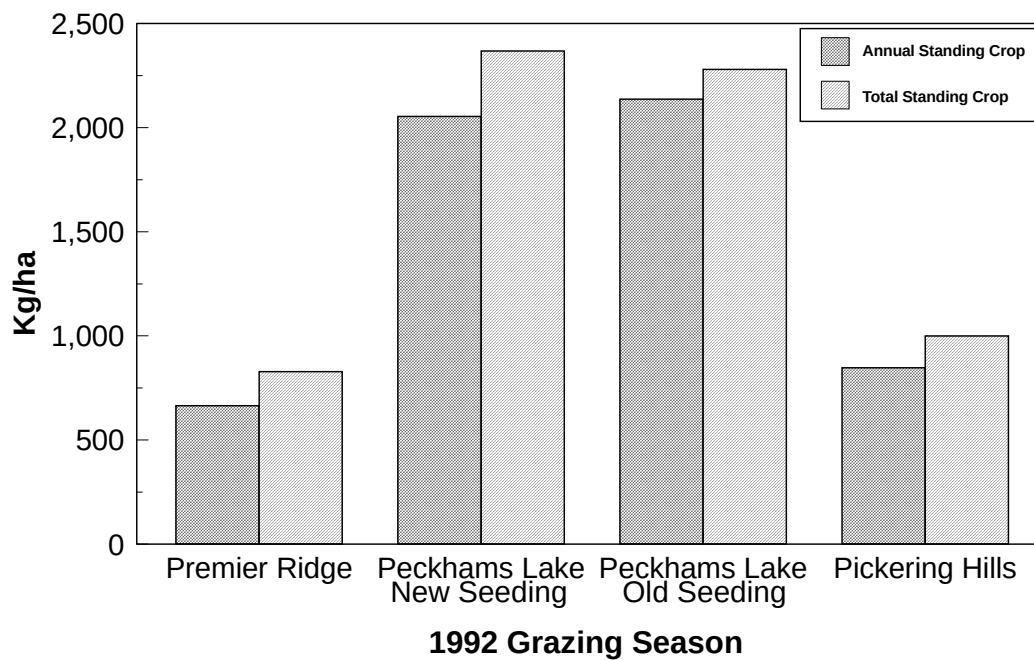


Figure 8. Annual standing crop and total standing crop at Premier Ridge, Peckhams Lake, and Pickering Hills in 1992.

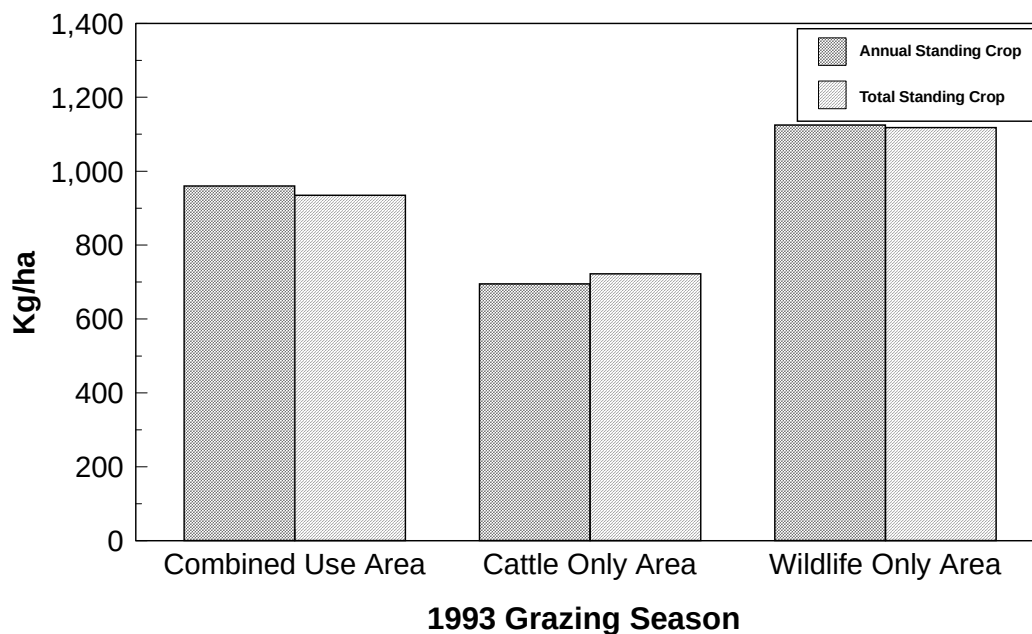


Figure 9. Annual standing crop and total standing crop at Skookumchuck Prairie in 1993.

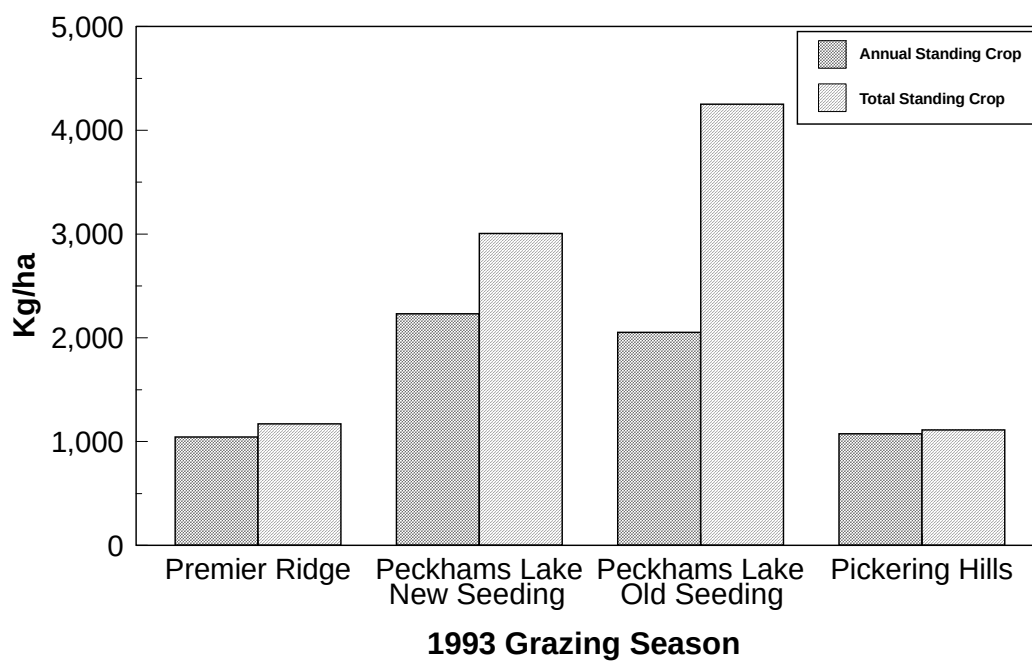


Figure 10. Annual standing crop and total standing crop at Premier Ridge, Peckhams Lake, and Pickering Hills in 1993.

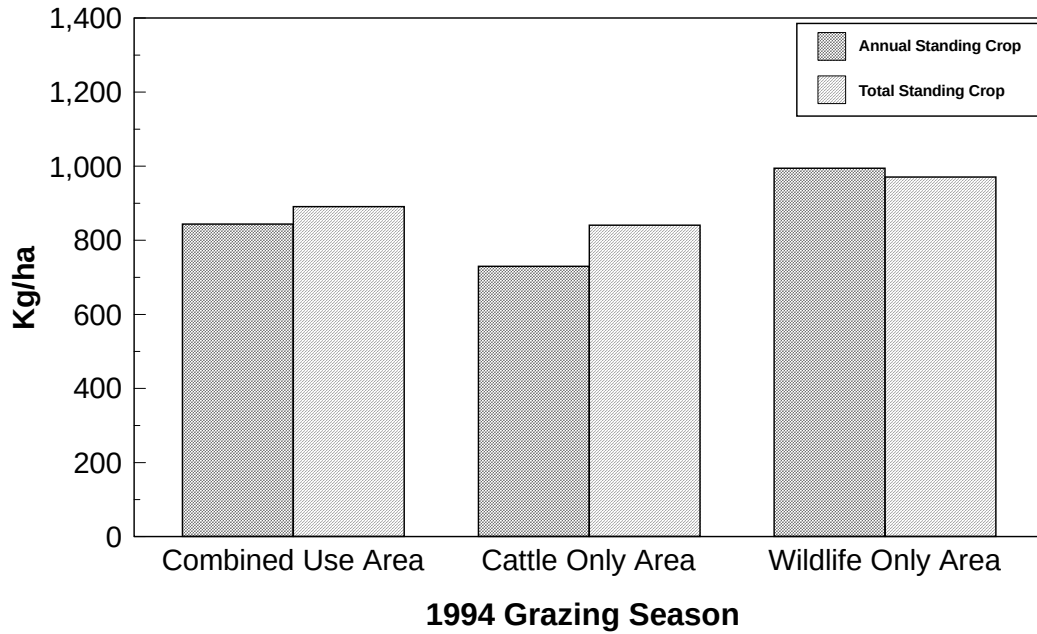


Figure 11. Annual standing crop and total standing crop at Skookumchuck Prairie in 1994.

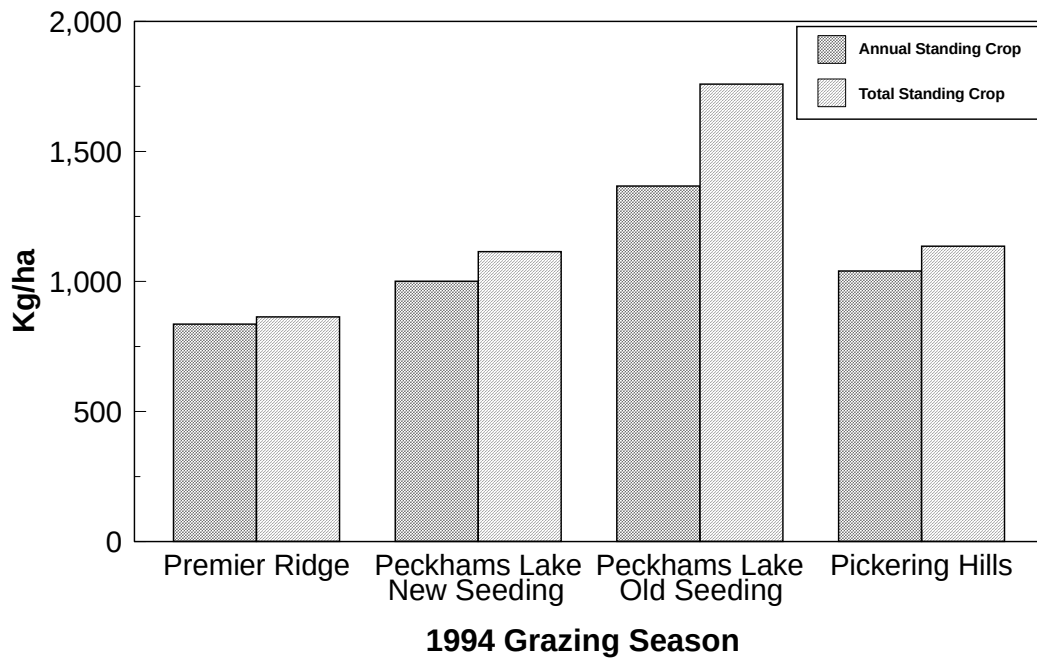


Figure 12. Annual standing crop and total standing crop at Premier Ridge, Peckhams Lake, and Pickering Hills in 1994.

Table 109. Comparison of annual standing crop versus total standing crop at Skookumchuck Prairie, Premier Ridge, Peckhams Lake, and Pickering Hills in 1992.

Site	Annual Standing Crop kg/ha	Standard Error of the Mean	Total Standing Crop kg/ha	Standard Error of the Mean	Significance Level
Skookumchuck Prairie					
Combined Use Area	617.0a	51.6	689.3a	81.4	NS
Cattle Only Area	704.1a	62.6	715.0a	56.8	NS
Wildlife Only Area	604.0a	62.6	746.0b	65.6	**
Secondary Sites					
Premier Ridge	665.0a	47.9	829.0b	58.8	*
Peckhams Lake - New	2054.0a	235.2	2368.0a	200.8	NS
Peckhams Lake - Old	2137.0a	408.3	2280.0a	316.7	NS
Pickering Hills	849.0a	55.9	841.0a	71.7	NS

Table 110. Comparison of annual standing crop versus total standing crop at Skookumchuck Prairie, Premier Ridge, Peckhams Lake, and Pickering Hills in 1993.

Site	Annual Standing Crop kg/ha	Standard Error of the Mean	Total Standing Crop kg/ha	Standard Error of the Mean	Significance Level
Skookumchuck Prairie					
Combined Use Area	960.0a	134.6	935.0a	104.2	NS
Cattle Only Area	695.0a	64.2	722.0a	85.1	NS
Wildlife Only Area	1125.0a	231.6	1118.0a	86.4	NS
Secondary Sites					
Premier Ridge	1044.0a	73.1	1172.0a	101.3	NS
Peckhams Lake - New	2232.0a	183.3	3005.0b	357.2	**
Peckhams Lake - Old	2052.0a	353.2	4252.0b	622.4	*
Pickering Hills	1076.0a	71.5	1113.0a	98.3	NS

Means within the same row followed by a different letter are significantly different between forage standing crop on ASC and TSC plots determined by paired t-test (Zar 1984).

* Means significantly different at $p < 0.05$

** Means significantly different at $p < 0.10$

*** Means significantly different at $p < 0.20$

Table 111. Comparison of annual standing crop versus total standing crop at Skookumchuck Prairie, Premier Ridge, Peckhams Lake, and Pickering Hills in 1994.

Site	Annual Standing Crop kg/ha	Standard Error of the Mean	Total Standing Crop kg/ha	Standard Error of the Mean	Significance Level
Skookumchuck Prairie					
Combined Use Area	844.0a	132	891.0a	139.2	NS
Cattle Only Area	730.0a	86.3	841.0a	121.2	NS
Wildlife Only Area	995.0a	83.7	971.0a	108.5	NS
Secondary Sites					
Premier Ridge	836.0a	64.8	864.0a	65.2	NS
Peckhams Lake - New	1001.0a	82	1115.0a	131.4	NS
Peckhams Lake - Old	1367.0a	146	1759.0b	262.9	***
Pickering Hills	1040	66.2	1136	109.5	NS

Means within the same row followed by a different letter are significantly different between forage standing crop on ASC and TSC plots determined by paired t-test (Zar 1984).

* Means significantly different at $p < 0.05$

** Means significantly different at $p < 0.10$

*** Means significantly different at $p < 0.20$

Table 112. The effect of clipping frequency and grazing on standing crop in 1992, 1993, and 1994 at Skookumchuck Prairie using analysis of variance.

Comparison	Standing Crop kg/ha		
Main Effects			
Clip	ASC 808a	TSC 848a	
Graze	Combined Use 823a	Cattle Only 734a	Wildlife Only 926a
Year	1992 679b	1993 926a	1994 879a
Interactions			
Graze * Clip		NS	
Clip * Year		NS	
Graze * Year		*	
Graze * Clip * Year		NS	

Means within the same row followed by a different letter are significantly different ($p < 0.05$) with Duncan's multiple range test.

* Means significantly different at $p < 0.05$

(Table 113). Standing crop was highest in 1993, more than double the production in 1994. A significant Clip by Year interaction at Peckhams Lake ($p < 0.05$) indicates that differences between ASC and TSC are dependent on growing conditions in a particular year.

At Premier Ridge and Pickering Hills there were no significant differences between ASC and TSC (Table 114, 115). The significant year effect at both sites indicates standing crop production at the sites was different among 1992, 1993, and 1994. Indeed, at Premier Ridge standing crop production in 1993 was significantly higher than in 1992 and 1994 (Table 114). At Pickering Hills, standing crop production was also highest in 1993, but production was approximately equal in 1994 (Table 115). Both 1993 and 1994 standing crops were significantly higher than 1992.

Differences among years likely reflect the effect of weather conditions, particularly precipitation, temperature, evapo-transpiration and growing degree days (GDD). These factors combine to determine forage standing crop. From a management standpoint, forage standing crop production should be related to the long-term averages in precipitation. Allocation should be made based on this conservative estimation of production rather than on production in above-average precipitation years such as 1993.

1993 was the wettest of the three years under study (Table 3,4). Indeed, precipitation from April to October in 1993 was 378.1 mm, 50% higher than in 1992, and 70% higher than the 37 year average. Precipitation in 1994 was 220.2 mm, very close to the 37 year average. Growth of key forage species is closely linked to available moisture. Stout et al. (1981) reported that rough fescue stops growing in the summer when soil moisture is depleted. They measured leaf growth and found this date to vary between May 28 and June 28, at two sites near Kamloops, over three years. Quinton et al. (1982) found that bluebunch wheatgrass stopped growing between May 7 and July 15 on the same sites and years. For domestic forages in general, water deficiencies for any length of time bring a reduction in vegetative growth and promote early maturity (Olmstead 1941 cited in Heath et al. 1973).

The timing of grazing is also an important part of the Year effect. Cattle are traditionally rotated between spring/fall in the East Kootenay. Other research documents that plants grazed in early phenological stages of growth exhibit different physiological responses to defoliation than plants grazed in late phenological stages of growth. Frost and Smith (1994) reviewed a number of clipping studies and concluded that plant vigour is affected more by the timing of defoliation than by grazing intensity. McLean and Wikeem (1985b) found the most vulnerable time for clipping rough fescue was mid-May to late-June, when the plants were clipped to 5 cm or less. When clipping ceased before the end of the growing season, or if more photosynthetic tissue was left, injury was reduced (McLean and Wikeem 1985a). In a similar study on bluebunch wheatgrass, McLean and Wikeem (1985a) found that it was most sensitive to clipping during early spring.

Determination of the ASC and TSC may be important in years with greater than average precipitation, as a estimate of the contribution regrowth makes to the standing crop. In years such as 1993 at Peckhams Lake, when TSC was significantly higher than ASC (Table 110, 113), grazing impacts of wildlife, cattle, and wildlife and cattle combined could be over-estimated if seasonal use was measured against the ASC. Conversely, in years where the ASC and TSC were not significantly different, if seasonal use was measured against the TSC, grazing impacts could be under-estimated.

Table 113. The effect of clipping frequency and grazing on standing crop in 1992, 1993, and 1994 at Peckhams Lake using analysis of variance.

Comparison	Standing Crop kg/ha		
Main Effects			
Clip	ASC	TSC	
	1807a	2454b	
Graze	Old Seeding	New Seeding	
	1958a	2303a	
Year	1992	1993	1994
	2203c	2879a	1310b
Interactions			
Graze * Clip		NS	
Clip * Year		*	
Graze * Year		NS	
Graze * Clip * Year		NS	

Table 114. The effect of clipping frequency and grazing on standing crop in 1992, 1993, and 1994 at Premier Ridge using analysis of variance.

Comparison	Standing Crop kg/ha		
Main Effects			
Clip	ASC	TSC	
	849a	955a	
Year	1992	1993	1994
	850b	1108a	747b
Interactions			
Clip * Year		NS	

Means within the same row followed by a different letter are significantly different ($p < 0.05$) with Duncan's multiple range test.

* Means significantly different at $p < 0.05$

Table 115. The effect of clipping frequency and grazing on standing crop in 1992, 1993, and 1994 at Pickering Hills using analysis of variance.

Comparison	Standing Crop kg/ha		
Main Effects			
Clip	ASC	TSC	
	989a	1130a	
Year	1992	1993	1994
	846b	1095a	1088a
Interactions			
Clip * Year		NS	

Means within the same row followed by a different letter are significantly different ($p < 0.05$) with Duncan's multiple range test.

* Means significantly different at $p < 0.05$

4.2.2 Skookumchuk Prairie 1992-1994

Skookumchuck Prairie - 1992

In the Wildlife Only Area more than 48% of the TSC was used during 1992 (Table 116, Figure 13). Cattle ate slightly less than 10% of the TSC in the Cattle Only Area (Table 116, Figure 14). Total use by wildlife and cattle in the Combined Use Area at Skookumchuck Prairie in 1992 was >60% of the TSC, of which wildlife used nearly two-thirds (Table 116, Figure 15). Total forage eaten was highest in the Combined Use Area and lowest in the Cattle Only Area (Table 116, Figure 13, 14, 15).

At Skookumchuck Prairie, significant use ($p < 0.20$) was calculated in all sampling periods in the Wildlife Only and Combined Use Areas, but not in the Cattle Only Area (Table 117). In the Combined Use and Wildlife Only Areas wildlife use ranged from 13% to 37% in the spring, fall, and winter grazing periods (Table 117, Figure 16, 18). Spring cattle use was 27% of the SSC in the Combined Use Area. SSC was nearly 450 kg/ha in July in the Cattle Only Area, but significant ($p > 0.20$) use was not calculated (Figure 17).

Although wildlife use, as a percentage of SSC, was highest in winter in the Wildlife Only and Combined Use Areas (Table 117), SSC was <300 kg/ha in March at both sites (Figure 16, 18). In contrast, SSC ranged from >400 kg/ha to >650 kg/ha in spring (May) and fall (October). Wildlife ate the most forage in all periods, at both sites, in fall (October) in the Wildlife Only Area, where wildlife ate approximately 150 kg/ha (Figure 16). Cattle ate a similar amount in July in the Combined Use Area, where the SSC was approximately 550 kg/ha (Figure 18).

Skookumchuck Prairie - 1993

Weather records indicate that 1993 was a higher than average year for precipitation (Table 3,4). Precipitation during the growing season in 1993 exceeded the 37-year average by 70%. Generally, May and June are the wettest months in the east Kootenay, with less rainfall in July, August, and September. In 1993, rainfall in June and July was about three times greater than the 37 year average. Above average rainfall and lower than average mean temperatures continued into August and September (Table 3,4). The decrease in mean temperature, combined with adequate soil moisture, probably contributed to increased fall regrowth and a larger standing crop. Plants likely did not become dormant until late-September. These growing season conditions resulted in a forage base that exceeded the 1992 average by 22% (Table 116, 118). TSC ranged from about 720 kg/ha in the Cattle Only Area to nearly 1120 kg/ha in the Wildlife Only Area (Table 118).

In the Wildlife Only Area at Skookumchuck Prairie more than 60% of TSC was eaten during 1993 (Table 118, Figure 19). Cattle ate almost 45% of the TSC in the Cattle Only Area; considerably more than in 1992 (Table 116, 118, Figure 14, 20). In 1993, total use by wildlife and cattle in the Combined Use Area at Skookumchuck Prairie in 1993 exceeded 50% of the TSC, with wildlife using more than twice as much of the TSC as cattle (Table 118, Figure 21). Significant ($p < 0.20$) forage use was recorded on all sites during all grazing periods (Table 119).

At Skookumchuck Prairie in 1993, wildlife ate a higher proportion of the available forage in the Wildlife Only Area than in the Combined Use Area (Table 118), similar to 1992 (Table 116). Wildlife ate nearly 690 kg/ha in the Wildlife Only Area, and <350 kg/ha or about 37% of the forage from the Combined Use Area (Table 118).

Forage use, determined by the difference between standing crop on grazed and ungrazed plots, was statistically different in the Wildlife Only Area ($p < 0.05$), Cattle Only Area ($p < 0.05$),

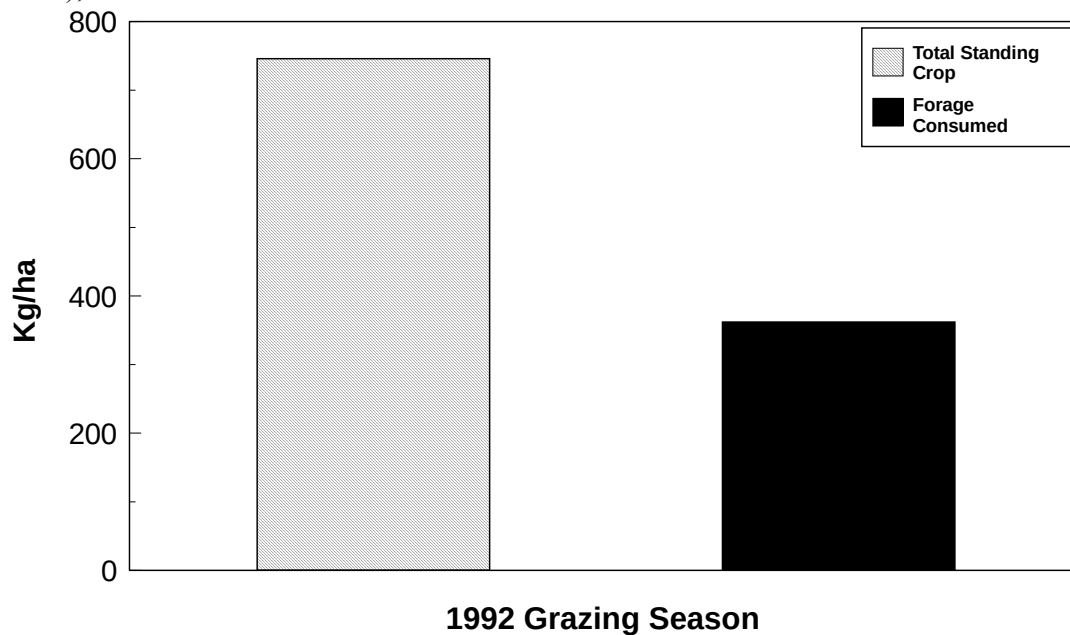


Figure 13. Total standing crop and forage consumed by wildlife in the wildlife only area at Skookumchuck Prairie in 1992.

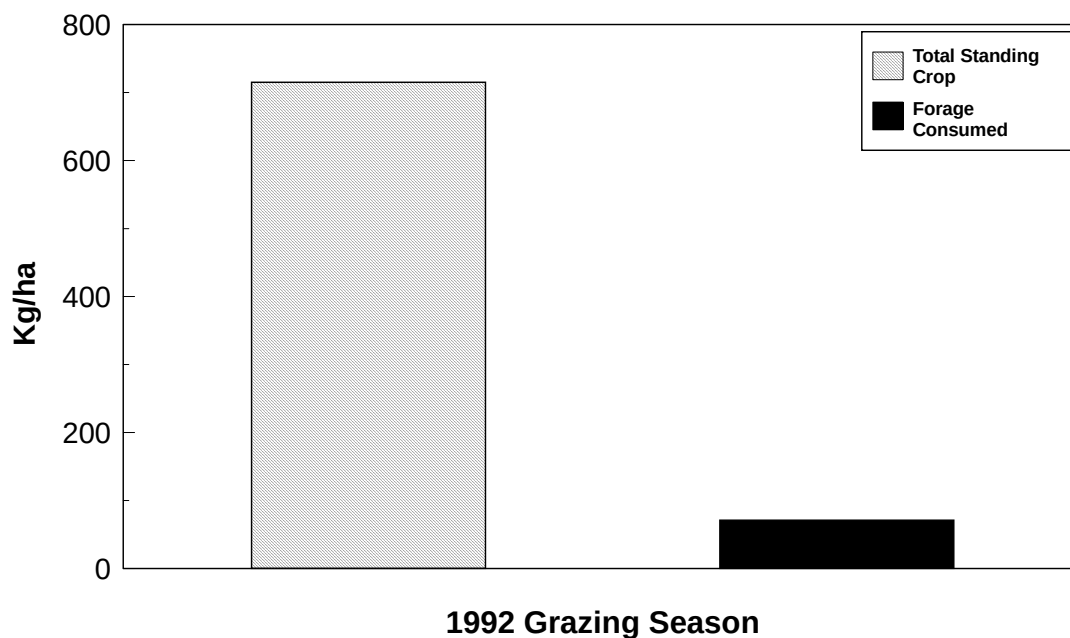


Figure 14. Total standing crop and forage consumed by cattle in the cattle only area at Skookumchuck Prairie in 1992.

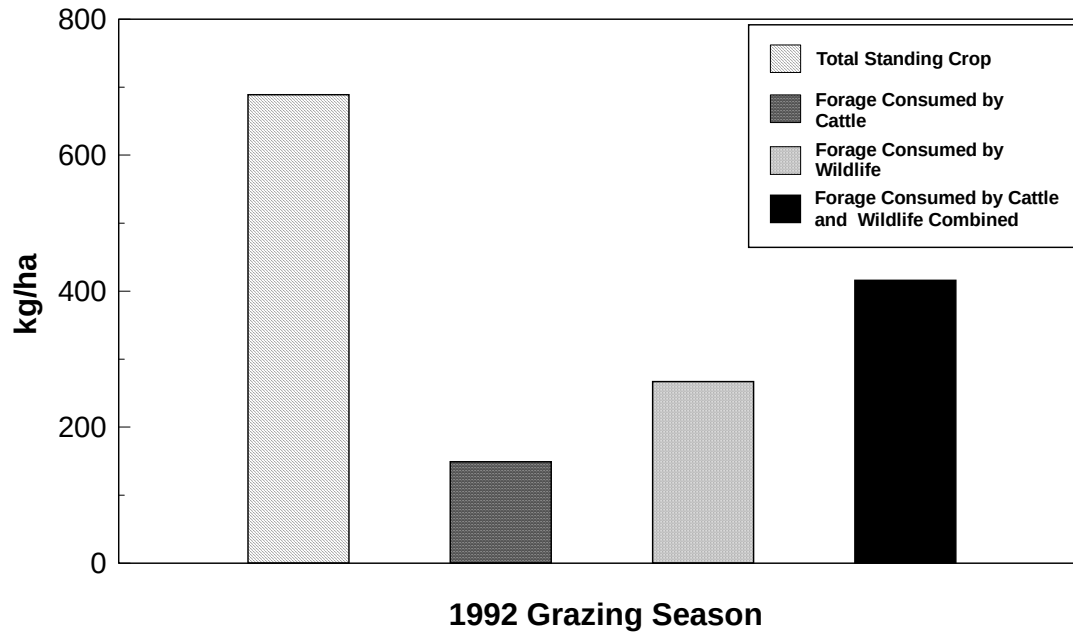


Figure 15. Total standing crop and forage consumed by cattle and wildlife in the combined use area at Skookumchuck Prairie in 1992.

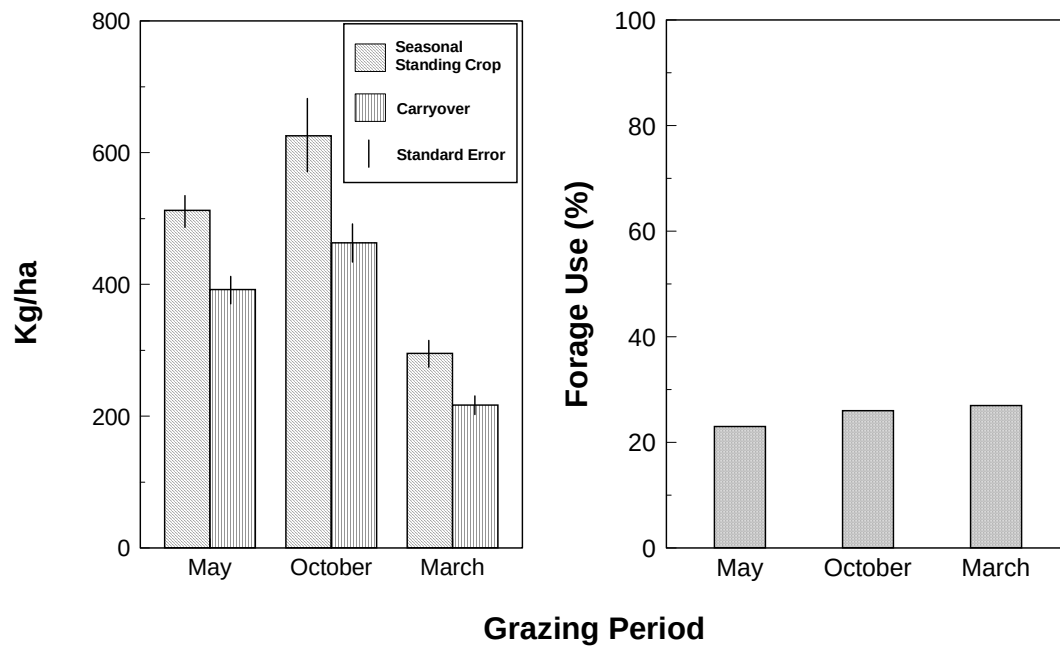


Figure 16. Seasonal standing crop, carryover, and forage use by wildlife in the wildlife only area at Skookumchuck Prairie in 1992.

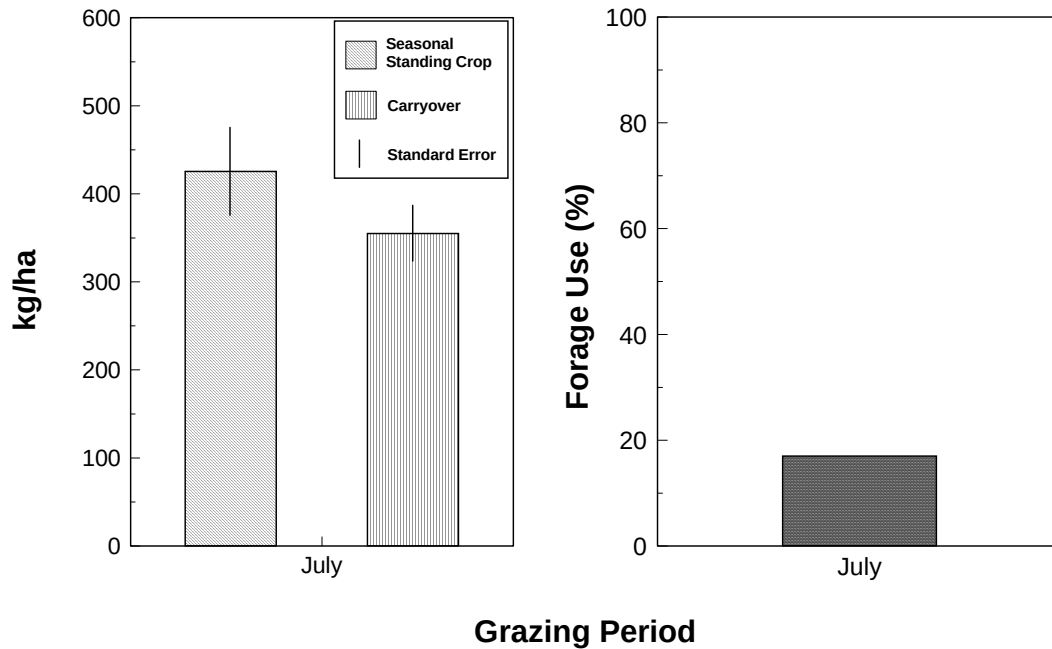


Figure 17. Seasonal standing crop, carryover, and forage use by cattle in the cattle only area at Skookumchuck Prairie in 1992.

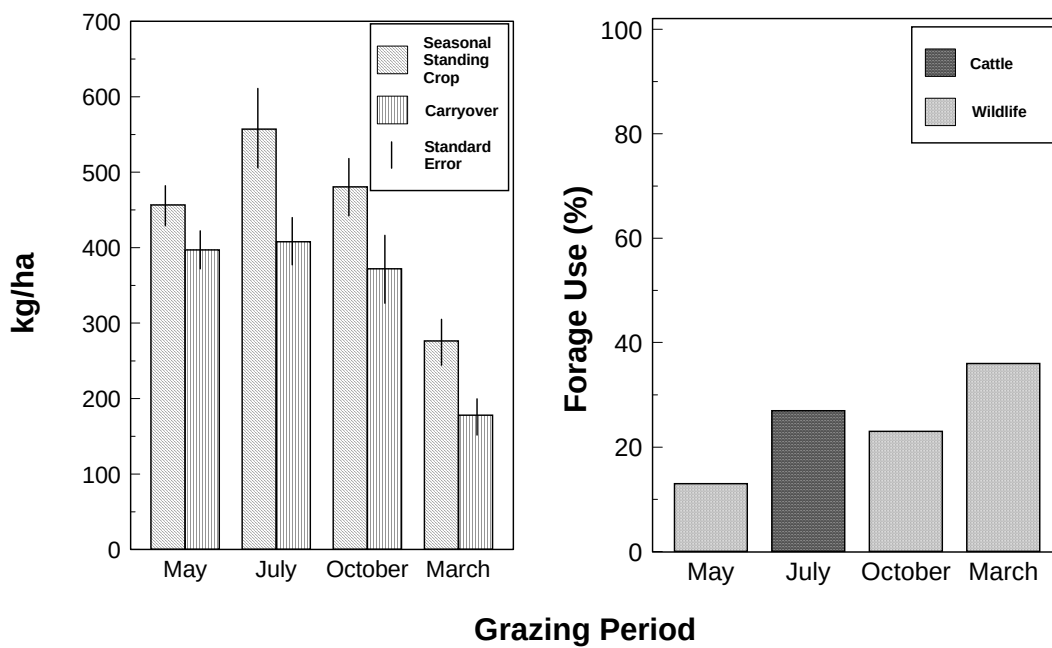


Figure 18. Seasonal standing crop, carryover, and forage use by cattle and wildlife in the combined use area at Skookumchuck Prairie in 1992.

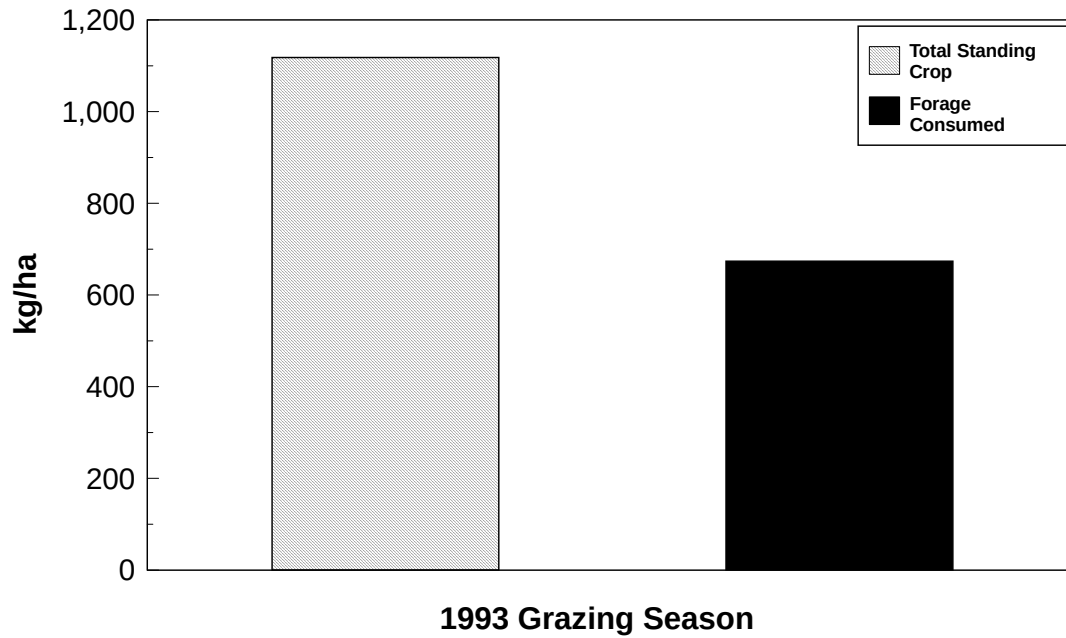


Figure 19. Total standing crop and forage consumed by wildlife in the wildlife only area at Skookumchuck Prairie in 1993.

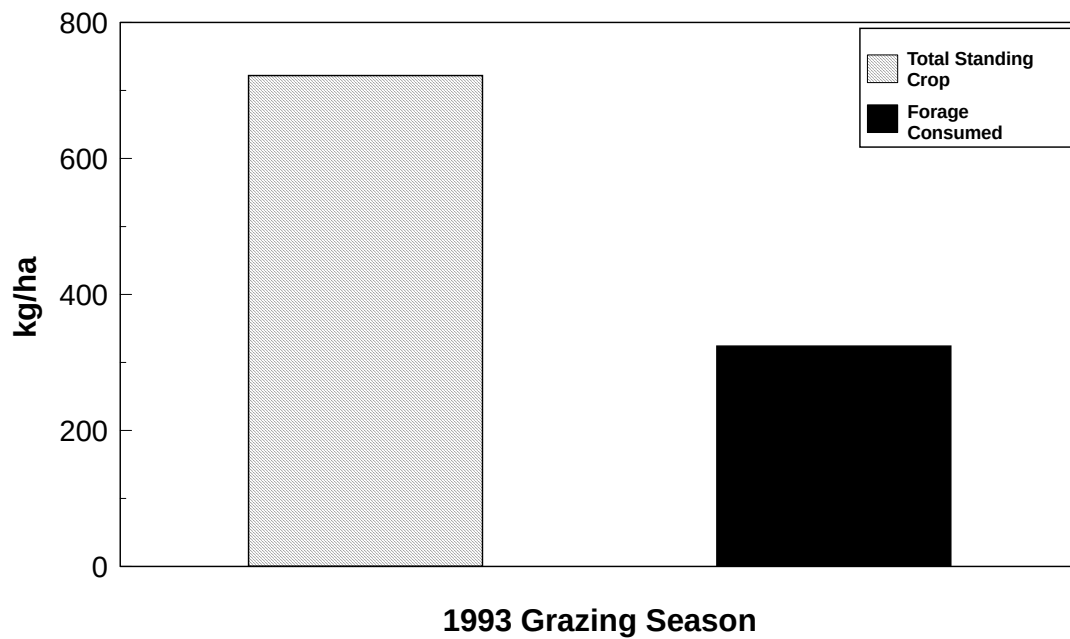


Figure 20. Total standing crop and forage consumed by cattle in the cattle only area at Skookumchuck Prairie in 1993.

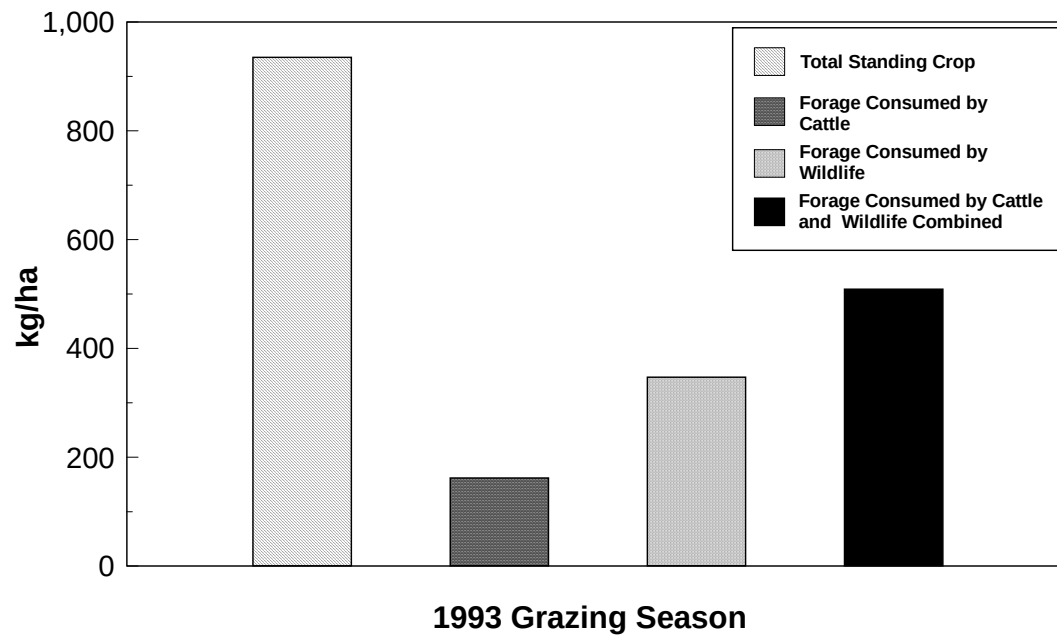


Figure 21. Total standing crop and forage consumed by cattle and wildlife in the combined use area at Skookumchuck Prairie in 1993.

Table 116. Wildlife, cattle and total use based on Total Standing Crop at Skookumchuck Prairie, Premier Ridge, Peckhams Lake, and Pickering Hills in 1992.

Site	Total Standing Crop kg/ha	Total Forage Eaten	Wildlife ¹ Use	Cattle Use %	Total Use
Skookumchuck Prairie					
Wildlife Only	745.6	361.2	48.4	0.0	48.4
Cattle Only	715.3	70.6	0.0	9.9	9.9
Combined Use	689.2	415.8	38.7	21.7	60.3
Secondary Sites					
Premier Ridge	828.7	411.1	30.7	18.9	49.6
Peckhams Lake - Old	2280.1	2084.3	30.2	61.3	91.5
Peckhams Lake - New	2363.0	2146.0	29.3	61.5	90.8
Pickering Hills	841.0	613.3	38.4	22.9	72.9

¹ % Wildlife Use and % Cattle Use calculated as a percentage of Total Standing Crop.

Table 117. Seasonal use by wildlife and cattle at Skookumchuck Prairie, Premier Ridge, Peckhams Lake, and Pickering Hills in 1992.

	Spring Wildlife	Spring Cattle	Fall Cattle %	Fall Wildlife	Winter Wildlife
Skookumchuck Prairie					
Wildlife Only	23* ¹	0	0	26*	27*
Cattle Only	0	17	0	0	0
Combined Use	13***	27*	0	23**	37*
Secondary Sites					
Premier Ridge	24*	40*	0	14***	43*
Peckhams Lake - Old	30***	68*	64*	50*	37*
Peckhams Lake - New	42*	82*	53*	44*	60*
Pickering Hills	9	0	29*	46*	64*

¹Denotation of significance indicates that percent use was based on a significant difference between forage standing crop on grazed and ungrazed plots determined by paired t-test (Zar 1984).

* Means significantly different at p<0.05

** Means significantly different at p<0.10

*** Means significantly different at p<0.20

Table 118. Wildlife, cattle and total use based on Total Standing Crop at Skookumchuck Prairie, Premier Ridge, Peckhams Lake, and Pickering Hills in 1993.

Site	Total Standing Crop kg/ha	Total Forage Eaten	Wildlife ¹ Use	Cattle Use %	Total Use
Skookumchuck Prairie					
Wildlife Only	1118.2	687.4	60.3	0.0	60.3
Cattle Only	721.6	324.0	0.0	44.9	44.9
Combined Use	935.1	508.5	37.1	17.3	54.4
Secondary Sites					
Premier Ridge	1171.8	730.5	33.0	29.3	62.3
Peckhams Lake - Old	4252.3	3259.6	24.9	51.7	76.7
Peckhams Lake - New	3005.5	1597.7	17.8	35.3	53.2
Pickering Hills	1112.9	624.6	21.7	34.5	56.2

¹ % Wildlife Use and % Cattle Use calculated as a percentage of Total Standing Crop.

Table 119. Seasonal use by wildlife and cattle at Skookumchuck Prairie, Premier Ridge, Peckhams Lake, and Pickering Hills in 1993.

	Spring Wildlife	Spring Cattle	Fall Cattle %	Fall Wildlife	Winter Wildlife
Skookumchuck Prairie					
Wildlife Only	41* ¹	0	0	26*	38*
Cattle Only	0	0	45*	0	0
Combined Use	27*	0	21*	20*	24***
Secondary Sites					
Premier Ridge	28*	0	33*	14***	56*
Peckhams Lake - Old	44*	0	69*	27	8
Peckhams Lake - New	28*	0	40*	8	15
Pickering Hills	15**	38*	0	12	41*

¹ Denotation of significance indicates that percent use was based on a significant difference between forage standing crop on grazed and ungrazed plots determined by paired t-test (Zar 1984).

* Means significantly different at p<0.05

** Means significantly different at p<0.10

*** Means significantly different at p<0.20

and the Combined Use Area ($p < 0.20$) at Skookumchuck Prairie in 1993 (Table 119, Figure 22, 23, 24). In contrast to 1992 where percentage use was highest in winter, wildlife use in 1993 was highest in spring (Table 117, 119).

In spring SSC and wildlife use were both higher in the Wildlife Only Area, than in the Combined Use Area. Wildlife ate approximately 265 kg/ha in the Wildlife Only Area and < 150 kg/ha (% Wildlife Use X TSC) in the Combined Use Area (Table 119, Figure 22, 24). The amount of forage carry-over in May was similar in both pastures at approximately 400 kg/ha (Figure 22, 24).

Cattle use was significant ($p < 0.05$) on both the Cattle Only Area and Combined Use Area (Table 119, Figure 23, 24), however, use in the Cattle Only Area was more than twice that in the Combined Use Area. The amount of available forage in fall (October) 1993 was similar in both pastures, but grazing removed > 320 kg/ha in the Cattle Only Area compared to < 170 kg/ha (% Cattle Use X TSC) in the Combined Use Area (Table 118, Figure 23, 24).

Forage standing crop was significantly greater ($p < 0.05$) in grazed compared to ungrazed plots in the Wildlife Only and Combined Use Areas in fall 1993 (Table 119, Figure 22, 24). Forage use in the Combined Use Area was slightly lower than in the Wildlife Only Area (20% vs. 26%) during the same period. Seasonal Standing Crop, however, equaled 854 kg/ha in the Wildlife Only Area compared to 479 kg/ha in the Combined Use Area. Consequently, twice the amount of forage was utilized in the Wildlife Only Area compared to the Combined Use Area.

In winter, statistical differences were calculated between the grazed and ungrazed standing crops in both the Wildlife Only ($p < 0.05$) and Combined Use Areas ($p < 0.20$), resulting in 38% and 24% use in the two areas, respectively (Table 119, Figure 22, 24).

Skookumchuck Prairie - 1994

Elk monitoring was completed in 1992/93 so no data are available regarding the time the herd spent at Skookumchuck 1994/95. Based on the previous two years however, the herd used the site from late-October, 1994 to early-June, 1995, for approximately 200 days. The total number of animals using the winter range were not available.

Distribution and total amount of precipitation was quite different in 1994/95 compared to 1993/94. Growing season precipitation (220.2 mm) equaled the long-term average, but the total precipitation from July through September (20 mm) was slightly $> 20\%$ of normal (90 mm) (Table 3,4). TSC in the three pastures ranged from approximately 840 kg/ha in the Cattle Only Area to 970 kg/ha in the Wildlife Only Area (Table 120). Likely, residual soil moisture enabled 1994 TSC to approach 95% of the average TSC in 1993

In 1994, total forage use in all pastures, and all grazing periods, was similar to use in 1993 (Table 118, 120). In the Wildlife Only Area wildlife use was nearly 70% of the TSC during 1994 (Table 120, Figure 25). Cattle ate slightly more than 40% of the TSC in the Cattle Only Area (Table 120, Figure 26). Total use by wildlife and cattle in the Combined Use Area at Skookumchuck Prairie in 1994 was $> 65\%$ of the TSC, which was relatively evenly distributed between wildlife ($> 30\%$) and cattle ($> 34\%$) (Table 120, Figure 27).

Cattle ate approximately equal amounts of forage, in the Combined Use (% Cattle Use X TSC = 306 kg/ha) and Cattle Only Areas (> 330 kg/ha) in 1994 (Table 120, Figure 26, 27). In contrast, wildlife ate more than double the amount of forage in the Wildlife Only Area, compared to the Combined Use Area (Table 120, Figure 25, 27). Similar results occurred in 1993, where total forage eaten by wildlife in the Wildlife Only Area was higher than in the

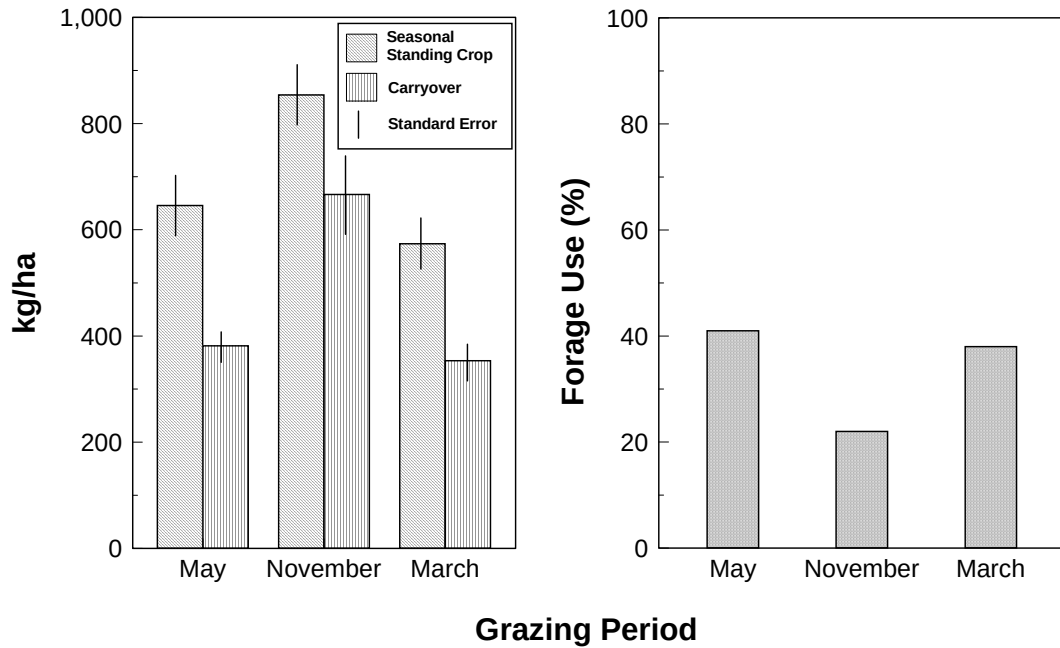


Figure 22. Seasonal standing crop, carryover, and forage use by wildlife in the wildlife only area at Skookumchuck Prairie in 1993.

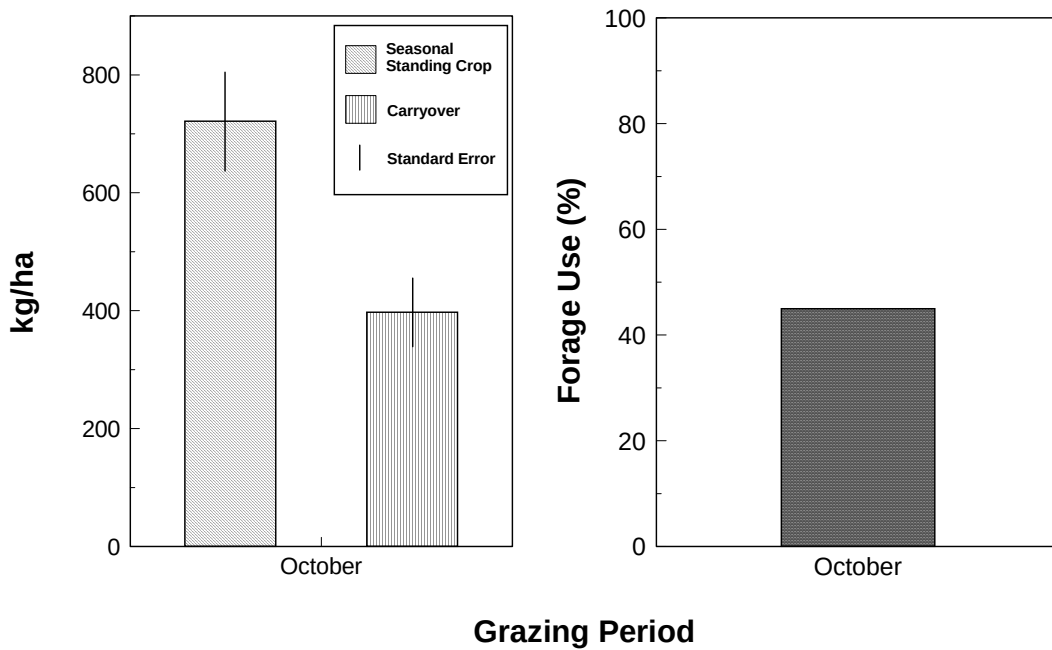


Figure 23. Seasonal standing crop, carryover, and forage use by cattle in the cattle only area at Skookumchuck Prairie in 1993.

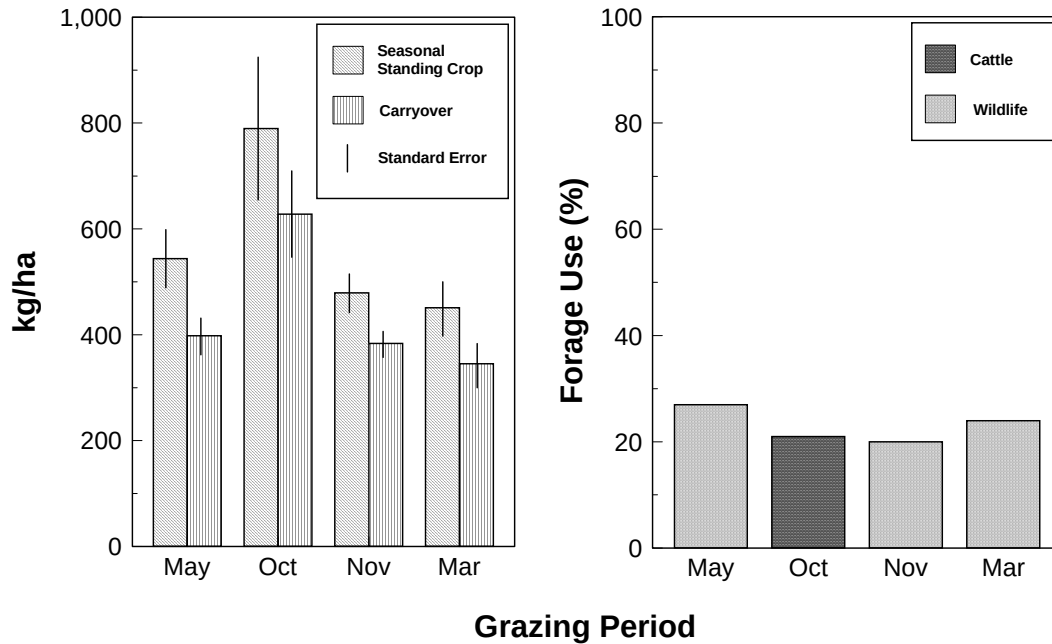


Figure 24. Seasonal standing crop, carryover, and forage use by cattle and wildlife in the combined use area at Skookumchuck Prairie in 1993.

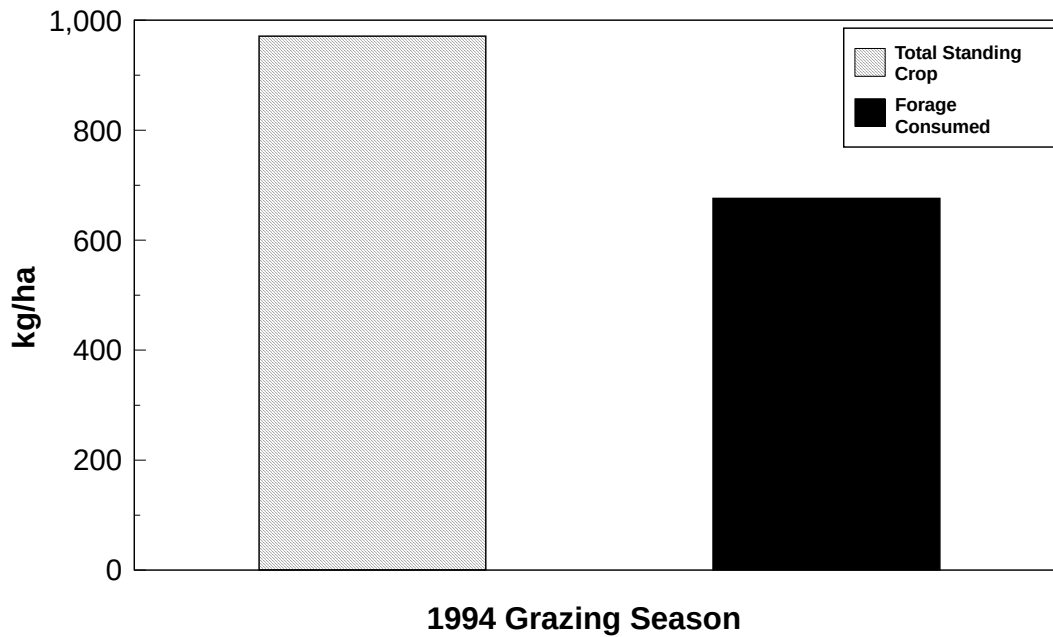


Figure 25. Total standing crop and forage consumed by wildlife in the wildlife only area at Skookumchuck Prairie in 1994.

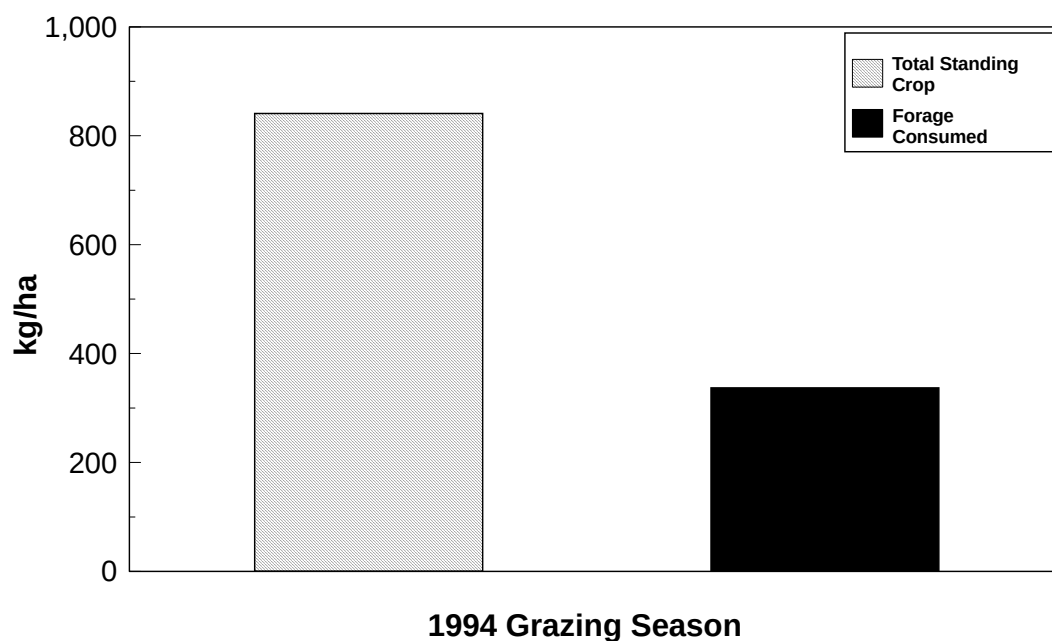


Figure 26. Total standing crop and forage consumed by cattle in the cattle only area at Skookumchuck Prairie in 1994.

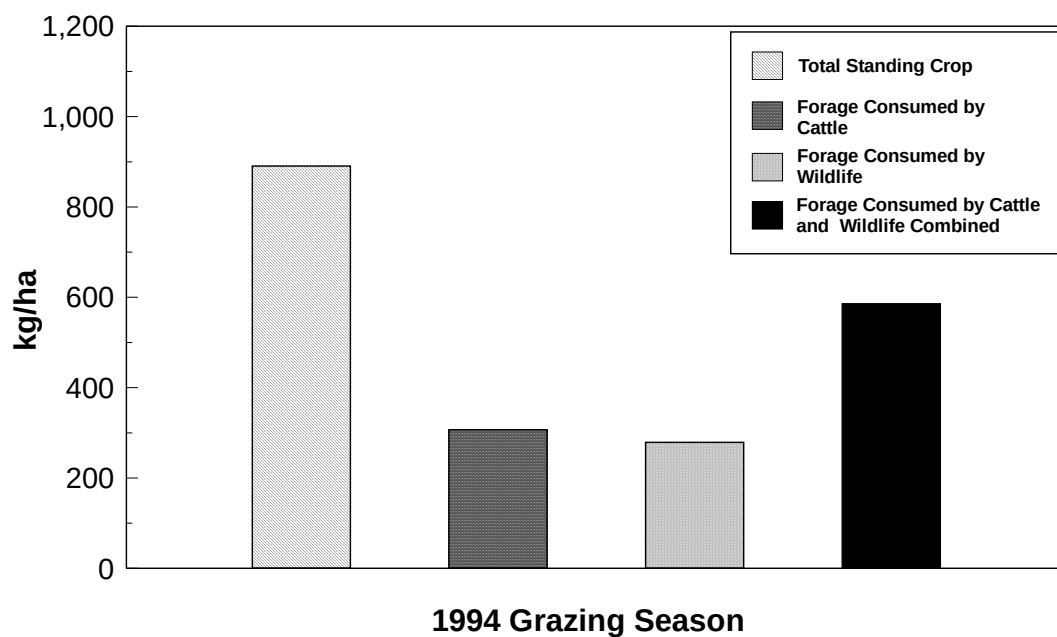


Figure 27. Total standing crop and forage consumed by cattle and wildlife in the combined use area at Skookumchuck Prairie in 1994.

Table 120. Wildlife, cattle and total use based on Total Standing Crop at Skookumchuck Prairie, Premier Ridge, Peckhams Lake, and Pickering Hills in 1994.

Site	Total Standing Crop Kg/ha	Total Forage Eaten	Wildlife ¹ Use	Cattle Use %	Total Use
Skookumchuck Prairie					
Wildlife Only	971.3	676.5	69.6	0.0	69.6
Cattle Only	841.3	337.4	0.0	40.1	40.1
Combined Use	891.1	584.5	31.2	34.4	65.6
Secondary Sites					
Premier Ridge	863.7	437.2	30.1	20.5	50.6
Peckhams Lake - Old	1758.5	1070.5	25.5	35.4	60.9
Peckhams Lake - New	1114.3	703.3	20.9	42.2	63.1
Pickering Hills	1136.0	627.2	26.5	28.2	55.2

¹ % Wildlife Use and % Cattle Use calculated as a percentage of Total Standing Crop.

Combined Use Area. In 1992 wildlife use was more evenly distributed between the Wildlife Only and the Combined Use Areas (Table 116, Figure 16, 17, 18). Increased use of the Wildlife Only Area, compared to the Combined Use Area, may have resulted from wildlife distributing themselves differently in 1994 in response to the cattle presence.

Forage standing crop was significantly greater ($p < 0.05$) on the ungrazed plots compared to the grazed plots during all grazing periods, except the fall wildlife use period in the Combined Use Area, and the spring wildlife use period in the Wildlife Only Area (Table 121, Figure 28, 29, 30). Similar to 1992, wildlife use was highest in winter in 1994, ranging from $>40\%$ in the Combined Use Area to $>60\%$ in the Wildlife Only Area (Table 121, Figure 28, 29, 30).

A statistical difference ($p < 0.05$) was calculated between the grazed plots and the SSC during the spring wildlife period in the Combined Use Area ($>20\%$) (Table 121, Figure 30), but no difference was found in spring in the Wildlife Only Area. SSC was relatively equal at both sites in May 1994 (Figure 28, 30).

Both SSC and total forage eaten by cattle were approximately equal in the Cattle Only and Combined Use Areas in 1994 during the cattle grazing period (Table 120, Figure 28, 30). Indeed, forage use by cattle was 40% at both sites. Cattle were grazed in July and August in 1994 (Table 3,4). The below-average precipitation from July to September likely resulted in limited regrowth following the cattle grazing period.

In contrast to the spring wildlife results, in fall wildlife used nearly 40% of the SSC in the Wildlife Only Area (Table 121, Figure 28), but no use was calculated in the Combined Use Area. In October, SSC in the Wildlife Only Area was nearly double the SSC in the Combined Use Area in October (Figure 28, 30). Cattle use in the previous grazing period resulted in a lower SSC in fall in the Combined Use Area than in the wildlife only period (Figure 28, 30). The lower standing crop, in combination with limited regrowth following cattle grazing, may have affected wildlife foraging patterns in fall in the Combined Use Area.

The majority of the total forage eaten in the Wildlife Only Area was consumed in fall and winter. Wildlife ate >350 kg/ha and >270 kg/ha in fall (October) and winter (March) in the fall and winter respectively (Table 121, Figure 28). Winter wildlife use (163 kg/ha) in the Combined Use Area was approximately double wildlife use in spring (Table 121, Figure 28, 30).

4.2.3 Premier Ridge, Peckham's Lake and Pickering Hills 1992-1994

Secondary Sites - 1992

Total Standing Crop (TSC) was higher on the secondary sites than at Skookumchuck Prairie. TSC varied from slightly <2300 kg/ha on the New Seeding at Peckhams Lake to nearly 830 kg/ha at Premier Ridge (Table 116, Figure 31, 32, 33, 34).

Forage use by wildlife and cattle generally followed similar patterns to those at Skookumchuck Prairie on all the secondary sites, except at Peckhams Lake (Table 116, Figure 31, 32, 33, 34). Total use by cattle and wildlife combined ranged from just under 50% at Premier Ridge to more than 90% at both of the Peckhams Lake sites. At Premier Ridge and Pickering Hills, cattle and wildlife used similar proportions of total forage used, although total use was higher at Pickering Hills both in $\%$ use and kg/ha of forage removed.

In 1992, patterns of use at Peckhams Lake were almost identical at the New Seeding and the Old Seeding. Wildlife occupied Peckhams Lake from green-up to about May 15, 1992. The New Seeding, planted in 1991, appeared to be preferentially grazed by wildlife. Indeed,

wildlife used 42% ($p<0.05$) of the available forage. In contrast, wildlife used only 30% ($p<0.20$) of the

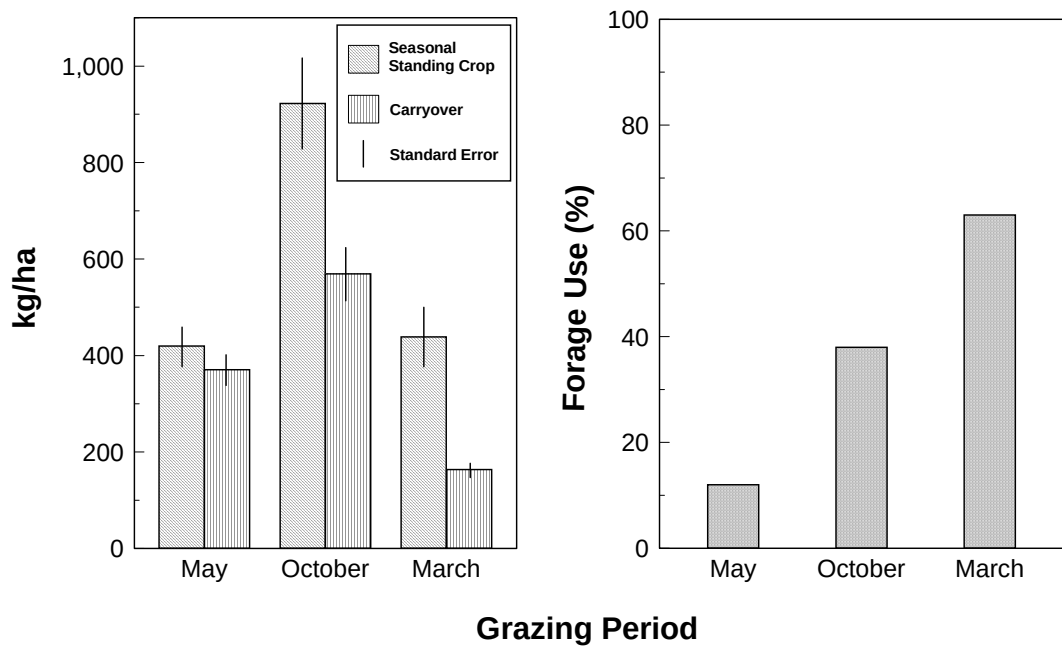


Figure 28. Seasonal standing crop, carryover, and forage use by wildlife in the wildlife only area at Skookumchuck Prairie in 1994.

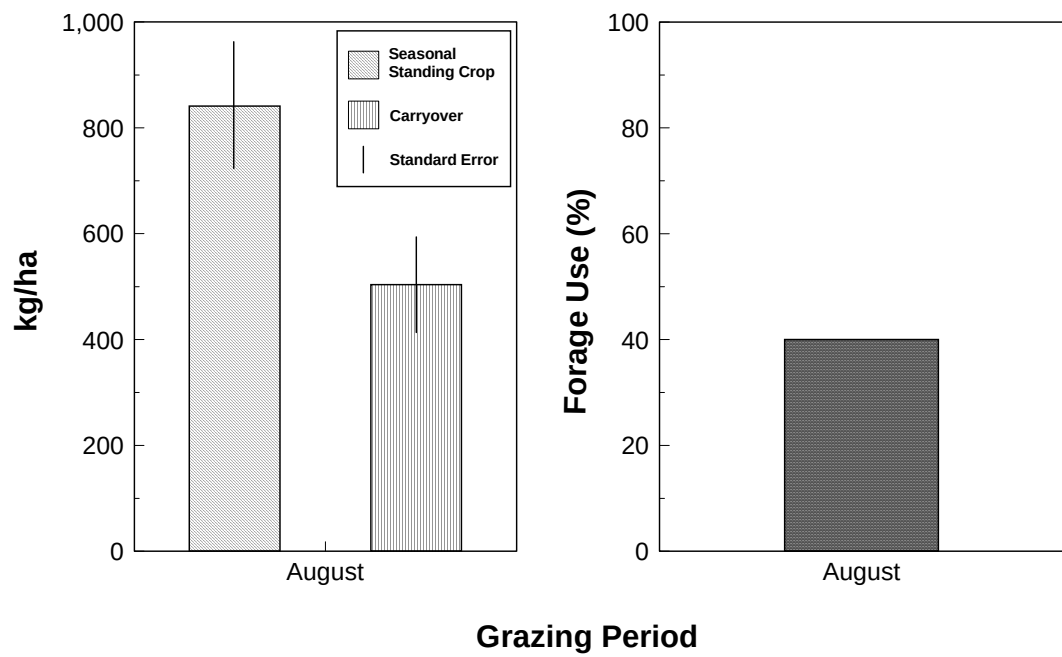


Figure 29. Seasonal standing crop, carryover, and forage use by cattle in the cattle only area at Skookumchuck Prairie in 1994.

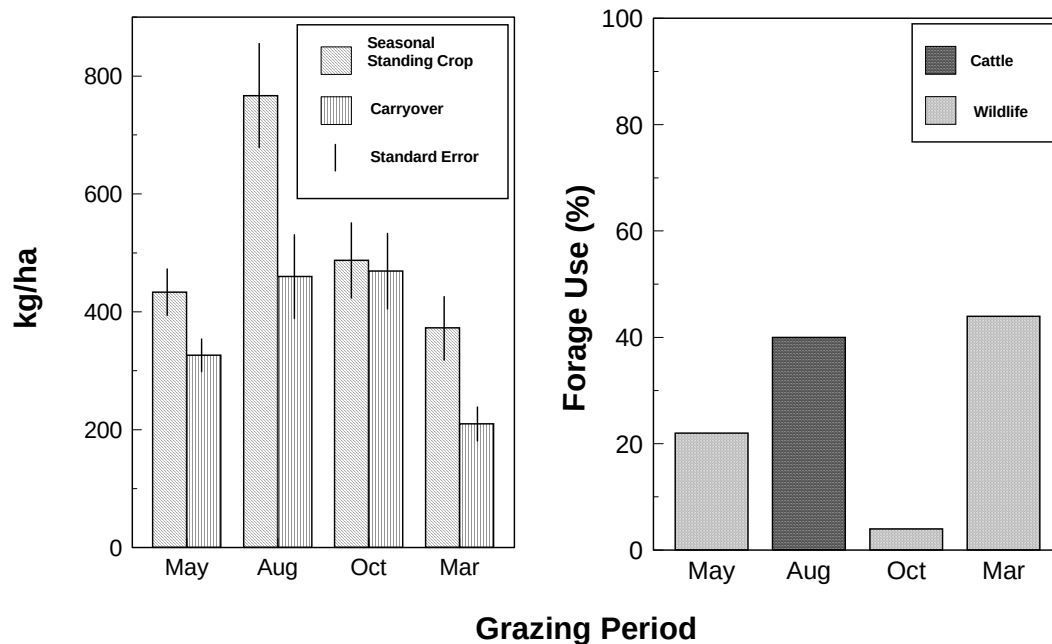


Figure 30. Seasonal standing crop, carryover, and forage use by cattle and wildlife in the combined use area at Skookumchuck Prairie in 1994.

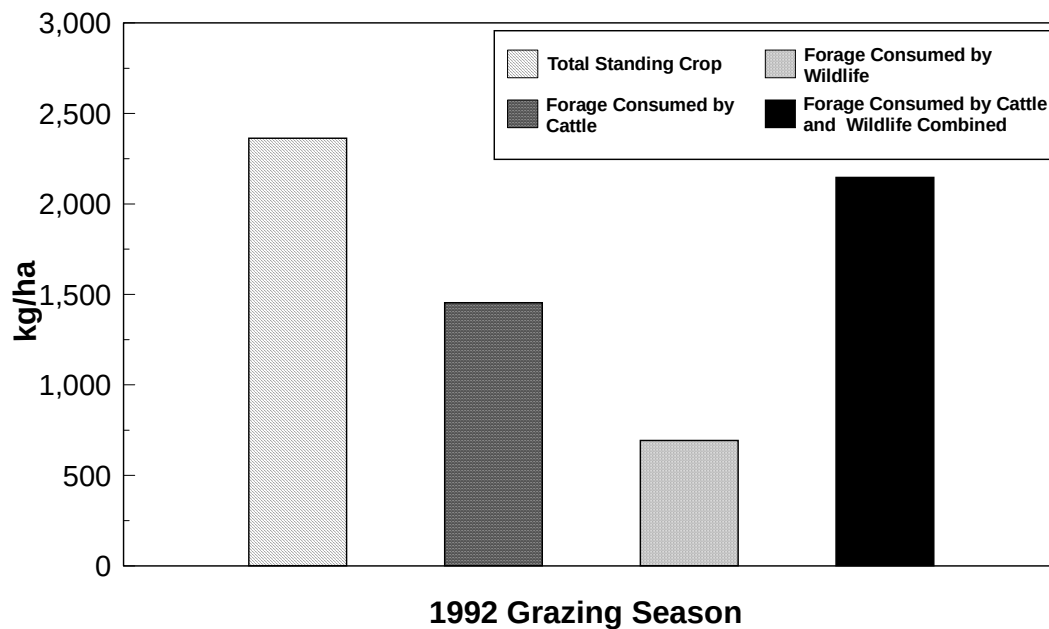


Figure 31. Total standing crop and forage consumed by cattle and wildlife at Peckhams Lake - new seeding in 1992.

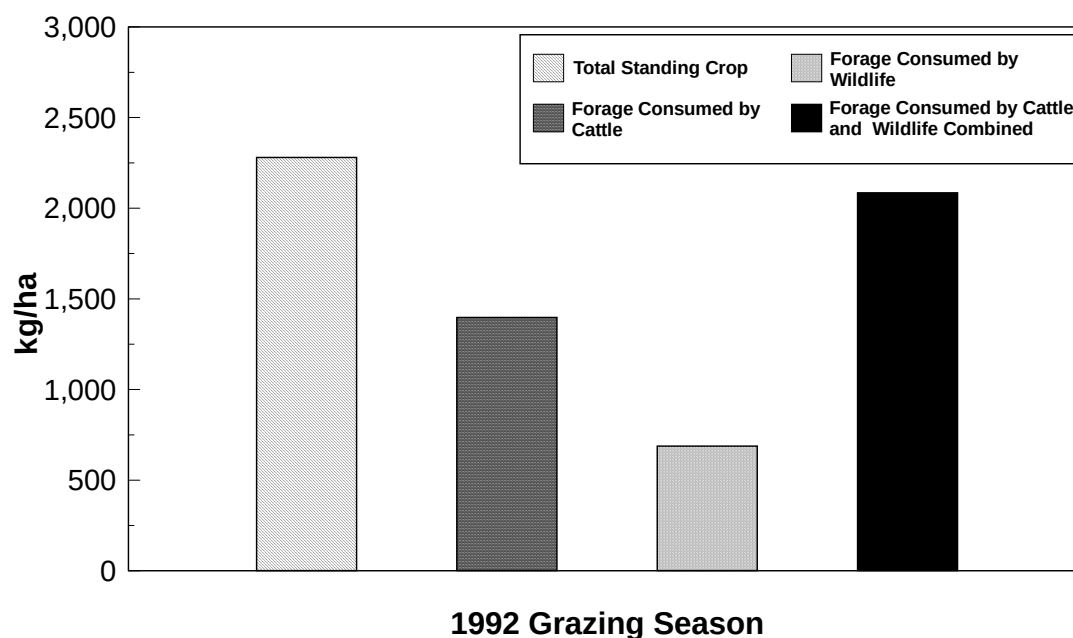


Figure 32. Total standing crop and forage consumed by cattle and wildlife at Peckhams Lake - old seeding in 1992.

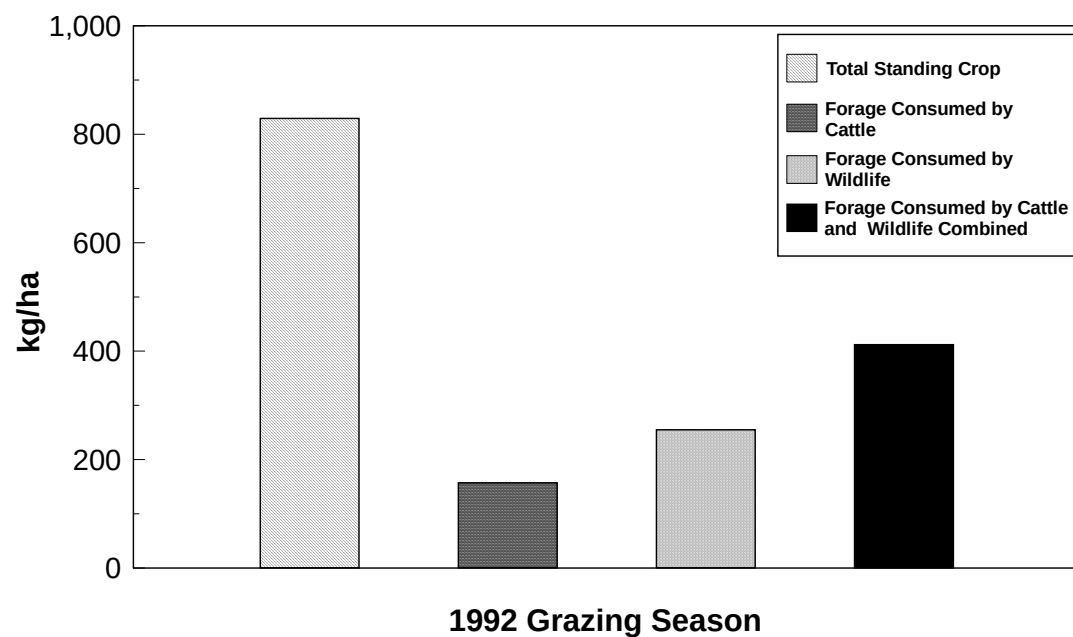


Figure 33. Total standing crop and forage consumed by cattle and wildlife at Premier Ridge in 1992.

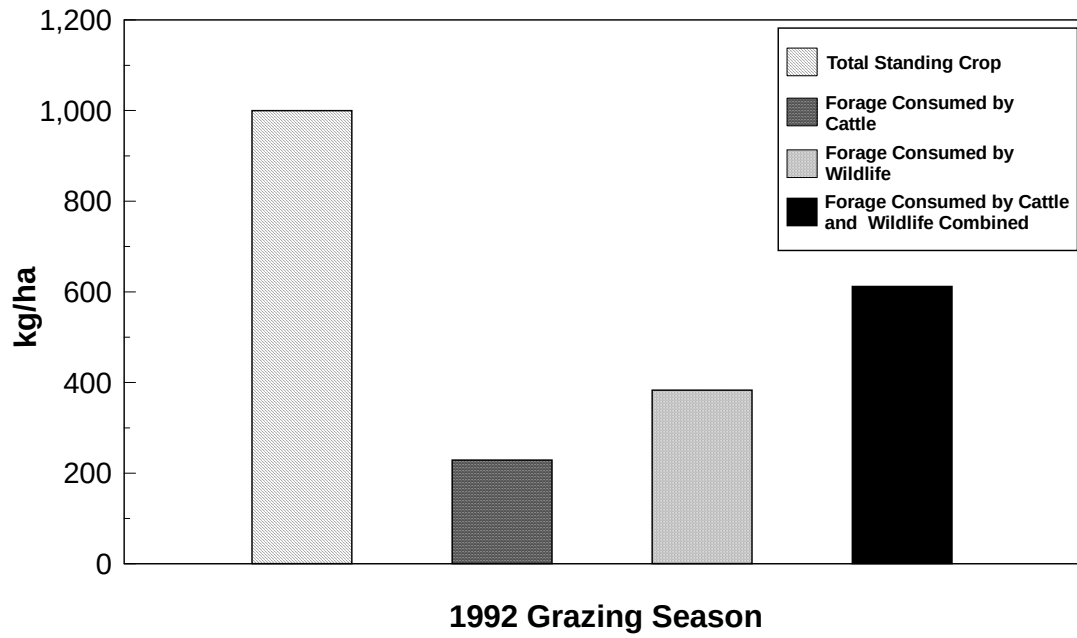


Figure 34. Total standing crop and forage consumed by cattle and wildlife at Pickering Hills in 1992.

Table 121. Seasonal use by wildlife and cattle at Skookumchuck Prairie, Premier Ridge, Peckhams Lake, and Pickering Hills in 1994.

	Spring Wildlife	Spring Cattle	Fall Cattle %	Fall Wildlife	Winter Wildlife
Skookumchuck Prairie					
Wildlife Only	12	0	0	38 ^{a1}	63 ^a
Cattle Only	0	40 ^a	0	0	0
Combined Use	22 ^a	40 ^a	0	4	44 ^a
Secondary Sites					
Premier Ridge	20 ^a	23 ^a	0	21 ^c	47 ^a
Peckhams Lake - Old	16	39 ^a	0	21 ^c	33 ^a
Peckhams Lake - New	19 ^c	45 ^a	0	17	18
Pickering Hills	24 ^a	0	33 ^a	14 ^c	44 ^a

¹ Denotation of significance indicates that percent use was based on a significant difference between forage standing crop on grazed and ungrazed plots determined by paired t-test (Zar 1984).

^a Means significantly different at $p < 0.05$

^b Means significantly different at $p < 0.10$

^c Means significantly different at $p < 0.20$

forage in the Old Seeding (Table 117, Figure 35, 36).

The spring cattle grazing period resulted in 68% (492 kg/ha), forage removal from the Old Seeding. The New Seeding was evidently preferred by the cattle, as well, because use was 82% with 712 kg/ha removed ($p < 0.05$) (Table 117, Figure 32, 34).

Ordinarily, the rotation in the Peckhams Lake range unit calls for a one month grazing period. In 1992, however, cattle spent an additional 2 weeks in the seeded pasture in August, which resulted in removal of >900 kg/ha and >700 kg/ha in the Old Seeding, and New Seeding, respectively (Figure 35, 36). Although a lower percentage of forage was grazed in August than in June (Table 117), the availability of more forage in August resulted in more forage being removed. Total use at Peckhams Lake was increased by 43% and 33% at the Old and New Seeding, respectively, because of this second pass by cattle.

Clearly, a second cattle grazing period can: 1) have an additional physiological impact on forage plants - management should not strive for maximum forage removal to maximize cattle gains, but rather, strive to sustain the forage base for long- term livestock and wildlife production, in addition for soil health, watershed and other values; and, 2) limit wildlife access to forage on critical winter habitat when it was previously eaten by cattle.

Fall wildlife use at both the New and the Old Seedings followed the second cattle grazing period. The amount of forage available in both seedings was similar but slightly higher use was made of the Old Seeding, (50%) compared to the New Seeding (44%). Standing crop on grazed plots was significantly lower ($p < 0.05$) than on ungrazed plots in both seedings (Table 117).

Following the second cattle grazing period, the carryover in the Old Seeding slightly exceeded 500 kg/ha, while in the New Seeding the carryover equaled 670 kg/ha (Figure 35, 36). The SSC in the New Seeding at the end of the fall wildlife period was equal to the carryover from the cattle grazing period, while in the Old Seeding >670 kg/ha were available. This greater use of the Old Seeding by wildlife in the fall may be the result of regrowth in the Old Seeding between the end of the second cattle grazing period and the return of the wildlife to the winter range.

Standing crop was significantly different ($p < 0.05$) between grazed and ungrazed plots at both the Old and New Seedings, respectively at Peckhams Lake during winter. Forage utilization ranged from nearly 40% (Old) to 60% (New) (Table 117). Although % use was higher on the New Seeding than the Old Seeding, the amount of forage removed was similar between the Old Seeding (>140 kg/ha) and the New Seeding (>150 kg/ha) due to the larger standing crop on the Old Seeding (Figure 35, 36).

Wildlife use at Peckhams Lake was lowest of all sites sampled. Despite this, total forage use by cattle and wildlife exceeded 90% of TSC at Peckhams Lake in both the New and the Old Seedings in 1992 (Table 116, Figure 31, 32). Cattle used slightly >60% of the TSC and wildlife used 30% in both the New and Old Seedings. Total forage use over all grazing periods averaged >2000 kg/ha.

At Premier Ridge, total use by wildlife and cattle was slightly <50% of the TSC, with wildlife consuming >30% and cattle <20% of available standing crop (Table 116, Figure 33). Significant differences ($p < 0.20$) existed between the grazed and ungrazed plots in all grazing periods (Table 117).

Spring wildlife grazing and spring cattle grazing, constrained regrowth as the cattle were turned-out into this pasture on May 1, 1992. However, Jamieson and Hebert (1993) estimated that 50% of the wildlife did not leave this site until May 5, 1992. SSC was approximately 400

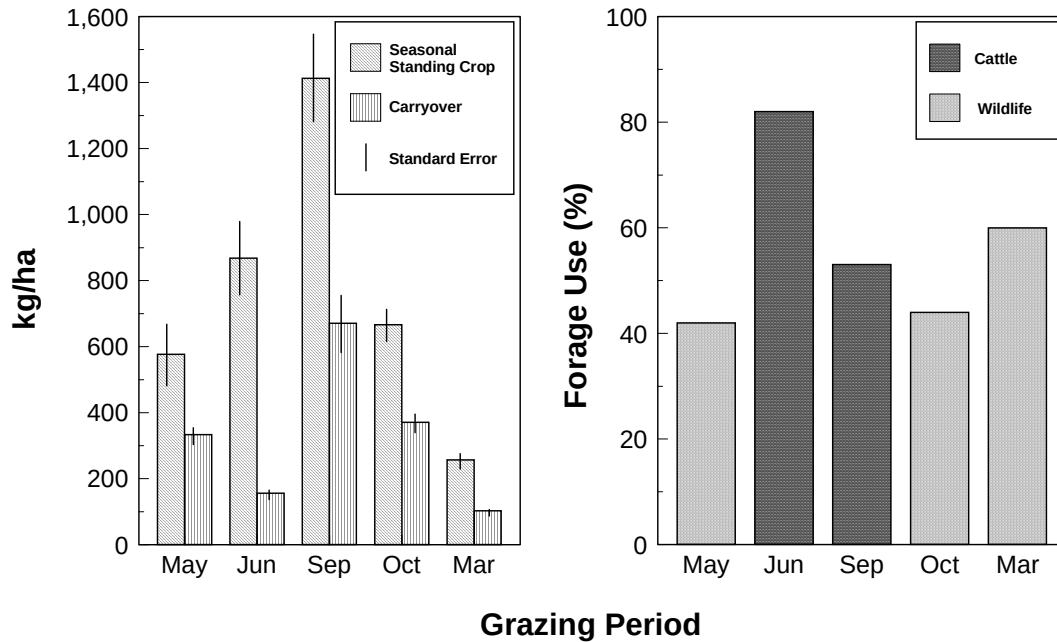


Figure 35. Seasonal standing crop, carryover, and forage use by cattle and wildlife at Peckhams Lake - new seeding in 1992.

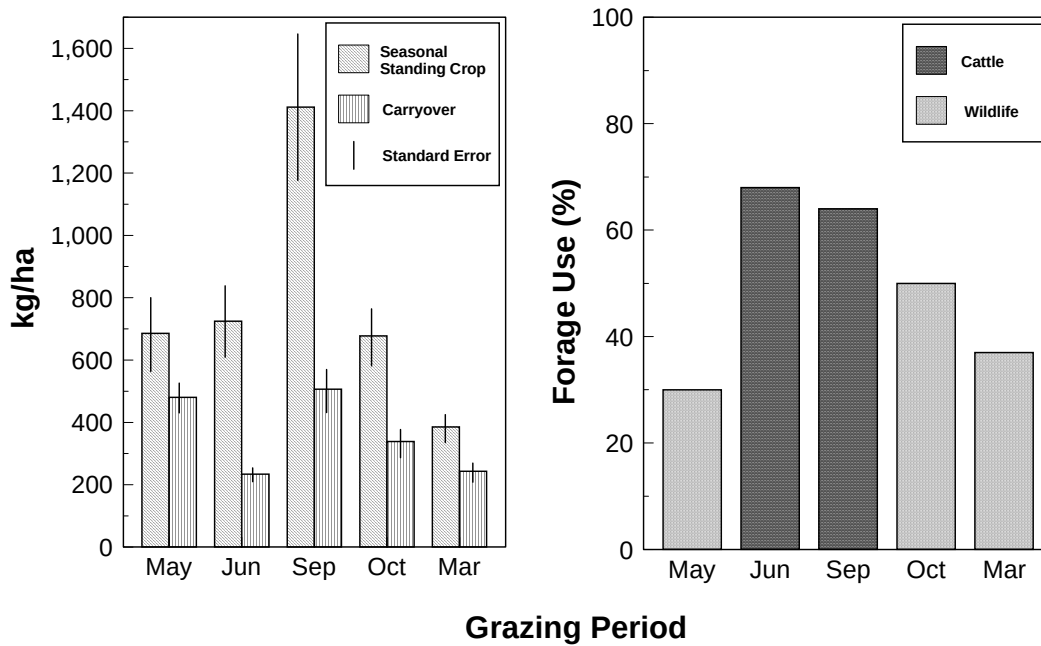


Figure 36. Seasonal standing crop, carryover, and forage use by cattle and wildlife at Peckhams Lake - old seeding in 1992.

kg/ha for both the spring wildlife and spring cattle grazing periods which ended on May 5 and June 15, respectively.

The difference between the carryover following spring wildlife grazing and the SSC for the cattle grazing period was approximately 100 kg/ha (Figure 37). Wildlife used 25% of the available forage while cattle used 40% of the forage in their respective spring grazing periods (Table 117, Figure 37).

The fall wildlife grazing period had the largest amount of available forage of all periods at Premier Ridge, as the SSC was >570 kg/ha (Figure 37). A significant difference ($p < 0.20$) was found between the grazed and ungrazed plots indicating 14% forage use by wildlife. SSC was measured at 190 kg/ha in late March, 1993. A significant difference ($p < 0.05$) was found between the ungrazed SSC and the grazed plots. Wildlife use was >40% in winter 1992/93 (Table 117, Figure 37).

TSC at Pickering Hills (841 kg/ha) and Premier Ridge were similar between sites in 1992. Combined use by wildlife and cattle totaled was >600 kg/ha or almost 73% of the TSC (Table 116). Although significant ($p > 0.20$) wildlife use did not occur in spring, wildlife use totaled over all periods was nearly 40% of the TSC, while cattle use was slightly <23% (Table 116, Figure 34).

At Pickering Hills in 1992, differences between grazed and ungrazed plots were significant ($p < 0.05$) in all grazing periods, except spring wildlife grazing (Table 117). The Pickering Hills site was grazed by cattle in fall in 1992 (Table 5). The SSC available in September was >800 kg/ha (Figure 38). Cattle used 29% ($p < 0.05$) which provided adequate carryover for the fall wildlife grazing period. Wildlife used >15% ($p < 0.05$) of the available forage during this period.

During winter 1992/93, nearly 170 kg/ha was available for wildlife grazing at Pickering Hills. Ungrazed SSC was higher than forage yields on grazed plots and use was nearly 65% (Table 117). Likely, weathering losses affected the standing crop as the October carryover from the fall wildlife period, was nearly 300 kg/ha, compared to <170 kg/ha available in March, 1993 (Figure 38).

Secondary Sites - 1993

Precipitation during the growing season was above average in 1993. During the growing season almost 380 mm of rain accumulated in 1993 representing 150% of the 37 year average (Table 3, 4). TSC ranged from slightly >1100 kg/ha at Pickering Hills and Premier Ridge to >4200 kg/ha in the Old Seeding at Peckhams Lake (Figure 39, 40, 41, 42).

At Peckhams Lake, which was seeded to a mix of domestic forages, forage yields were substantially greater than in 1992. At Peckhams Lake - Old Seeding the TSC for the 1993 growing season was >4250 kg/ha, an increase of 86% over 1992 (Table 116, 118). Although the absolute values were lower at Peckhams Lake - New Seeding, the trend was the same, the TSC (3006 kg/ha) was 27% higher than the TSC in 1992. Clearly, forage were enhanced by increased growing season precipitation. The cattle grazing period was scheduled for September allowing adequate time for regrowth following the spring wildlife grazing period.

Generally, total forage use at Peckhams Lake was lower in 1993 compared to 1992 (Table 116), even though in absolute terms, more forage was eaten in 1993 (Table 118). Total use by wildlife and cattle was calculated at just over 50% for the New Seeding, and more than 75% in the Old Seeding. Cattle used a larger percentage of the forage at Peckhams Lake in 1993

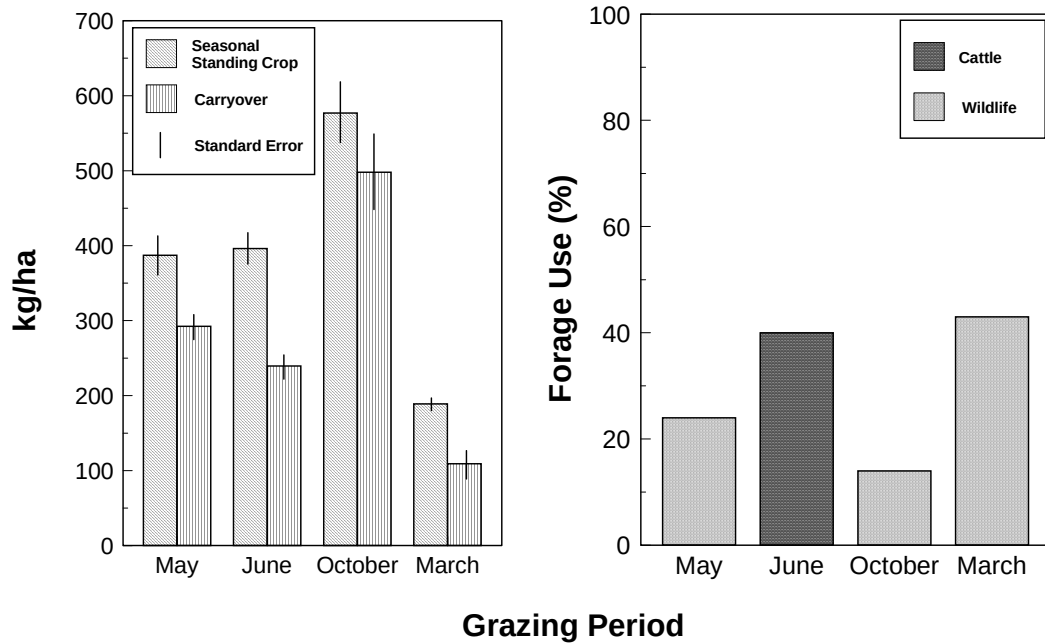


Figure 37. Seasonal standing crop, carryover, and forage use by cattle and wildlife at Premier Ridge in 1992.

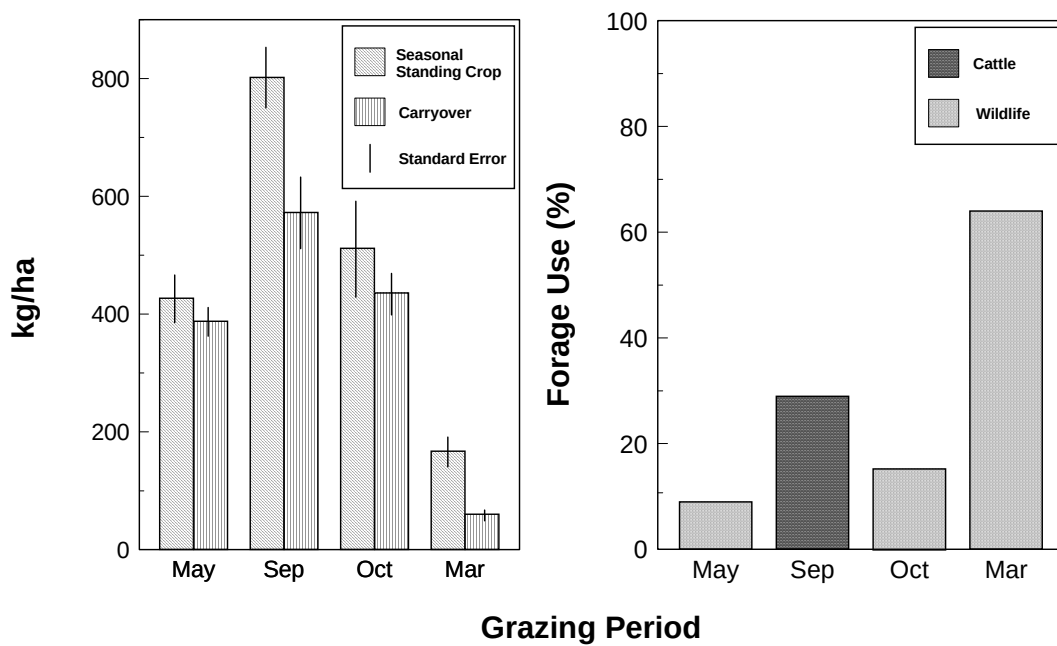


Figure 38. Seasonal standing crop, carryover, and forage use by cattle and wildlife at Pickering Hills in 1992.

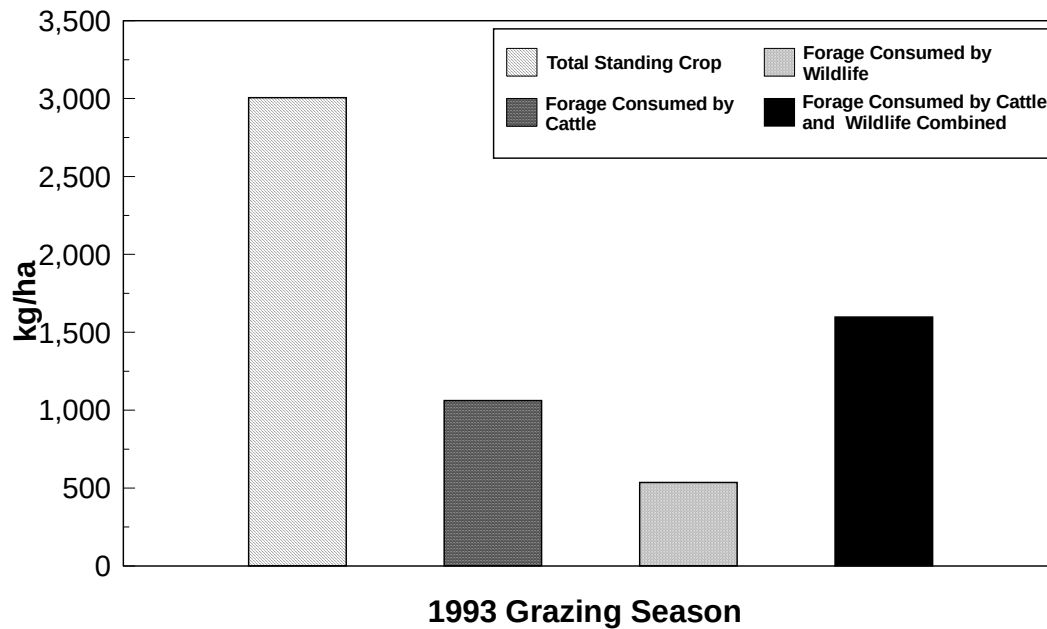


Figure 39. Total standing crop and forage consumed by cattle and wildlife at Peckhams Lake - new seeding in 1993.

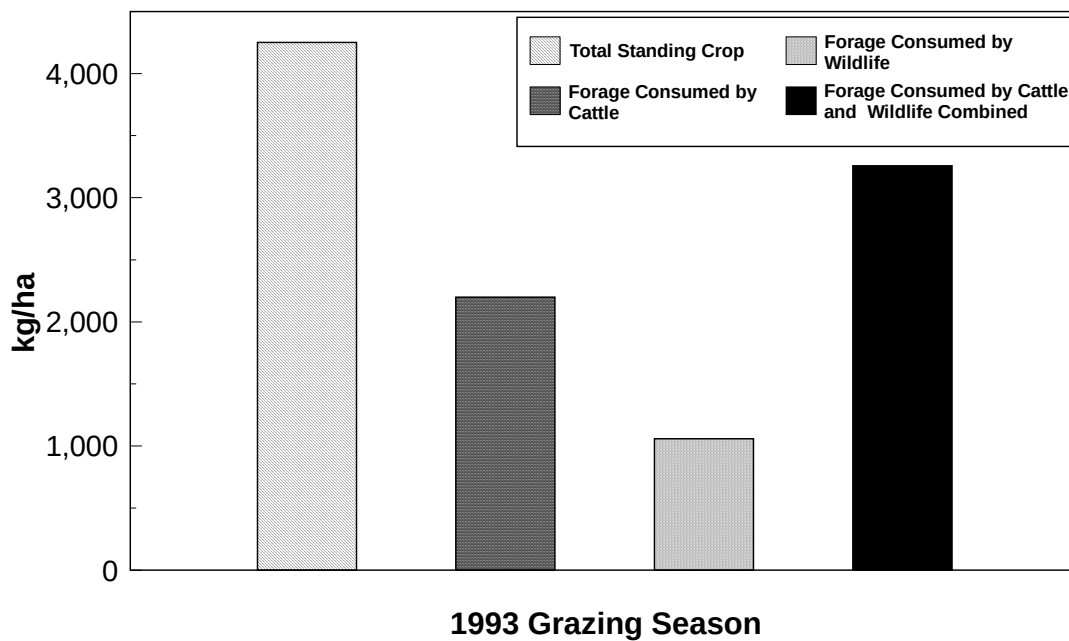


Figure 40. Total standing crop and forage consumed by cattle and wildlife at Peckhams Lake - old seeding in 1993.

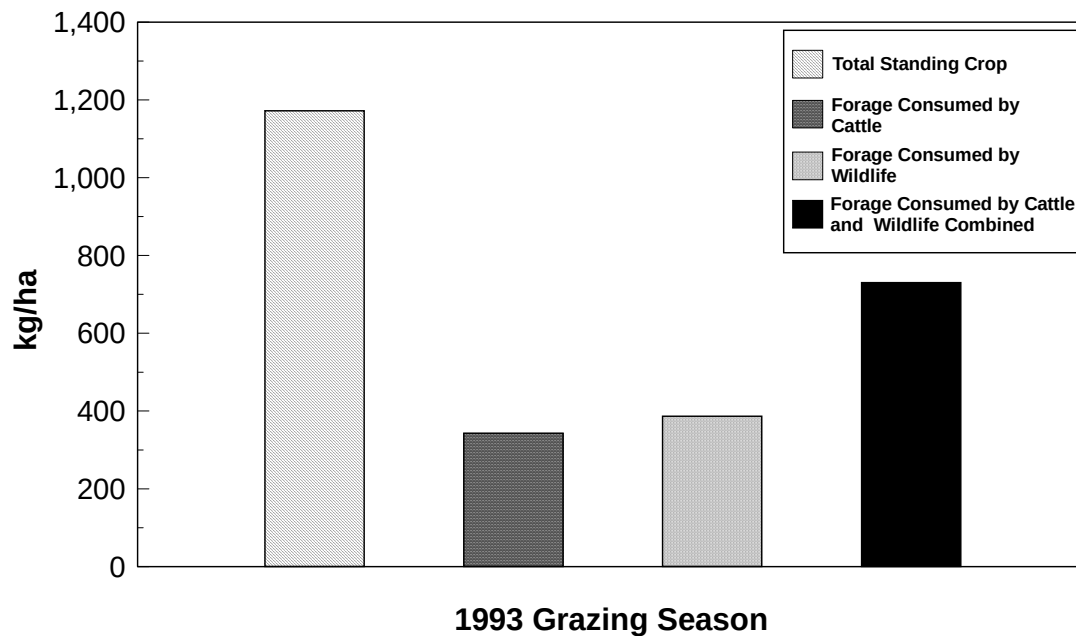


Figure 41. Total standing crop and forage consumed by cattle and wildlife at Premier Ridge in 1993.

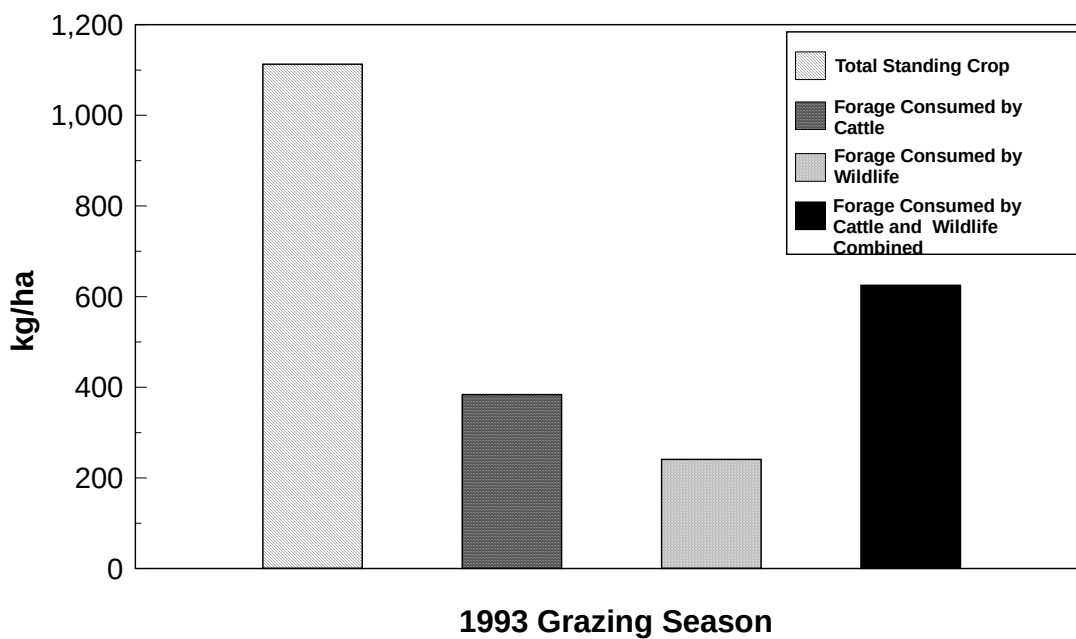


Figure 42. Total standing crop and forage consumed by cattle and wildlife at Pickering Hills in 1993.

than wildlife did (Table 118, Figure 39, 40).

Forage standing crop in the ungrazed plots was significantly ($p < 0.05$) higher than on the ungrazed plots in both the spring wildlife and the fall cattle grazing periods at both Peckhams Lake sites in 1993 (Table 119). In contrast, no significant differences ($p > 0.20$) were found in the fall or winter wildlife grazing periods on either site.

SSC in the Old Seeding was nearly 1500 kg/ha in the spring wildlife grazing period (May) while SSC at the New Seeding was approximately 1300 kg/ha (Figure 43, 44). Wildlife use at the Old Seeding was calculated at nearly 44% of the SSC, compared to 28% at the New Seeding. This trend was reversed from 1992 where the New Seeding received heavier use (Table 117).

The SSC for Peckhams Lake - Old Seeding was almost 3200 kg/ha, compared to the New Seeding (> 2600 kg/ha) at the end of the cattle grazing period in September, 1993 (Figure 43, 44). However, at both sites the ungrazed SSC was significantly ($p < 0.05$) larger than the grazed plots. Cattle forage use on the Old Seeding ($> 70\%$) exceeded use on the New Seeding. Despite the amount of forage removed, the carryover for the fall wildlife period ranged from < 1000 kg/ha in the Old Seeding to > 1500 kg/ha in the New Seeding (Figure 43, 44). However, no significant differences ($p > 0.20$) were found between grazed and ungrazed on either the New and Old Seedings in the fall or winter wildlife grazing periods (Table 119).

Like the other sites, Premier Ridge had higher than normal precipitation in 1993. The TSC in 1993 was nearly 1200 kg/ha, which exceeded the 1992 TSC by 41% (Table 116, 118, Figure 33, 41). Total use by wildlife and cattle was $> 62\%$ of the TSC. Wildlife use, totaled over the spring, fall, and winter grazing periods was 33% of the TSC, similar to cattle use (29%). Total forage eaten at Premier Ridge was > 730 kg/ha, 78% higher than in 1992 (Table 116, 118, Figure 33, 41). Both cattle and wildlife ate more forage in 1993.

The SSC was significantly greater ($p < 0.20$) than the grazed plots during all grazing periods at Premier Ridge in 1993 (Table 119). Spring wildlife use was nearly 30% of the SSC where > 400 kg/ha were available (Table 119, Figure 45). The SSC in May, 1993 at the end of the spring wildlife grazing period, was similar to the SSC in 1992 (Figure 37, 45). However, in 1993, cattle grazed the site in August rather than May/June, as in 1992 (Table 5). This resulted in more forage available for cattle grazing in 1993 than in 1992. Cattle ate 33% of the > 1000 kg/ha available to them in 1993, approximately double the amount eaten in 1992. However, > 700 kg/ha of carryover was available for wildlife in the fall and winter.

Forage use by wildlife in 1993 was lowest in the fall ($< 15\%$) and highest in the winter, where wildlife used more than 50% of the SSC (Table 119, Figure 45). However, the SSC in March was less than 300 kg/ha. Carryover from the fall wildlife period was approximately 450 kg/ha (Table 119, Figure 45). Likely some of this difference is due to weathering of the standing crop.

At Pickering Hills in 1993, TSC was > 1100 kg/ha, which exceeded 1992 TSC by $> 30\%$ (Table 116, 118, Figure 34, 42). In 1993, total use by wildlife and cattle at Pickering Hills exceeded 55% of the TSC (Table 118). Although % use in 1993 was less than in 1992, the total forage eaten, in kg/ha, was almost identical in both years (Table 116, 118). Cattle ate slightly $< 35\%$ of the TSC in 1993 while wildlife used about 22% (Table 118). In contrast, in 1992 wildlife used nearly 40% of the TSC, while cattle used approximately 23% (Table 116). Significant differences ($p < 0.10$) between the grazed and ungrazed SSC plots were calculated in all grazing periods, except the fall wildlife period ($p > 0.20$).

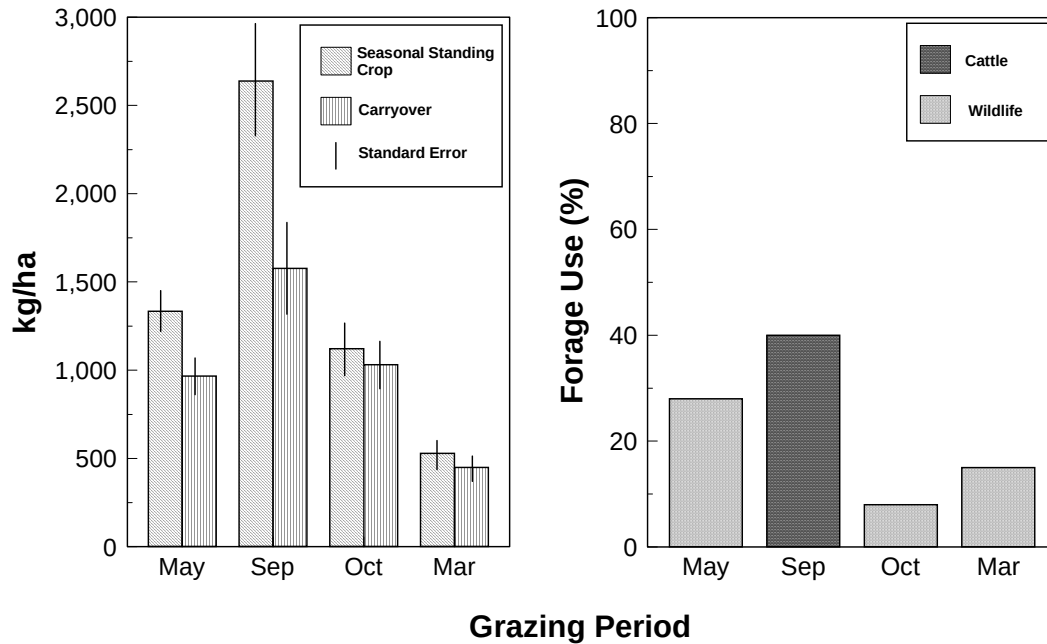


Figure 43. Seasonal standing crop, carryover, and forage use by cattle and wildlife at Peckhams Lake - new seeding in 1993.

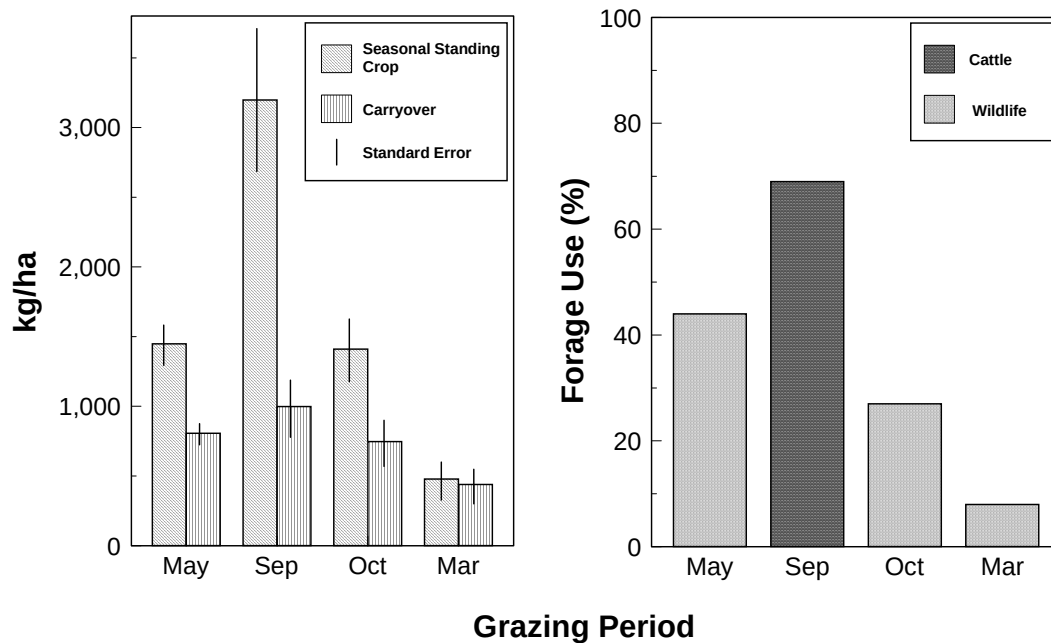


Figure 44. Seasonal standing crop, carryover, and forage use by cattle and wildlife at Peckhams Lake - old seeding in 1993.

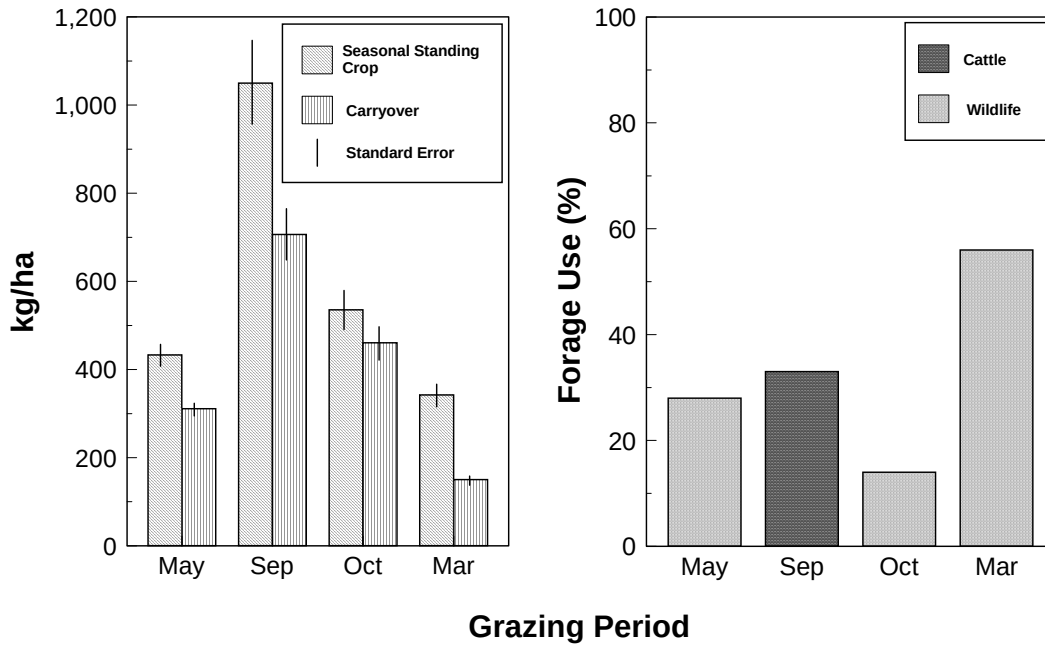


Figure 45. Seasonal standing crop, carryover, and forage use by cattle and wildlife at Premier Ridge in 1993.

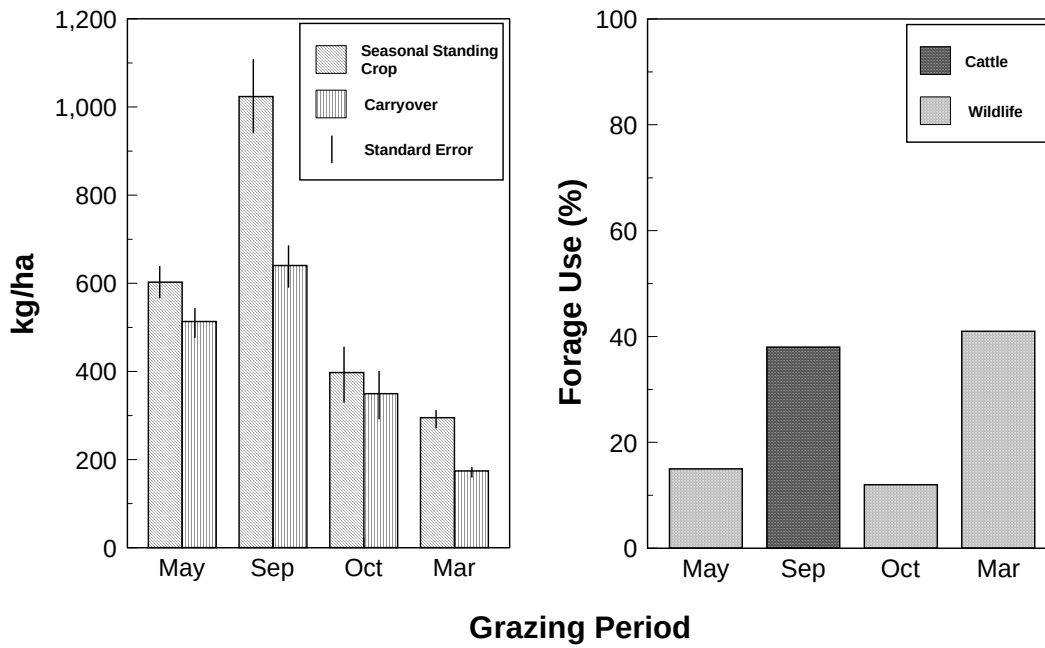


Figure 46. Seasonal standing crop, carryover, and forage use by cattle and wildlife at Pickering Hills in 1993.

SSC was approximately 600 kg/ha in May at Pickering Hills (Figure 46). Forage standing crop on the grazed plots was significantly lower than on ungrazed SSC plots ($p < 0.10$) resulting in 15% forage use by wildlife (Table 119, Figure 46). SSC in September, 1993, at Pickering Hills was > 1000 kg/ha and was significantly higher ($p < 0.05$) than on the ungrazed plots. Although cattle used nearly 40% of the SSC in September, approximately 600 kg/ha of forage carryover was available for fall and winter wildlife use (Table 119, Figure 46). At Pickering Hills in 1993, both fall and winter wildlife use were lower than at Pickering Hills in 1992. In contrast to 1992, where fall wildlife use was nearly 50% (Table 117), no fall wildlife use was calculated at Pickering Hills in 1993. Winter wildlife use exceeded 60% of SSC in 1992, while wildlife use in winter in 1993 was approximately 40% (Table 117, 119). The SSC was < 300 kg/ha in March 1994, at Pickering Hills (Figure 46).

Secondary Sites - 1994

In contrast to 1993, July, August, and September of 1994 were virtually rain-free. Total precipitation at the Cranbrook Airport from July through September was 20.2 mm compared to the long-term average, which is almost 90.0 mm (Table 3, 4). TSC ranged from slightly > 860 kg/ha at Premier Ridge to nearly 1800 kg/ha at the Old Seeding at Peckhams Lake (Figure 47, 48, 49, 50).

At Peckhams Lake in 1994, the timing and amount of rainfall appears to have affected the amount of standing crop. TSC at both the New and Old Seedings, was the lowest in 1994 of all years during the three year study on these seeded range units. In fact, in the New Seeding in 1992, the establishment year, TSC was almost double the TSC in 1994 (Table 116, 120, Figure 31, 47). The TSC ranged from > 1700 kg/ha in the Old Seeding to slightly > 1100 kg/ha in the New Seeding in 1994 (Table 120, Figure 47, 48). Total use by cattle and wildlife at Peckhams Lake was approximately 60% of the TSC at both the Old and New Seedings (Table 120). However, total forage eaten by cattle and wildlife was $> 50\%$ higher in the Old Seeding than in the New Seeding (Table 120, Figure 47, 48). As in 1992 and 1993, cattle used a larger portion of the available forage at both sites at Peckhams Lake in 1994, $> 35\%$ and $> 40\%$ of the TSC in the Old and New Seedings, respectively. Wildlife used slightly $> 25\%$ and $> 20\%$, respectively, at the same two sites (Table 120).

Of the eight grazing periods under study in the two sites at Peckhams Lake in 1994, significant differences ($p > 0.20$) between the grazed plots and the ungrazed SSC plots were not found in three periods (Table 121). Use was not calculated in the spring wildlife period in the Old Seeding, and in the fall and winter wildlife periods in the New Seeding.

The most important comparison of these two sites is the difference in the SSC, particularly in May, 1994. At the Old Seeding the SSC was nearly 1000 kg/ha, while at the New Seeding the SSC was slightly > 400 kg/ha (Figure 51, 52). For spring wildlife use, ungrazed SSC plots were significantly greater ($p < 0.20$) than grazed plots only in the New Seeding at Peckhams Lake in 1994 (Table 121). Use was calculated at nearly 20% in the New Seeding in 1994 (Table 121).

Cattle grazed the seedings at Peckhams Lake in June, 1994 (Table 5). Forage standing crop on ungrazed SSC plots was significantly greater ($p < 0.05$) than grazed plots at both sites. Cattle used approximately 40% of the SSC, in both the Old and New Seedings (Table 121). As in May 1994, the SSC at the Old Seeding in June was higher (> 1600 kg/ha) than the SSC in the New Seeding (< 1100 kg/ha) (Figure 51, 52).

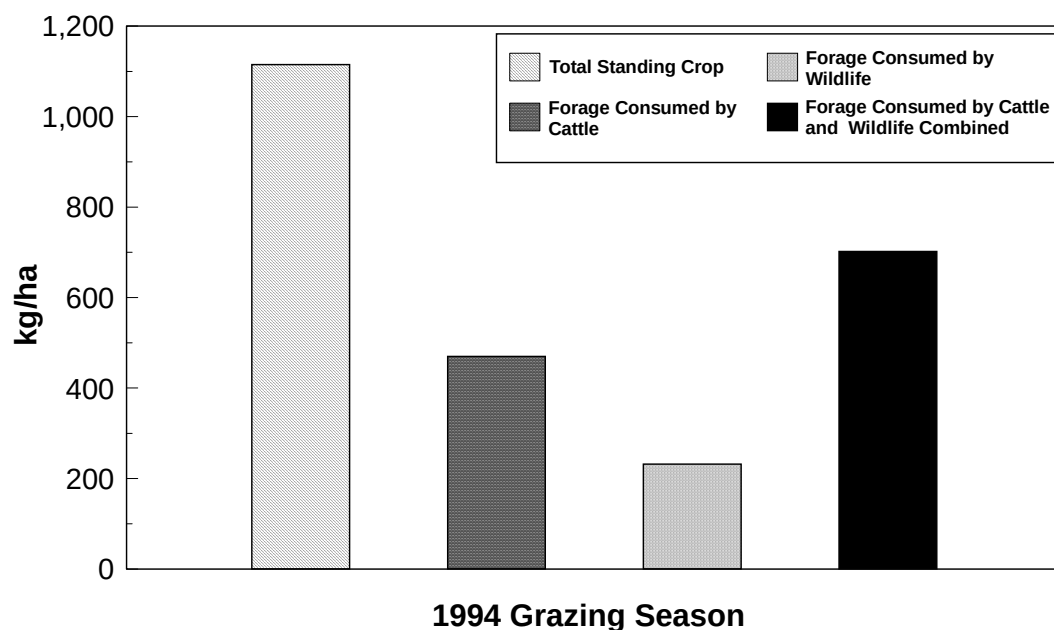


Figure 47. Total standing crop and forage consumed by cattle and wildlife at Peckhams Lake - new seeding in 1994.

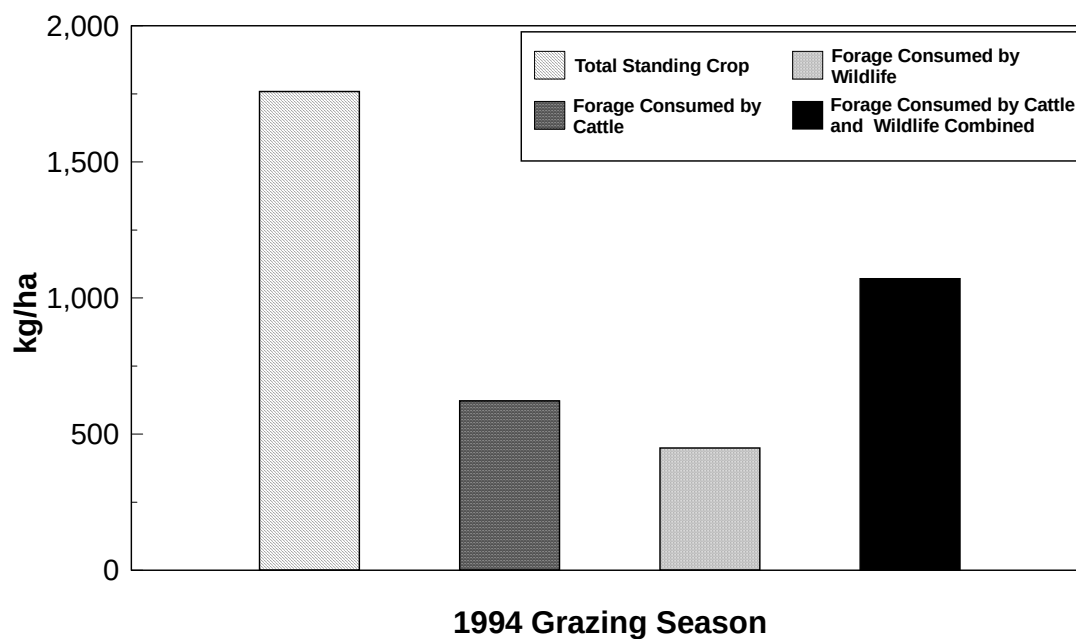


Figure 48. Total standing crop and forage consumed by cattle and wildlife at Peckhams Lake - old seeding in 1994.

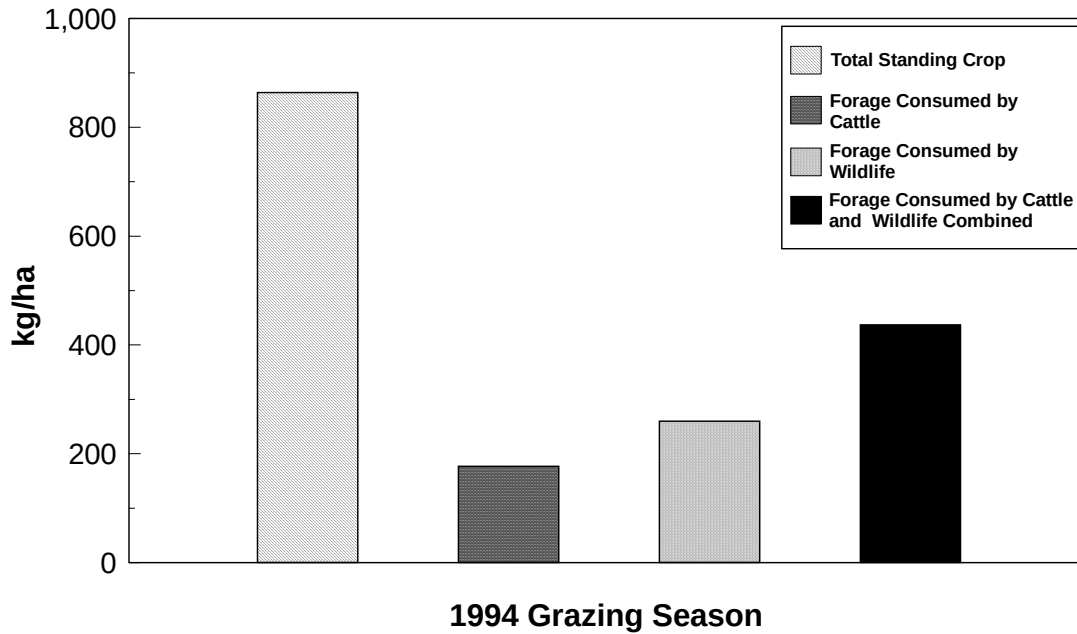


Figure 49. Total standing crop and forage consumed by cattle and wildlife at Premier Ridge in 1994.

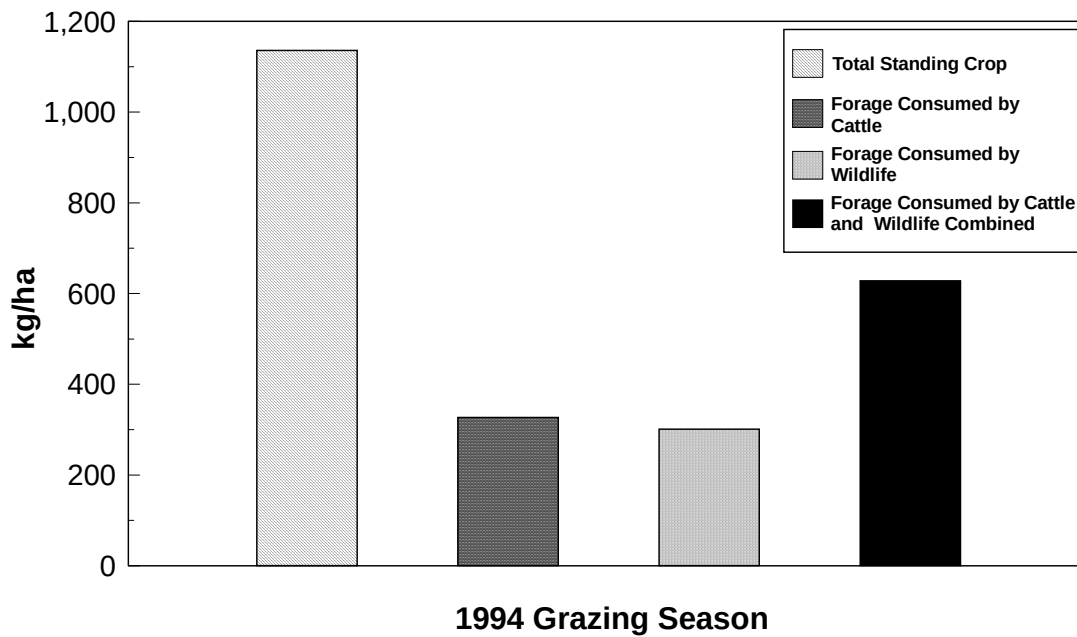


Figure 50. Total standing crop and forage consumed by cattle and wildlife at Pickering Hills in 1994.

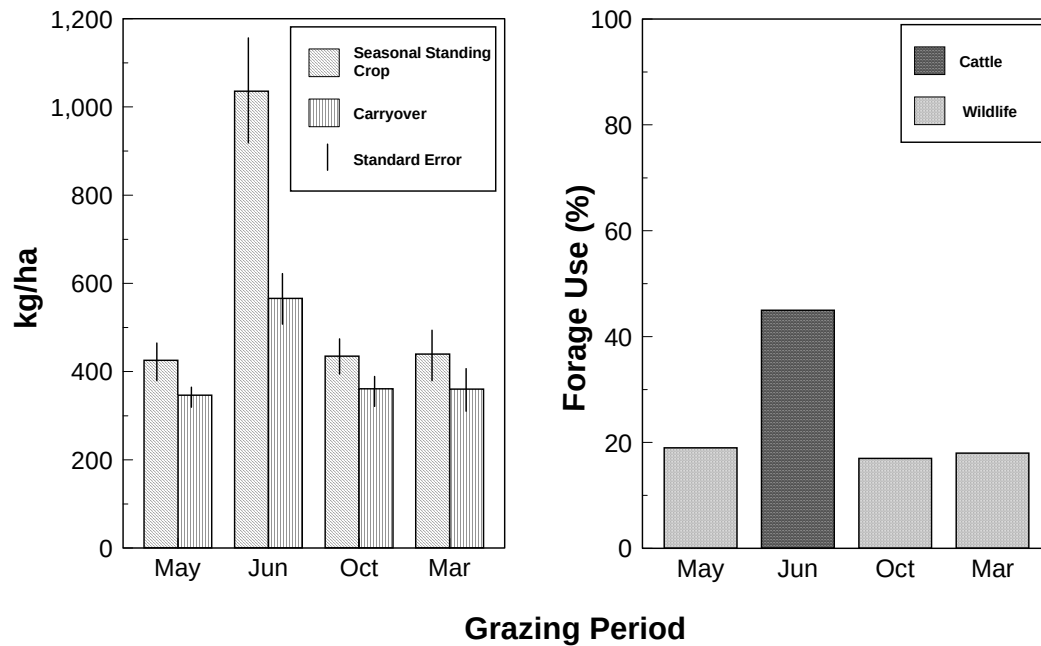


Figure 51. Seasonal standing crop, carryover, and forage use by cattle and wildlife at Peckhams Lake - new seeding in 1994.

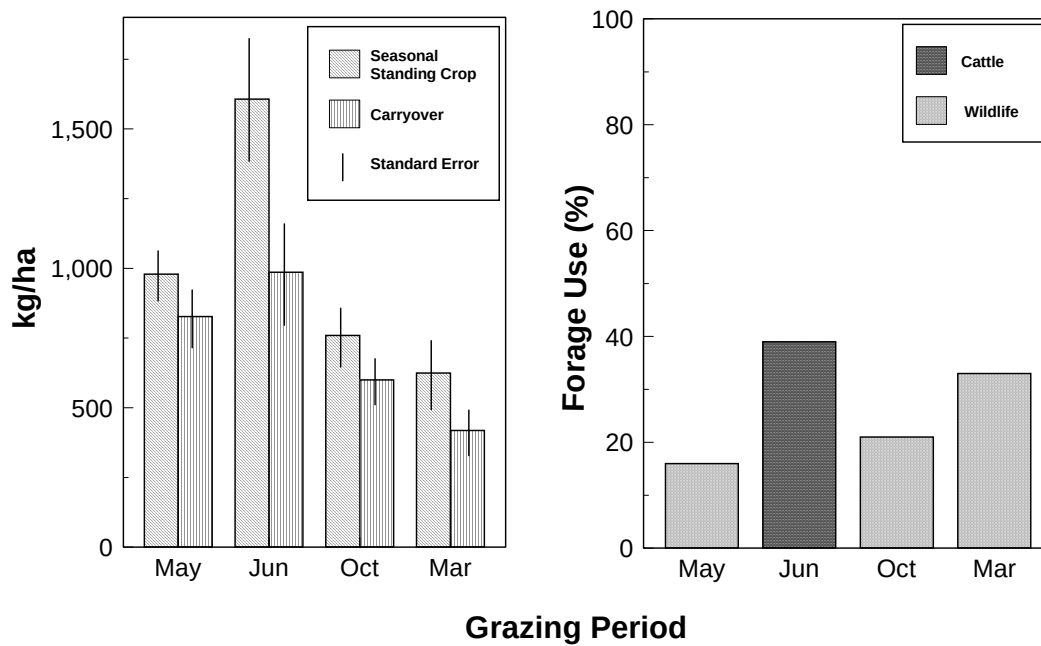


Figure 52. Seasonal standing crop, carryover, and forage use by cattle and wildlife at Peckhams Lake - old seeding in 1994.

Although a greater percentage of the SSC was eaten in the New Seeding, more forage, in kg/ha, was removed in the Old Seeding (Table 121, Figure 51, 52). Forage use by wildlife at the Old Seeding was >20% and >30% in the fall and winter, respectively (Table 121). No use was calculated in the New Seeding in either period (Table 121). This is in contrast to spring, where wildlife use was calculated at the New Seeding, but not at the Old Seeding. SSC was almost 50% higher in the Old Seeding, compared to the New Seeding in the fall, while SSC was similar in winter at both the New and Old Seedings (Figure 51, 52).

At Premier Ridge in 1994 the TSC was >850 kg/ha, approximately 35% less than TSC in 1993, but similar to TSC in 1992 (Table 116, 118, 120, Figure 33, 41, 49). Total forage eaten, and the relative proportions eaten by wildlife and cattle were also similar compared to 1992 (Table 116, 120). Total use at Premier Ridge in 1994 was approximately 50% of the TSC (Table 120). Wildlife used approximately 30% of the TSC, while cattle used about 20% (Table 120). Standing crop on ungrazed SSC plots was greater than on grazed plots in the spring wildlife ($p<0.05$), spring cattle ($p<0.05$), fall wildlife ($p<0.20$), and winter wildlife ($p<0.05$) grazing periods (Table 121).

The SSC at Premier Ridge in May was higher in 1994 than in 1992 or 1993, at >450 kg/ha (Figure 53). Forage use by wildlife in spring was calculated at 20%. Approximately equal amounts of forage were eaten by wildlife in spring in 1992 and 1993 (Figure 37, 45, 53). Cattle grazed the Premier Ridge site from mid-May to mid-June in 1994. The SSC was >770 kg/ha, nearly double the SSC in June, 1992. Cattle used approximately 20% of the available forage, resulting in carryover of nearly 600 kg/ha for fall and winter wildlife grazing (Table 121, Figure 53).

Use by wildlife was calculated at approximately 20% and nearly 40% of the SSC in fall and winter, respectively, at Premier Ridge in 1994 (Table 121, Figure 52). The SSC at the end of March, 1995 equaled 180 kg/ha, about one-half of the SSC in October (Figure 53). Consequently, approximately equal amounts of forage were eaten by wildlife in the fall and winter.

At Pickering Hills in 1994, total forage use by cattle and wildlife was >55%, less than in 1992, but similar to 1993 (Table 116, 118, 120). TSC was >1100 kg/ha, similar to TSC in 1993, but approximately 35% higher than TSC in 1992 (Table 116, 118, 120). However, total forage eaten was approximately equal in all three years (Table 116, 118, 120). Wildlife and cattle ate similar amounts of the TSC at Pickering Hills in 1994 (Table 120, Figure 53). Forage in the ungrazed SSC plots was significantly greater than in the grazed plots in the spring wildlife ($p<0.05$), fall cattle ($p<0.05$), fall wildlife ($p<0.20$), and winter wildlife ($p<0.05$) grazing periods (Table 121).

The SSC in May, 1994 was >600 kg/ha, the highest in all wildlife grazing periods. Wildlife used nearly 25% of this forage, (approximately 150 kg/ha), the highest in all wildlife grazing periods at Pickering Hills in 1994 (Figure 54). Cattle were grazed from late July to late August in 1994 (Table 5). The SSC was almost 1000 kg/ha at the end of the cattle grazing period, of which cattle utilized >30%, or >300 kg/ha (Table 121, Figure 54). Similar to Premier Ridge, at Pickering Hills, percent wildlife use of the SSC was higher in winter (>40%) than in fall (Table 121). Although SSC in October was approximately double SSC in March, at Pickering Hills, wildlife ate more forage in winter than in fall (Table 121, Figure 54).

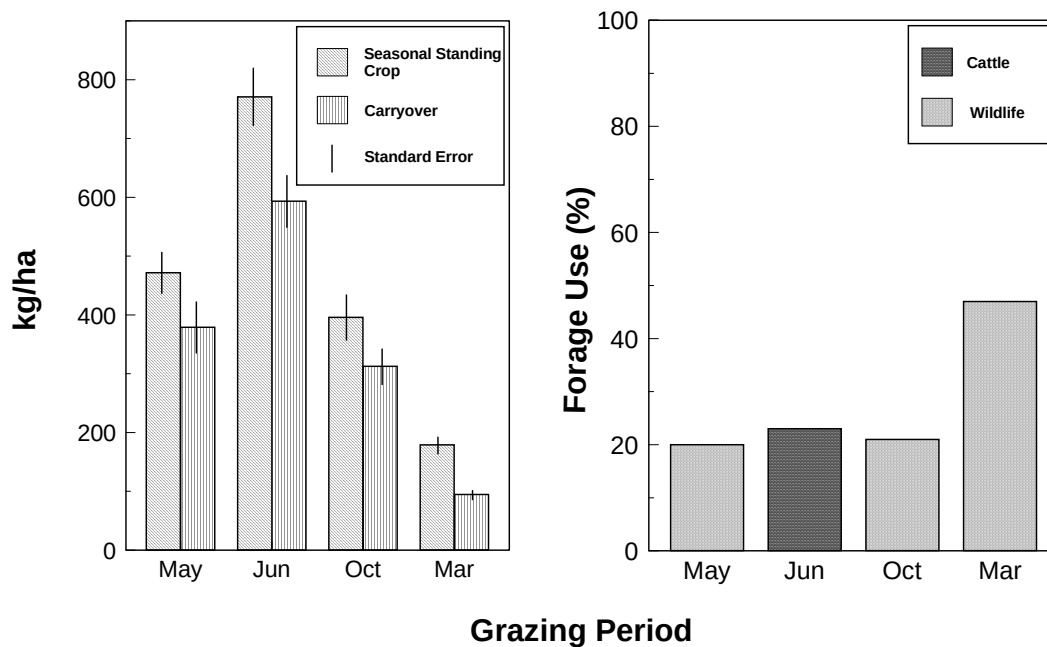


Figure 53. Seasonal standing crop, carryover, and forage use by cattle and wildlife at Premier Ridge in 1994.

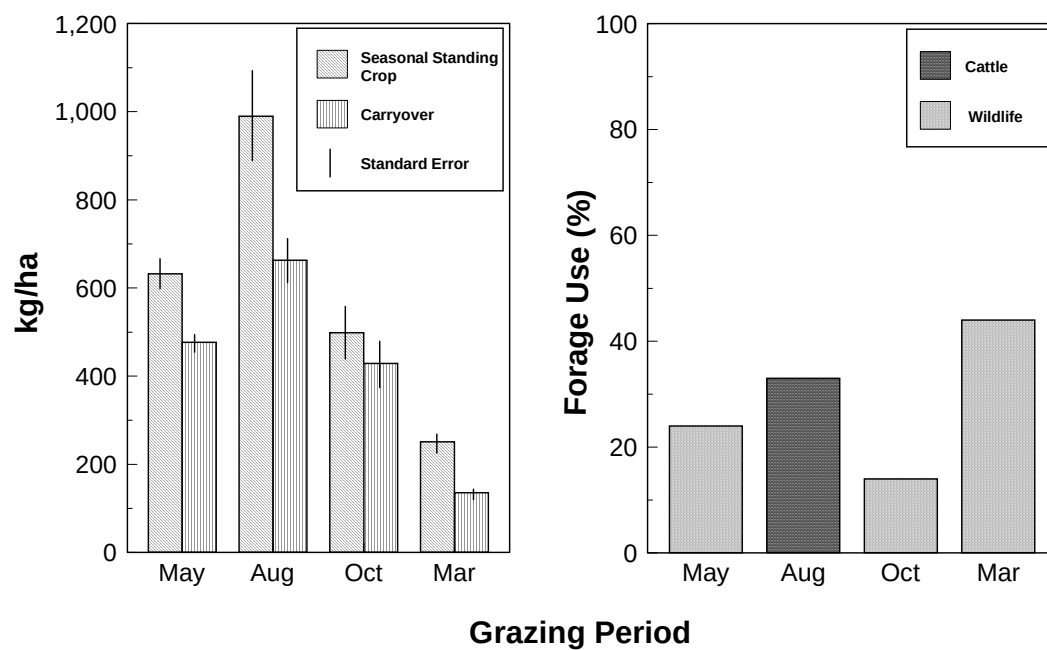


Figure 54. Seasonal standing crop, carryover, and forage use by cattle and wildlife at Pickering Hills in 1994.

4.2.4 Discussion - Skookumchuck Prairie - 1992-1994

Standing Crop

To develop grazing management plans which optimally integrate the habitat and forage requirements of cattle and wildlife, the quantity of the herbaceous standing crop and the actual forage demands, during each grazing period, of all forage users are essential information. This portion of the study has focused on documenting herbaceous standing crop, and the differences in standing crop between years and sites. The amount of forage available during each grazing period is compared to forage use during each grazing period.

Aside from the soils, composition of the plant community and prior grazing history, herbaceous standing crop is largely a feature of the weather patterns of that growing season, and to a lesser extent, the previous growing season. Except for the Cattle Only Area at Skookumchuck Prairie, where the highest standing crop occurred in 1994, all sites produced the maximum TSC in 1993 (Table 109, 110, 111, Figure 7, 9, 11). These maxima coincided with growing season precipitation in 1993 that was 70% higher than the long term average (Table 3, 4). The lowest TSC, at all sites, was in 1992.

Combined Forage Use

Total use by cattle and wildlife was consistent in the Combined Use Area during the three year study at Skookumchuck Prairie. Although total forage eaten ranged from a low of slightly >400 kg/ha in 1992, to a high of nearly 600 kg/ha in 1994, % use varied between approximately 55% and 65% (Table 116, 118, 120). The quantity of forage eaten by wildlife in 1992, 1993, and 1994 in the Combined Use Area ranged between approximately 250 kg/ha and 350 kg/ha (Figure 15, 21, 27). Cattle ate approximately 150 kg/ha in the Combined Use Area in 1992 and 1993 (Table 116, 118, Figure 15, 21), although they were grazed in spring and fall respectively, and TSC was higher in 1993. Cattle ate almost twice as much forage in the Combined Use Area in 1994 (approximately 300 kg/ha) as in 1992 and 1993. However, cattle grazed an additional 20 days in the Combined Use Area in 1994 (Table 5).

Wildlife used more forage in the Wildlife Only Area than in the Combined Use Area in all years. Wildlife ate >650 kg/ha in 1993 and 1994. Use in these two years was almost double that of 1992 (Table 116, 118, 120, Figure 13, 19, 25). In particular, the highest carryover from fall wildlife grazing and the highest SSC in March occurred in the Wildlife Only Area. Sheehy (1987) concluded that carrying capacity for current numbers of elk on seasonal rangeland in northeastern Oregon, was limited by the availability of dry matter in winter and spring.

Generally, cattle used consistent amounts of forage in the Cattle Only Area. Although the lowest use in both percentage eaten and kg/ha was in 1992, cattle ate >300 kg/ha in the Cattle Only Area in both 1993 and 1994 (Table 116, 118, 120, Figure 14, 20, 26). Cattle distribution may have been affected by the location of the water source in the Cattle Only Area in 1992. Cattle use of browse (>20% in July), likely contributed to lower use of herbaceous forage in 1992 (Table 23).

Seasonal Use

Wildlife spring use was relatively consistent at Skookumchuck Prairie during this study. Although spring wildlife use at the Combined Use was higher in 1993, than in 1992 or 1994, Area, both in percentage used and kg/ha, wildlife use in the Combined Use Area was about equal in 1992 and 1994 (Table 117, 119, 121, Figure 18, 24, 30). The same pattern held true in the Wildlife Only Area, in 1992 and 1993. However, spring wildlife use was not calculated in

the Wildlife Only Area in 1994 (Table 121). This may be in response to forage availability. Litter accumulation may have inhibited wildlife foraging in spring as 1994 was the third year of Wildlife Only use in this pasture.

Several authors have observed reduced wildlife spring use due to litter accumulation. Anderson and Scherzinger (1975) at the Bridge Creek WMA in Oregon, found reduced elk use of the area 3 years after cattle had been removed. Wintering elk numbers had initially increased, which they attributed to increased volume of available forage. However, "Mature grass became increasingly more rank, forage quality decreased, and standing leached residues restricted availability of desirable forage". "Wolf plants" had developed in the absence of cattle grazing so a cattle rotation was re-introduced to the area to remove this accumulated litter. At the Mount Haggin WMA in Montana, Frisina (1986) noted that 96% of elk observed in May and June were in pastures receiving livestock grazing in the previous year. Also in Montana, in the Elkhorn Mountains, Grover and Thompson (1986) found elk selected spring feeding sites which had been grazed by cattle in the previous fall, and supported relatively high densities of bunchgrasses. Willms et al. (1979), working near Kamloops, B.C., concluded that moderate or heavy fall grazing by cattle made spring forage more attractive to deer by removing mature forage.

Wildlife forage use in the spring does not appear to have affected forage availability for cattle at Skookumchuck Prairie during the course of this study. Cattle use was consistent both in % used and kg/ha, in all periods, except in the Cattle Only Area in 1992, where browse was >20% of diet composition (Table 23), and in the Combined Use Area in 1994, where cattle grazed 20 days longer than in the Cattle Only Area. This research agrees with that of Sheehy (1987) in Oregon, who found there was no significant reduction in standing crop available for cattle in summer and fall because of deer and elk grazing in winter and spring.

At Skookumchuck Prairie, there does not appear to be a lack of available forage, following cattle grazing, for wildlife during the fall and winter. During this study, forage carryover ranged from approximately 350 kg/ha to >600 kg/ha following cattle grazing in the Cattle Only and Combined Use Areas (Figure 17, 18, 23, 24, 29, 30).

However, timing of cattle grazing and/or amount of forage use by cattle may have affected fall wildlife use. Although SSC was slightly <500 kg/ha in the Combined Use Area in all years, SSC was higher in the Wildlife Only Area, ranging from approximately 450 to >650 kg/ha. In the fall of 1992 and 1993, wildlife used between 20% and 26% of SSC in both the Combined Use and Wildlife Only Areas (Table 117, 119, Figure 16, 18, 22, 24). However, in 1993, the actual forage removed was about two and a half times greater in the Wildlife Only Area than in the Combined Use Area (Table 119, Figure 22). Additionally, in 1994, fall use at the Wildlife Only Area was nearly 40%, while there was no significant fall use calculated in the Combined Use Area (Table 121, Figure 28, 30). It is uncertain whether lower forage use by wildlife in the Combined Use Area compared to the Wildlife Only Area, is due to lower SSC or other factors. Frisina (1986), in an evaluation of elk use within a three pasture rest-rotation system in Montana, found that elk preferred habitats not occupied by cattle but this was due to lower standing crop, rather than social intolerance. Lonner and Mackie (1983) found that the probability of finding elk sign where cattle were present was about one in four, while the probability of finding elk sign where cattle were absent was about one in two. They concluded that elk preferentially avoided areas with active cattle grazing or areas where cattle had recently grazed.

Several authors report that elk require a certain minimum biomass to maintain forage intake rates required for body maintenance. McCorquodale, working in Washington state, (1991) hypothesized some amount of biomass exceeding 600 kg/ha would be required during the summer months to maintain intake rates. Hudson and Neitfield (1995), while examining the effect of forage depletion on the feeding behaviour of elk in the aspen boreal forest of Alberta, based their research on bite rates and maximum foraging times, also for the summer months. They concluded there was no decrease in intake rate as forage standing crop decreased from 2400 to 800 kg/ha. Merrill (1994) reported that in fall elk selected communities with the highest abundance of grasses. Elk compensated for reduced biomass and digestibility by increasing the length of both foraging and ruminating periods.

At Skookumchuck Prairie, the amount of forage available for wildlife during the winter can be affected by summer cattle use and fall wildlife use. Fall carryover from wildlife grazing was similar to the carryover following cattle grazing. During this study, forage carryover ranged from approximately 400 kg/ha to >600 kg/ha following wildlife grazing in the Wildlife Only and Combined Use Areas (Figure 17, 18, 23, 24, 29, 30).

Winter wildlife use ranged from 24% in the Combined Use Area in 1993 to 63% in Wildlife Only Area in 1994 (Table 117, 119, 121). However, with the exception of 1992, wildlife removed a higher percentage of the forage in winter in the Wildlife Only pasture when compared to the Combined Use Area (Table 117, 119, 121, Figure 16, 18, 22, 24, 28, 30). The lowest use in kg/ha was in both the Wildlife Only and Combined Use Areas in 1992, while the highest use was made of the Wildlife Only Area in 1994. In southeastern Washington, Skovlin et al. (1983) found that moderate levels of spring cattle grazing did not increase winter elk use on bunchgrass range in the northern foothills of the Blue Mountains. In fact, cattle grazing decreased winter elk use by 28% during one of the years studied.

Grazing after plant dormancy in the fall and winter period can adversely affect both rough fescue and bluebunch wheatgrass. With the exception of 1993, during which forage carryover was higher, carryover following winter wildlife grazing was approximately 200 kg/ha in all years in the Combined Use and Wildlife Only Areas (Figure 16, 18, 22, 24, 28, 30). While production and use on rough fescue and bluebunch wheatgrass was not an objective of this study, several authors have demonstrated reduced production by these species in the year following dormant season defoliation. Willms et al. (1986), for example, reported that rough fescue production declined by 25% after litter was removed in the fall before winter dormancy. Similarly, bluebunch wheatgrass production has been reduced by 28% (Sauer 1978), 42% (McShane and Sauer 1985) and by 23% (Wikeem et al. 1989) by removing litter during dormancy in the fall. Little is known about direct effects of dormant season defoliation on most other plant species.

Grazing after plant dormancy also reduces the amount of litter available for protecting the site against soil erosion. "Sustainability is the fundamental goal of rangeland management and sustainable management of rangelands depends primarily on conservation of the soil" (Society for Range Management Task Group 1995).

Some of the difference between fall carryover and winter SSC may be due to weathering losses. The difference between the fall wildlife carryover and the SSC in March ranged between 10% and 30% in the Combined Use and Wildlife Only Areas (Figure 16, 18, 22, 24, 28, 30). Willms et al. (1996) examined differences between fall and spring standing crop in rough fescue, Parry oatgrass (*Danthonia parryi*) - Kentucky bluegrass, and Kentucky bluegrass - sedge communities. Percent losses of total herbage biomass from fall to spring were 24%,

43%, 56% in the rough fescue, Parry oatgrass - Kentucky bluegrass, and Kentucky bluegrass - sedge communities, respectively.

4.2.5 Discussion - Secondary Sites

Standing Crop

At the secondary sites, like at Skookumchuck Prairie, weather patterns, composition of the plant community, prior grazing history, and soil fertility are important factors affecting standing crop. Standing crop production at Premier Ridge, Peckhams Lake, and Pickering Hills followed the same pattern as Skookumchuck Prairie in that the highest TSC was produced in 1993 (Table 116, 118, 120). With the exception of Peckhams Lake, the smallest standing crops were produced in 1992 (Table 116, 118, 120). However, different factors influenced TSC at the secondary sites.

Peckhams Lake is seeded to domestic forage species. These species are selected for their forage production capability and regrowth potential. Clearly the increased precipitation in 1993 influenced the production of standing crop. For example, the TSC in 1993 was almost 50% higher than in 1992 at the New Seeding (Table 116, 118). In 1994, which had the least precipitation of all years during the July to September period (Table 3, 4), the TSC was less than one-half of the 1992 production (Table 116, 120).

At Premier Ridge in both 1992 and 1994, cattle were turned out in early-May (Table 5). Elk monitoring data (Jamieson and Hebert 1993) indicate the 50% departure date for the Premier Ridge elk herd was May 5 in 1992 (no data for 1994). The result of early-May cattle turn-out at Premier Ridge is that forage was grazed from green-up until mid-June. However, June precipitation in 1992 and 1994 was well above the 37 year average (Table 3, 4) allowing for regrowth following cattle grazing.

At Pickering Hills cattle were fall grazed in 1992 and 1994, the opposite rotation as at the other sites. Although spring grazing was scheduled for 1993, grazing did not begin until July 10 (Table 5). The absence of cattle grazing during the growing season at Pickering Hills may have resulted in a lesser contribution of regrowth to the TSC. Regrowth following grazing only occurred after the spring wildlife period at Pickering Hills.

Combined Use

TSC varied the most among years at Peckhams Lake, compared to Premier Ridge or Pickering Hills. TSC was equal at the New and Old Seedings only in 1992, while in 1993 and 1994, the Old Seeding produced more forage. Total use was similar between the Old and New Seedings in 1992 (>90%), and in 1994 (>60%), but total forage eaten (>2000 kg/ha) was higher in 1992 than in 1994 (Table 116, 120, Figure 31, 32, 47, 40). The highest TSC and total forage eaten was in the Old Seeding in 1993 (Table 118, Figure 41). In all years, at both the Old and New Seedings, total use exceeded 50% of the TSC.

The proportion of the total forage eaten by wildlife and cattle appears to be relatively consistent in all years at both seedings at Peckhams Lake. Except for at the Old Seeding in 1994, cattle ate approximately double the amount of forage compared to wildlife in all years at Peckhams Lake (Table 116, 118, 120, Figure 31, 32, 39, 40, 47, 48). This information can be used in planning yearly allocation of forage for wildlife and cattle at Peckhams Lake.

Total forage eaten by wildlife and livestock peaked at the New Seeding in 1992; the year following establishment. Spring use by wildlife was approximately 250 kg/ha, nearly as high as in 1993, despite the SSC being nearly double in spring 1993 (Figure 31, 39). Also, the

Peckhams Lake site was grazed twice by cattle in 1992, with the second pass accounting for an additional 700 kg/ha (Figure 35). Significant ($p < 0.05$) wildlife use occurred in both the fall and winter grazing periods in 1992 as well (Table 117, Figure 35). The forage in the recently established New Seeding likely attracted cattle and wildlife to the area and also promoted use of the Old Seeding.

Total forage eaten was highest in the Old Seeding in 1993 (Table 118, Figure 40). The greatest proportion of the total forage eaten came in the spring wildlife and fall cattle grazing periods. The SSC in spring (May) was nearly 1500 kg/ha of which wildlife used slightly $< 45\%$, while cattle in fall ate > 2500 kg/ha from a SSC in October which exceeded 3500 kg/ha (Figure 40). The amount of forage eaten by wildlife and cattle at Peckhams Lake was likely related to higher TSC in 1993.

Total forage eaten was lowest at both the New and Old Seedings at Peckhams Lake in 1994 which was also the year with the lowest TSC (Table 120, Figure 47, 48). TSC at the Old Seeding in 1994 (approximately 1760 kg/ha) was less than one-half TSC at the Old Seeding in 1993. At the New Seeding in 1994, TSC was less than one-half of TSC in 1992, and about one-third of TSC in 1993 (Table 116, 118, 120, Figure 31, 39, 47). Total forage eaten at the New Seeding in 1994 was about one-third that of 1992, and less than one-half of use in 1993. How much of the decline in TSC is due to the dry July to September period in 1994 and how much is due to the heavy use the New Seeding received in 1992 is uncertain. Alsike clover and orchardgrass, the predominant species in the plant community in the establishment year, comprised 22.2% and 22.5%, respectively, of the cover in the New Seeding enclosure in June of 1992, while in the grazed area cover of these species was 0.1% and 13.6%. These species were also common in the diets of deer, elk, and cattle in 1992 (Table 15, 33, 51).

Wildlife grazed during spring in all years at Peckhams Lake, but the Old Seeding was not grazed as consistently as the New Seeding. Although SSC in spring at the New Seeding at Peckhams Lake in 1993 was more than double compared to SSC in 1992, wildlife ate approximately 250 - 300 kg/ha in both years (Figure 26, 43). In contrast, SSC at the New Seeding in 1994 was lowest of all three years, and use was $< 20\%$ in contrast to $> 40\%$ and slightly $< 30\%$ in 1992 and 1993, respectively (Table 117, 119, 121, Figure 35, 43, 51). Use by wildlife in the Old Seeding in spring was calculated in 1992 and 1993, but not in 1994 (Table 117, 119, 121). Wildlife used similar amounts of forage in both Seedings in spring 1992. In spring 1993 however, SSC exceeded 1300 kg/ha in both Seedings, and wildlife used approximately 700 kg/ha in the Old Seeding (Figure 39, 40). Miller et al. (1981), working in Oregon, found that in March to June, deer and elk obtained 66% of their forage from seeded clearcuts when clearcuts represented 31% of the area, while forested communities supplied 10% of the forage but covered 41% of the area. Peckhams Lake is analogous to the Oregon site in that it consists of areas seeded to domestic forage species, interspersed with forest.

Spring use by wildlife did not impact available forage for cattle during either spring or fall grazing at Peckhams Lake during this study. Except for spring 1992 and 1994 in the New Seeding, carryover ranged between 500 kg/ha and 1000 kg/ha at both sites and in all years (Figure 35, 36, 39, 40, 51, 52). Although carryover was only 350 kg/ha following spring wildlife use (May) in the New Seeding in 1992 and 1994, SSC available for spring cattle grazing in June exceeded 900 kg/ha in both years (Figure 35, 39). This points to the importance of delaying cattle grazing into early-June to allow forage to regrow following spring wildlife grazing.

Wildlife use in the fall and winter at Peckhams Lake is not affected solely by the amount of forage available following cattle grazing. At the New Seeding, fall and winter use were only calculated in 1992, when SSC equaled approximately 700 kg/ha and >300 kg/ha in October and March, respectively (Figure 35). In contrast, in 1993 when significant ($p>0.20$) use was not calculated in fall or winter, SSC was >1100 kg/ha and approximately 500 kg/ha in October and March, respectively (Figure 39). Fall and winter use ranged between 20% and 50% in the Old Seeding in 1992 and 1994, but use was not calculated in either period in 1993 (Table 117, 119, 121). As at the New Seeding, SSC was higher in fall and winter 1993, compared to 1992 or 1994 (Figure 35, 43, 51). This indicates that other factors besides the size of the SSC influence fall and winter use of herbaceous forage by wildlife. Wildlife displacement during fall hunting seasons, and weather conditions which limited forage availability, may have resulted in less use of herbaceous forage plants in fall and winter 1993. Kufeld (1973) reviewed 48 elk diet studies and concluded that elk prefer grasses in winter, but will switch to browse species if the grasses are unavailable. However, elk diet at Peckhams Lake during winter 1993 indicates between 60% and 90% of elk diet was comprised of grasses, with orchardgrass and smooth brome as the principal species (Table 38, 43). Clearly, elk were in the Peckhams Lake area during this period but they did not graze either the New or Old Seeding.

Similar to Skookumchuck Prairie, in 1994 wildlife appear to have divided use between the New and Old Seeding by using the New Seeding in spring and the Old Seeding in fall and winter. SSC at the New Seeding in spring 1994 was more than double the SSC at the Old Seeding, yet significant ($p>0.20$) use was not calculated at the Old Seeding. In fall and winter SSC was higher at the Old Seeding. Wildlife may have used the New Seeding in spring due to less standing litter accumulation, and the Old Seeding in winter due to the higher standing crop. Ganskopp et al. (1992) working with crested wheatgrass, found cattle to be sensitive to the presence of cured stems in green foliage up to the late-boot and anthesis stages of growth. As few as 3 stems/dm² decreased use. Cattle were oblivious to the presence of cured stems once the plants became dormant. Ganskopp et al. (1992) recommended that cattle grazing to remove standing litter would be most effective after plant dormancy.

The New Seeding at Peckhams Lake appears to be grazed most consistently in spring by deer and elk, with some fall use, and a lesser degree of winter use. Significant ($p<0.20$) wildlife use was calculated in spring, in all years, at the New Seeding (Table 117, 119, 121). Resource managers must consider that seedings of domestic forages are attractive to both wildlife and cattle, and that use may be concentrated on these seedings, particularly in the years following establishment. In Oregon, Miller et al. (1981) found that the presence and availability of spring forage plants which were preferred by deer and elk, was much higher in seeded clearcuts than in surrounding forest communities. They recommended that managers consider the structural characteristics of a habitat, and the specific forage plants and their value to deer and elk when devising grazing plans.

Forage standing crop production and forage use patterns by cattle and wildlife were more constant at the Old Seeding than at the New Seeding. Except for an interval extending from fall 1993 to spring 1994, significant ($p<0.20$) forage use was calculated in all grazing periods at the Old Seeding (Table 117, 119, 121). Except for the 1992, the TSC at the Old Seeding was higher compared to the New Seeding in all years; likely because it was an established seeding.

Production of forage standing crop was comparable over the three year study at Premier Ridge. TSC was almost equal at Premier Ridge in 1992 and 1994. However, in 1993 standing crop production was about 30% higher. Total forage eaten by wildlife and cattle combined was almost identical at Premier Ridge in 1992 and 1994, but in 1993 total forage eaten was more than 70% higher (Table 116, 118, 120, Figure 34, 41, 49). Percent wildlife use was approximately 30% of TSC in all years. Wildlife ate approximately 250 kg/ha in 1992 and 1994, while in 1993 wildlife consumed nearly 400 kg/ha. Cattle use followed an equivalent trend to wildlife use with the highest use (nearly 30%) and amount of forage eaten (slightly <350 kg/ha) occurring in 1993. Grazing patterns of wildlife and cattle at Premier Ridge are less variable than at Peckhams Lake or Pickering Hills so management can be planned based on these levels of use.

Wildlife ate equal amounts of forage in spring at Premier Ridge in all years. Spring wildlife use at Premier Ridge ranged from 20% in 1994 to 28% in 1993. Wildlife ate similar amounts of forage in 1992 and 1994, while in 1993 they ate slightly more. TSC in spring ranged between 400 kg/ha in 1992, and 500 kg/ha in 1994 (Figure 37, 45, 53). Wildlife did not remain at Premier Ridge longer in 1993 compared to 1992. In both 1992 and 1993, the 50% departure date was May 5, with the final departure date on May 28 and June 4, respectively (Jamieson and Hebert 1993). This indicates that elk did not alter their use of the winter/spring range at Premier Ridge in response to the season of cattle use. This level of spring wildlife grazing indicates that when managers are planning cattle grazing rotations, they should assume a consistent amount of forage will be eaten by wildlife at Premier Ridge between green-up and mid-May.

Cattle ate equivalent amounts of forage at Premier Ridge during this study regardless of whether they were spring or fall grazed. Cattle ate the most forage in 1993, when SSC was greatest (Table 117, 119, 121, Figure 37, 45, 53). Although similar amounts of forage were eaten by cattle in the spring grazing periods in 1992 and 1994, SSC was greater in 1994 (approximately 750 kg/ha), than in 1992 (slightly <400 kg/ha). This resulted in a higher percentage use in 1992 (Table 117, 121, Figure 37, 53). Part of the reason for the larger SSC in 1994 was due to turn-out date. In 1994 cattle were not turned-out until May 15, two weeks later than in 1992. Managers can reasonably predict the amount of forage cattle will eat based on the number of AUMs, the size of the area, and known distribution problems. This information should be considered together with the amount of SSC to determine optimal spring turn-out date.

Wildlife grazed equal amounts of forage in fall at Premier Ridge during the three years under study. SSC was approximately 550 kg/ha in 1992 and 1993, but was over 150 kg/ha lower in 1994 (Figure 37, 45, 53). Cattle grazing, whether in spring or fall, left sufficient forage carryover for wildlife grazing in fall at Premier Ridge. Wildlife foraging apparently was not impacted by other disturbances, such as hunting.

Winter wildlife use was uniform in winter at Premier Ridge, but they ate more when SSC was higher. In all years wildlife ate between 40% and 60% of the SSC in March, however in 1993, more forage was available and more forage was eaten (Table 117, 119, 121 Figure 37, 45, 53). Winter carryover (March) was approximately 100 kg/ha to 150 kg/ha in all years (Figure 37, 45, 53). As a result, wildlife use in the following spring was not likely inhibited by litter accumulation. However, there may not be sufficient carryover to protect the soil from erosion and compaction.

The present cattle rotation apparently has not affected fall and winter wildlife use at Premier Ridge during the study. Moreover, wildlife do not appear to be displaced by spring cattle turn-out at Premier Ridge. Except for 1993, wildlife and cattle use was consistent among all grazing periods, over the three years. Above average rainfall during the growing season in 1993 (>70% of normal) resulted in higher TSC. Greater use in 1993 may in part be a result of wildlife and cattle remaining longer on the site, in response to the increased amount of available forage which did not become dormant until later than normal. In Colorado, Senft et al. (1985) found that in the dormant season, when forage was not being replenished by regrowth, cattle moved to new areas after the forage was depleted on initially favoured areas.

Forage availability for fall and winter wildlife use does not appear to be altered by varying the season of cattle grazing at Premier Ridge. Knowing that wildlife make consistent use of this pasture in fall and winter, the cattle rotation must continue to provide sufficient carryover for fall and winter wildlife grazing. However, cattle should not be turned-out in this pasture until late-May in order to allow a period of regrowth following spring wildlife grazing. In 1992, the SSC was almost identical at the end of the spring wildlife period and the spring cattle grazing period, one month later. If cattle are turned-out immediately following spring wildlife grazing, as they were in 1992, the pasture is used continuously from green-up until the middle of June. June is generally a wet month (Table 3, 4), but under dry spring and summer conditions cattle grazing in early-May could affect the amount of forage carryover for fall and winter wildlife use, and negatively impact the site capability.

Premier Ridge was the most consistently grazed site of the four sites under study. One result of this consistent use is the low amount of carryover in March (Figure 37, 45, 53). If the objectives for the management of this site include maintaining or improving the site capability, the range unit must be managed to leave more carryover on the Premier Ridge site. In order to accomplish this cattle and wildlife use must be distributed more evenly over the unit. Miller and Krueger (1976) and Miller et al. (1981) studied cattle, deer, and elk use on foothills range in Oregon which contained seeded clearcuts, bunchgrass, and forested communities. They recommended concentrating clearcuts away from bunchgrass communities to draw cattle, deer, and elk if the objective is to reduce the use on bunchgrass communities. To improve animal distribution and increase use of less preferred forest communities they recommended interspersing clearcuts with bunchgrass and forest.

Total forage eaten by wildlife and cattle at Pickering Hills was very consistent over the three year study (Table 116, 118, 120, Figure 34, 42, 50). TSC was lower in 1992, where total use exceeded 70% of TSC, than TSC in 1993 and 1994 (Table 116, 118, 120, Figure 34, 42, 50). Total use exceeded 55% of TSC in all years. In contrast to Premier Ridge, the distribution of use between the two classes of ungulates, differed among years at Pickering Hills. Maximum wildlife use occurred in 1992, whereas cattle use peaked in 1993. Use in 1994 was relatively equal between cattle and wildlife. This indicates the importance of site specific planning in forage allocation.

Compared to other sites, Pickering Hills receives less spring use. Differences between the grazed and ungrazed standing crops were not significant ($p>0.20$) in the spring wildlife period at Pickering Hills in 1992 (Table 117). SSC was about 400 kg/ha in May (Figure 38). Spring use was calculated between 15% and 25% in 1993 and 1994 when the SSC exceeded 600 kg/ha in May (Table 119, 121, Figure 46, 54). Spring use of herbaceous forage by wildlife at Pickering Hills may be related to the amount of standing crop. McCorquodale (1991), working on forage based estimates of metabolizable energy for elk in the arid shrub-steppe in

Washington, hypothesized "only habitats with a forage biomass >600 - 800 kg/ha represent habitats in which elk can attain required intake rates". Also, elk appear to browse more in spring at Pickering Hills than at the other sites. Elk ate nearly 20% and 40% browse species in April and May, respectively in 1992 at Pickering Hills, in contrast to 1993 where browse species comprised fewer than 10% of diet composition in these months (Table 21, 39).

Cattle use at Pickering Hills was very consistent over the study, similar to Premier Ridge. Use ranged from slightly <30% to nearly 40% with similar amounts of forage removed in each year (Table 117, 119, 121, Figure 38, 46, 54). Carryover for fall and winter wildlife use was approximately 450 kg/ha in 1992 and more than 650 kg/ha in 1993 and 1994.

Fall use patterns by wildlife were not consistent at Pickering Hills compared to other sites. Pickering Hills cattle grazing rotation required that the Pickering Pasture be fall grazed in 1992 and 1994, and spring grazed in 1993. The fall grazing periods in 1992 and 1994 actually took place mainly during late-August, while the spring grazing period was actually in late-July and early-August (Table 5). In 1992, carryover following the cattle grazing period was the lowest during the study. However, in contrast to both 1993 and 1994, SSC was higher in October 1992, than the carryover from the cattle grazing period (Figure 38, 46, 54). In fall 1992, wildlife ate the most forage (kg/ha) and used nearly 50% of the SSC. However, in 1994 fall use by wildlife was only 14%, when SSC was about equal in 1992 and 1994. In fall 1993, when there were no significant ($p>0.20$) differences between the grazed and ungrazed plots, SSC in October was approximately 400 kg/ha, lower than in 1993 or 1994 (Table 117, 119, 121, Figure 38, 46, 54). Wildlife fall use at Pickering Hills in 1993 may have been limited by the amount of SSC available in October, but carryover following cattle grazing in August exceeded 650 kg/ha. Carryover from cattle grazing was approximately equal in 1993 and 1994, but SSC in October 1994, following fall wildlife grazing, was higher than in 1993. Due to dry conditions in July and August, 1994, the forage plants were dormant in August following cattle grazing. However, in 1993 the growing season continued after cattle grazing in July and August. Standing crop in October 1993 may have been subject to more weathering losses than SSC in October 1994. Fall wildlife distribution, and thus forage use at Pickering Hills was likely affected by fall hunting seasons as well.

Pickering Hills, although a similar type of site to Premier Ridge, appears to be most consistently used as a winter range. Use of the available forage during winter at Pickering Hills ranged from >40% to nearly 65% of the SSC in March in all years (Table 117, 119, 121, Figure 38, 46, 54). Forage eaten, in kg/ha, was lowest in 1994, and about equal in 1992 and 1993. Managers can assume that wildlife will routinely graze the site in winter although the SSC in March was about 250 kg/ha in all years. The amount of forage available is not a limiting factor in winter wildlife grazing at Pickering Hills.

Based on forage use patterns in 1992 to 1994 at the secondary sites, it appears that wildlife distribution patterns, TSC, and forage use characteristics by wildlife and cattle are different at each site. Wildlife and cattle management should consider the individuality of each site when devising grazing plans.

4.3 Shrub Production and Use

4.3.1 Shrub Production - 1992

Saskatoon production was highest at Pickering Hills and lowest at Premier Ridge (Table 122). Indeed, average production per shrub was nearly 400% greater on Pickering Hills than at Premier Ridge. Although there was wide variability in mean shrub production among sites, the

relative proportion of leaf to stem mass was virtually identical among the three sites with a leaf:twig ratio of 65:35 (Table 122).

Bitterbrush production was considerably less variable than Saskatoon in terms of production per plant. The highest average production per plant occurred at Skookumchuck Prairie compared to the lowest at Pickering Hills, but production on this site was still 75% of Skookumchuck Prairie. In contrast to Saskatoon, the ratio of leaf to twig mass was considerably more variable for bitterbrush with the leaf component ranging from slightly more than 50% at Skookumchuck Prairie and Premier Ridge to more than 73% of the total forage at Pickering Hills (Table 122).

Shrub Production - 1993

Saskatoon production was virtually identical at Pickering Hills in 1992 and 1993, but despite the increased rainfall available during the growing season, production actually decreased at Skookumchuck Prairie and Premier Ridge in 1993 compared to 1992 (Table 123). Production of Saskatoon was still over 400% higher at Pickering Hills than at Premier Ridge. In absolute terms, Pickering Hills was still the most productive site, producing nearly 900 g/shrub. Browse yields at Skookumchuck Prairie and Premier Ridge were approximately equal at slightly >150 g/shrub (Table 123).

The leaf:twig ratio remained similar when compared to 1992. Saskatoon at Skookumchuck Prairie and Pickering Hills were virtually identical in 1992 and 1993 (Table 122, 123). At Premier Ridge in 1993, Saskatoon shrubs produced 10% less leaf and 10% more twig, changing the ratio to 55% leaves and 45% twigs.

On a per shrub basis, bitterbrush production was the highest at Skookumchuck Prairie (>320 g/shrub) compared to Pickering Hills (>250 g/shrub) and Premier Ridge (approximately 120 g/shrub) (Table 123). Bitterbrush production was lower at all sites than in 1992 (Table 122, 123). In fact, bitterbrush shrubs at Premier Ridge produced about 25% of 1992 production in 1993 (Table 122, 123).

The contrast between the bitterbrush leaf:twig ratios at each site remained in 1993 (Table 123). Shrubs responded differently at each site. For example, bitterbrush at Skookumchuck Prairie and Premier Ridge in 1993 were similar to 1992 with leaf:twig ratios of 75:25 and 50:50, respectively. In contrast, leaf:twig ratios on bitterbrush at Pickering Hills, changed from 1992. Bitterbrush shrubs produced more leaf in 1993 moving from a 50:50 leaf:twig ratio in 1992, to a ratio of 60:40 in 1993.

Shrub Production - 1994

Average Saskatoon production at Skookumchuck Prairie and Premier Ridge in 1994 was similar to browse production in 1992 (Table 122, 124). In 1992 and 1993 Saskatoon production at Pickering Hills was nearly 900 g/shrub (Table 122, 123). However, production decreased by over 200 g/shrub in 1994 (Table 124). In 1994, production was lowest during the study for Skookumchuck Prairie and Pickering Hills, but highest for Premier Ridge.

Saskatoon leaf:twig ratios varied among sites more in 1994 than in 1992 or 1993. The highest leaf:twig ratio was at Pickering Hills and the lowest was at Skookumchuck Prairie (Table 124). Production differences appear to be at least partly related to the leaf:twig ratio. For example, at Premier Ridge in 1992 and 1994, production was very similar. In these years the leaf:stem ratio was approximately equal. In contrast, the decreased production in 1993, coincided with a decreased leaf:stem ratio. However, at Pickering Hills just the opposite effect

was observed. Yield on a per plant basis was the lowest of the three years in 1994, which corresponded with the highest leaf:stem ratio encountered in the study (Table 122, 123, 124).

Table 122. Shrub production at Skookumchuck Prairie, Premier Ridge and Pickering Hills in 1992.

Site	Leaf		Twig		Total	
	Mass (g)	Percent Total	Mass (g)	Percent Total	Mass (g)	Percent Total
Saskatoon						
Skookumchuck Prairie	123.1	66.0	63.7	34.0	186.8	100
Premier Ridge	111.0	65.9	57.5	34.1	168.5	100
Pickering Hills	573.8	64.0	322.6	36.0	896.4	100
Bitterbrush						
Skookumchuck Prairie	233.8	53.0	207.0	47.0	440.8	100
Premier Ridge	201.9	51.8	187.8	48.2	389.7	100
Pickering Hills	240.1	73.4	87.0	26.6	327.1	100

Table 123. Shrub production at Skookumchuck Prairie, Premier Ridge and Pickering Hills in 1993.

Site	Leaf		Twig		Total	
	Mass (g)	Percent Total	Mass (g)	Percent Total	Mass (g)	Percent Total
Saskatoon						
Skookumchuck Prairie	95.5	62.6	57.0	37.4	152.5	100
Premier Ridge	84.5	54.9	69.3	45.1	153.8	100
Pickering Hills	525.7	60.0	350.1	40.0	875.8	100
Bitterbrush						
Skookumchuck Prairie	156.8	48.7	164.9	51.3	321.7	100
Premier Ridge	74.6	61.2	47.3	38.8	121.9	100
Pickering Hills	186.3	73.9	65.8	26.1	252.1	100

Table 124. Shrub production at Skookumchuck Prairie, Premier Ridge and Pickering Hills in 1994.

Site	Leaf		Twig		Total	
	Mass (g)	Percent Total	Mass (g)	Percent Total	Mass (g)	Percent Total
Saskatoon						
Skookumchuck Prairie	94.1	56.0	73.5	44.0	167.6	100
Premier Ridge	115.7	62.8	68.7	37.2	184.4	100
Pickering Hills	455.5	70.3	192.5	29.7	648.0	100
Bitterbrush						
Skookumchuck Prairie	106.2	48.5	112.6	51.5	218.8	100
Premier Ridge	128.6	58.2	91.7	41.8	220.3	100
Pickering Hills	248.9	74.5	85.3	25.5	334.2	100

This lower yield in 1994 likely results from the shrubs having been excluded from grazing for three years. The morphology of the shrubs changed; twig lengths increased and density decreased.

Bitterbrush production appears less variable over the sites, and years of the study. However, with the exception of shrubs at Pickering Hills, production on a per plant basis decreased during the study. At Skookumchuck Prairie bitterbrush production steadily declined such that production in 1994 was less than one-half of production in 1992 (Table 122, 123, 124). The Pickering Hills site maintained production at virtually the same level in 1992 and 1994, although production was lower in 1993. Meanwhile, bitterbrush shrub production at Premier Ridge declined between 1992 and 1994, but the lowest producing year was in 1993 (Table 124).

The bitterbrush shrubs at Skookumchuck Prairie and Pickering Hills retained their leaf:twig ratios throughout the study at approximately 50:50 and 75:25, respectively. Bitterbrush shrubs at Premier Ridge, on the other hand, moved toward a 60:40 leaf to twig ratio in 1993 and retained it in 1994 (Table 124).

4.3.2 Shrub Density and Production Potential

Differences in absolute production/shrub among sites partially results from the size and morphology of the shrub. When production is compared on a unit volume basis the differences between sites are not as great. This comparison is a better indicator of shrub vigour, which in itself is indicative of the amount of use they have received (all shrubs clipped for production have been excluded from browsing since 1991).

When Saskatoon production was measured on a mass per area basis in 1992, differences in browse production are not as great among sites. Pickering Hills is still the most productive site, at nearly 400 g/m³, but Saskatoon shrubs at Premier Ridge produced almost 325 g/m³ (Table 125). Saskatoon shrubs at Skookumchuck Prairie are about one-half as productive on a unit volume basis as those at Premier Ridge (Table 125).

The range of production of bitterbrush among sites on a mass per area basis was less variable than for Saskatoon shrubs, with shrubs at Premier Ridge producing slightly >250 g/m³ and those at Pickering Hills producing >330 g/m³ (Table 126). In 1993, Saskatoon shrubs at Pickering Hills were still the most productive at slightly >300 g/m³. Saskatoon at Skookumchuck Prairie and Premier Ridge produced approximately 200 g/m³ (Table 125). The range of production among sites was much narrower than in 1992 (Table 125).

When bitterbrush production is calculated on a unit volume basis in 1993, the sites rank in the same order as for Saskatoon production. Pickering Hills bitterbrush production was approximately 300 g/m³ in 1993, virtually identical to the production of Saskatoon (Table 125, 126). Skookumchuck Prairie and Premier Ridge rank second and third in g/m³ produced but bitterbrush production at these sites was slightly lower than Saskatoon on a volume basis (Table 125, 126).

Saskatoon production was higher in 1994 than in the previous years at Premier Ridge and Pickering Hills. In contrast, Saskatoon production at Skookumchuck Prairie was highest in 1993, while production in 1992 and 1994 were similar. At Premier Ridge, Saskatoon production ranged from a low of approximately 190 g/m³ in 1993 to nearly 500 g/m³ in 1994 (Table 125). Saskatoon browse availability was lowest at Pickering Hills in 1993 (300 g/m³), while in 1994 production was double compared to 1993. Possibly some of the increased growth rate comes as a result of being excluded from browsing since 1991.

Table 125. Saskatoon production in the ungulate exclosure at Skookumchuck Prairie, Premier Ridge, and Pickering Hills in 1992, 1993, and 1994.

	Height	Circumf	Diameter	Area	Leaf	Twig	Total	Prod
	(m)	(m)	(m)	(m ²)		(g)		g/m ²
Skookumchuck Prairie								
1992	0.63	5.10	0.81	1.20	123.10	63.7	186.8	155.6
1993	0.76	4.11	0.65	0.73	95.50	57.0	152.5	208.9
1994	0.81	4.63	0.73	1.03	94.10	73.5	167.6	162.7
Premier Ridge								
1992	0.52	3.70	0.59	0.52	111.00	57.5	168.5	324.0
1993	0.76	4.14	0.66	0.80	84.50	69.3	153.8	192.3
1994	0.96	3.30	0.52	0.38	115.70	68.7	184.4	485.0
Pickering Hills								
1992	1.34	5.90	0.94	2.26	573.80	322.6	896.4	396.6
1993	1.58	6.48	1.03	2.88	525.70	350.1	875.8	304.1
1994	1.04	4.84	0.77	1.08	455.50	192.5	648.0	600.0

Table 126. Bitterbrush production in the ungulate exclosure at Skookumchuck Prairie, Premier Ridge, and Pickering Hills in 1992, 1993, and 1994.

	Height	Circumf	Diameter	Area	Leaf	Twig	Total	Prod
	(m)	(m)	(m)	(m ²)		(g)		g/m ²
Skookumchuck Prairie								
1992	0.79	5.59	0.89	1.60	233.8	206.9	440.7	275.4
1993	0.83	5.74	0.91	1.64	155.8	164.9	320.7	195.5
1994	0.81	4.63	0.73	1.03	94.1	73.5	167.6	162.7
Premier Ridge								
1992	0.81	5.52	0.88	1.55	201.9	187.8	389.7	251.4
1993	1.28	4.32	0.69	0.68	74.6	47.3	121.9	179.3
1994	0.98	5.38	0.85	1.34	128.6	91.7	220.3	164.4
Pickering Hills								
1992	0.98	4.80	0.76	0.98	240.1	87.1	327.2	333.9
1993	1.24	4.56	0.72	0.84	186.3	65.8	252.1	301.1
1994	1.22	4.36	0.69	0.82	248.9	85.3	334.2	407.6

Bitterbrush shrubs at Premier Ridge and Skookumchuck Prairie produced the lowest amount of browse in 1994, of all three years (Table 126). This could be a result of browsing exclusion affecting the vigour of the shrubs. Indeed, production on a g/m^3 basis at Premier Ridge and Skookumchuck Prairie declined in each year of the study. In contrast, bitterbrush shrubs at Pickering Hills were the most productive in 1994.

Saskatoon production was lower at Skookumchuck Prairie, compared to Premier Ridge and Pickering Hills. At Skookumchuck Prairie, estimates of Saskatoon production in 1993 ranged from approximately 125 kg/ha in the Wildlife Only Area, to slightly more than 300 kg/ha in the Combined Use Area (Table 127). The highest estimate of Saskatoon production at the secondary sites was in the 1960 ungrazed area at Pickering Hills, where nearly 800 kg/ha of annual leaf and twig growth was produced (Table 128). In contrast, the grazed area at Pickering Hills produced slightly <500 kg/ha (Table 128). Saskatoon production at Premier Ridge, in both the grazed and ungrazed areas, ranged between 500 kg/ha and 700 kg/ha (Table 128). Saskatoon shrubs at Premier Ridge and Pickering Hills are larger, more numerous, and more productive (g/m^3) than Saskatoon shrubs at Skookumchuck Prairie (Table 127, 128). These estimates indicate that Saskatoon shrubs can contribute a substantial amount of browse to the forage base on these sites.

Bitterbrush production estimates at Skookumchuck Prairie were lower, when compared to estimates at Premier Ridge and Pickering Hills. Bitterbrush production at Skookumchuck Prairie ranged from <800 kg/ha to >1250 kg/ha (Table 127). In contrast, bitterbrush production in the 1960 enclosure at Pickering Hills exceeded 3700 kg/ha (Table 128). Bitterbrush production was >2000 kg/ha on the grazed areas at Premier Ridge and Pickering Hills. Bitterbrush shrub density is higher at Premier Ridge and Pickering Hills, compared to bitterbrush density at Skookumchuck Prairie (Table 127, 128).

4.3.3 Shrub Production - Discussion

Few studies have documented the distribution of twig and leaf mass on shrubs probably because most previous work has focused on winter ranges when leaves are not available. Leaf mass, however, must be taken into account when estimating spring and summer or fall browse use by cattle or wildlife otherwise a significant proportion of the forage available for use is not taken into account.

Leaves contributed less to total Saskatoon mass than twigs on all sites compared to other studies. Cook and Stoddart (1953) found leaves comprised 80% of the total forage produced on Saskatoon in northern Utah. Similarly, Williams (1976) reported that leaves contributed nearly 82% of total forage produced averaged over six sites in North Dakota, but leaf production varied from 71.3% to 87.3%. In British Columbia, Wikeem and Pitt (1987) found that leaves and twigs provided about 74% and 26%, respectively, of Saskatoon production.

Production differences associated with changes in the leaf:twig ratio can have implications for browsing in later periods. For example, in 1994 at Pickering Hills Saskatoon production decreased from 1993 by about 200 g/shrub. With a shrub density on the grazed area of about 1600 shrubs/ha this production decrease means about 320 kg/ha less Saskatoon browse was available. With a leaf:twig ratio of 70:30, about 98 kg/ha fewer twigs will be present for fall and winter browsing.

At Skookumchuck Prairie, Premier Ridge, and Pickering Hills, as much as ten times more browse is available from bitterbrush production compared to Saskatoon production (Table 127,

Table 127. Shrub density and production for saskatoon and bitterbrush at Skookumchuck Prairie in 1993.

	(#/m2)	(#/ha.)	Average Production	
			(g/m3)	(kg/ha)
Saskatoon				
Combined Use Area	0.15	1500	208.9	313.4
Cattle Only Area	0.09	900	208.9	188.0
Wildlife Only Area	0.06	600	208.9	125.3
Ungrazed Exclosure	0.10	1000	208.9	208.9
Bitterbrush				
Combined Use Area	0.58	5800	195.5	1133.9
Cattle Only Area	0.40	4000	195.5	782.0
Wildlife Only Area	0.64	6400	195.5	1251.2
Ungrazed Exclosure	0.52	5200	195.5	1016.6

Table 128. Shrub density and production for saskatoon and bitterbrush at Pickering Hills and Premier Ridge in 1993.

	(#/m2)	(#/ha)	Average Production	
			(g/m3)	(kg/ha)
Saskatoon				
Premier Ridge				
grazed	0.35	3500	192.3	673.1
ungrazed	0.28	2800	192.3	538.4
Pickering Hills				
grazed	0.16	1600	304.1	486.6
ungrazed	0.20	2000	304.1	608.2
1960 ungrazed	0.26	2600	304.1	790.7
Bitterbrush				
Premier Ridge				
grazed	1.22	12200	179.3	2187.5
ungrazed	0.93	9300	179.3	2828.1
Pickering Hills				
grazed	0.74	7400	301.1	2228.1
ungrazed	0.63	6300	301.1	1896.9
1960 ungrazed	1.24	12400	301.1	3733.6

128).

On a mass per area basis bitterbrush and Saskatoon production was similar in 1993 (Table 127, 128). Thomson (1988) reported bitterbrush production averaged 41.8 g/m^2 at four browsed sites in the east Kootenay region. Saskatoon production averaged 26.4 g/m^2 at the same sites. These production figures were lower than for this study, but they were collected from browsed areas. Estimates of Saskatoon production are lower, when compared with bitterbrush production estimates, primarily due to higher bitterbrush density on all sites.

Bitterbrush density is an important factor in determining the composition of available browse on these sites. Bitterbrush densities ranged from 4,000 plants/ha in the Cattle Only Area at Skookumchuck Prairie to more than 12,000 in the grazed area at Premier Ridge and the 1960 exclosure at Pickering Hills (Table 127, 128). Fraas (1992) reported bitterbrush densities in southwest Montana ranging from 2,000 plant/ha to 9,600 plants/ha. Peek et al. (1978), working in Idaho, found that bitterbrush density was similar outside and inside an exclosure, but that twig production was 12 times greater outside.

Bitterbrush production declined in the exclosures during the study. Garrison (1953) reported that protecting bitterbrush for four years resulted in shrubs with open crowns, little current twig growth, and generally the least amount of forage of all shrubs studied. Most of the leaves were produced on tiny spurs that studded long, ascending stems and branches. Dealy (1970) found that bitterbrush shrubs released from browsing increased in height slightly, and in crown cover greatly.

4.3.4 Shrub Use

Shrub Use - 1992

Shrub use was measured on all three sites at Skookumchuck Prairie in late May, 1992 immediately after most wildlife migrated from the winter range. Deer and elk browsed 53% of Saskatoon and 23% of bitterbrush during the spring (June) grazing period in the Combined Use Area. In the Wildlife Only Area, however, deer and elk browsed Saskatoon to 65% use and bitterbrush use was almost doubled compared to the Combined Use Area (Table 129). Similar use was recorded at Premier Ridge and Pickering Hills (Table 130).

Cattle browsed Saskatoon more than bitterbrush during the summer (July) grazing period in 1992 in the Combined Use Area (Table 129). In the Cattle Only Area, Saskatoon and bitterbrush use equaled nearly 50% and >30% for each species, respectively. Cattle browsed Saskatoon slightly less at Premier Ridge and Pickering Hills than at Skookumchuck Prairie, but use on bitterbrush was similar among the three sites (Table 129, 130). Cattle browsing at Premier Ridge in spring (June) resulted in slightly >30% use on both Saskatoon and bitterbrush (Table 130). During fall (September) at Pickering Hills, cattle browsed nearly 40% of bitterbrush annual growth, but no significant differences were found between browsed and unbrowsed Saskatoon (Table 130).

Winter wildlife browsing was assessed in March 1993 on all sites. Winter browsing patterns were similar among all sites (Table 129, 130). For example, at Skookumchuck Prairie, deer and elk browsed Saskatoon to >50% in the Combined Use and Wildlife Only Areas (Table 129). These levels of use on Saskatoon were almost identical to browse use at Premier Ridge and Pickering Hills (Table 130).

Wildlife winter use of bitterbrush was more erratic among sites compared to Saskatoon. At Skookumchuck Prairie, for example, significant ($p < 0.05$) deer and elk use on bitterbrush only

Table 129. Shrub use at Skookumchuck Prairie in 1992/93.

Site	Date	Species	Shrub	% Use	Significance level
Wildlife Only	June 1992	Elk and Deer	Saskatoon	65	*
			Bitterbrush	44	*
	March 1993	Elk and Deer	Saskatoon	52	*
			Bitterbrush	13	
Cattle Only	July 1992	Cattle	Saskatoon	48	*
			Bitterbrush	33	*
Combined Use	June 1992	Elk and Deer	Saskatoon	53	*
			Bitterbrush	25	*
	July 1992	Cattle	Saskatoon	52	*
			Bitterbrush	42	*
	March 1993	Elk and Deer	Saskatoon	56	*
			Bitterbrush	58	*

Table 130. Shrub use at Premier Ridge and Pickering Hills in 1992/93.

Site	Date	Species	Shrub	% Use	Significance level
Premier Ridge	June 1992	Elk and Deer	Saskatoon	50	**
			Bitterbrush	44	*
	July 1992	Cattle	Saskatoon	31	***
			Bitterbrush	33	*
	March 1993	Elk and Deer	Saskatoon	53	*
			Bitterbrush	12	*
Pickering Hills	June 1992	Elk and Deer	Saskatoon	47	*
			Bitterbrush	28	*
	Sept 1992	Cattle	Saskatoon	30	
			Bitterbrush	38	*
	March 1993	Elk and Deer	Saskatoon	49	*
			Bitterbrush	35	**

* Means significantly different at $p < 0.05$

** Means significantly different at $p < 0.10$

*** Means significantly different at $p < 0.20$

occurred in the Combined Use Area. Bitterbrush was browsed least at Premier Ridge and moderately at Pickering Hills (Table 130).

Shrub Use - 1993

In 1993, shrub use was measured in late-May on all three sites at Skookumchuck Prairie after most wildlife had migrated from the winter range. Elk and deer browsed Saskatoon similarly in the Combined Use and Wildlife Only Areas (Table 131). Significant bitterbrush use was measured only in the Combined Use Area (Table 131).

During fall, cattle usually browse shrubs as they shift their diet from grasses and forbs to shrubs, as the herbaceous vegetation becomes senescent (cattle made this diet shift in 1993, despite the increased rainfall relative to normal). Cattle used Saskatoon identically in both the Cattle Only ($p < 0.20$) and Combined Use ($p < 0.10$) Areas (Table 131). No significant difference ($p > 0.20$) between browsed and unbrowsed bitterbrush twigs was measured in either pasture in 1993 (Table 131).

Saskatoon and bitterbrush were measured in November, 1993 to determine fall wildlife use. Wildlife browsed Saskatoon to $>35\%$ in the Wildlife Only and Combined Use Areas. Bitterbrush was not significantly used ($p > 0.20$) at either site (Table 131). March wildlife shrub use was very similar on the two sites at Skookumchuck Prairie. Saskatoon were browsed to nearly 50% by wildlife in March, 1994 (Table 131). Bitterbrush use was not significant ($p > 0.20$) at either site.

Similar use patterns occurred on bitterbrush and Saskatoon in spring and summer at Premier Ridge and Pickering Hills in 1993. Although measurable differences were recorded in June and October during wildlife and cattle grazing periods, twig lengths of browsed and unbrowsed Saskatoon and bitterbrush were not significantly different ($p > 0.20$) in either period at either site (Table 132).

Wildlife browsed bitterbrush in fall and winter 1993 at Premier Ridge and Pickering Hills, but they did not use Saskatoon in fall at these sites. Fall use of bitterbrush (November) was $>35\%$ and nearly 25% at Premier Ridge and Pickering Hills, respectively (Table 132). Winter 1994 (March) use of Saskatoon ranged between 35% at Pickering Hills to nearly 70% at Premier Ridge (Table 132). Wildlife used ($p < 0.20$) about 40% bitterbrush in March 1994 at both sites (Table 132).

Shrub Use - 1994

Deer and elk browsed Saskatoon in spring, fall, and winter in the Wildlife Only Area at Skookumchuck Prairie in 1994. Use ranged from slightly $>30\%$ in June to nearly 70% in March (Table 133). In the Combined Use Area wildlife browsed Saskatoon more than 40% in November and March, but significant ($p > 0.20$) wildlife use was not calculated in May (Table 133).

In contrast to wildlife use of Saskatoon, bitterbrush was not browsed by deer and elk in any period in the Wildlife Only Area in 1994. Additionally, wildlife did not browse bitterbrush in spring (June) in the Combined Use Area. Wildlife only browsed approximately 20% of available bitterbrush in November and March (Table 133).

Cattle browsed Saskatoon to nearly 40% in the Combined Use Area in 1994, but significant ($p > 0.20$) use was not calculated in the Cattle only Area (Table 133). In contrast, the difference ($p < 0.05$) between browsed and unbrowsed bitterbrush twigs was nearly 30% in the **Table 131. Shrub use at Skookumchuck Prairie in 1993/94.**

Site	Date	Species	Shrub	% Use	Significance level
Wildlife Only	June 1993	Elk and Deer	Saskatoon	44	*
			Bitterbrush	21	
	March 1994	Elk and Deer	Saskatoon	47	*
			Bitterbrush	9	
Cattle Only	Oct 1993	Cattle	Saskatoon	38	**
			Bitterbrush	18	
Combined Use	June 1993	Elk and Deer	Saskatoon	45	*
			Bitterbrush	35	*
	Oct 1993	Cattle	Saskatoon	38	*
			Bitterbrush	18	
	March 1994	Elk and Deer	Saskatoon	49	*
			Bitterbrush	21	

* Means significantly different at $p < 0.05$

** Means significantly different at $p < 0.10$

*** Means significantly different at $p < 0.20$

Table 132. Shrub use at Premier Ridge and Pickering Hills in 1993/94.

Site	Date	Species	Shrub	% Use	Significance level
Premier Ridge	June 1993	Elk and Deer	Saskatoon	18	
			Bitterbrush	28	
	Oct 1993	Cattle	Saskatoon	29	
			Bitterbrush	34	
	Nov 1993	Elk and Deer	Saskatoon	32	
			Bitterbrush	36	***
	March 1994	Elk and Deer	Saskatoon	66	*
			Bitterbrush	41	***
Pickering Hills	June 1993	Elk and Deer	Saskatoon	29	
			Bitterbrush	27	
	Oct 1993	Cattle	Saskatoon	0	
			Bitterbrush	18	
	Nov 1993	Elk and Deer	Saskatoon	4	
			Bitterbrush	24	***
	March 1994	Elk and Deer	Saskatoon	35	***
			Bitterbrush	36	***

* Means significantly different at $p < 0.05$

** Means significantly different at $p < 0.10$

*** Means significantly different at $p < 0.20$

Table 133. Shrub use at Skookumchuck Prairie in 1994/95.

Site	Date	Species	Shrub	% Use	Significance level
Wildlife Only	June 1994	Elk and Deer	Saskatoon	31	***
			Bitterbrush	0	
	Nov 1994	Elk and Deer	Saskatoon	34	***
			Bitterbrush	0	
	March 1995	Elk and Deer	Saskatoon	67	*
			Bitterbrush	0	
Cattle Only	July 1994	Cattle	Saskatoon	10	*
			Bitterbrush	27	
Combined Use	June 1994	Elk and Deer	Saskatoon	20	
			Bitterbrush	0	
	July 1994	Cattle	Saskatoon	39	**
			Bitterbrush	19	***
	Nov 1994	Elk and Deer	Saskatoon	40	**
			Bitterbrush	18	***
	March 1995	Elk and Deer	Saskatoon	52	*
			Bitterbrush	21	***

* Means significantly different at $p < 0.05$

** Means significantly different at $p < 0.10$

*** Means significantly different at $p < 0.20$

Cattle Only Area, and slightly <20% in the Combined Use Area, (Table 133).

Shrub use at Premier Ridge in 1994 was different from use in 1993, but similar to use in 1992. For example, >50% of available Saskatoon was browsed in each of the four grazing periods in 1994, similar to 1992 (Table 130, 134). In contrast to 1993, where wildlife use of bitterbrush exceeded 35% in both November and March, bitterbrush use was only significant ($p < 0.20$) in the fall (November) in 1994 (Table 132, 134). At Pickering Hills significant differences between browsed and unbrowsed twigs were not determined in any grazing period (Table 134).

4.3.5 Shrub Use - Discussion

Saskatoon and bitterbrush production estimates from Skookumchuck Prairie, Premier Ridge, and Pickering Hills in 1993 indicate that available browse may exceed available herbaceous forage on these sites in some years. For example, in 1993 forage standing crop was greatest of all years studied, at all sites (Table 116, 118, 120, 127, 128). At Skookumchuck Prairie, the combined bitterbrush and Saskatoon production exceeded the herbaceous forage production in all Areas. Browse availability was higher at Premier Ridge and Pickering Hills, compared to Skookumchuck Prairie, primarily due to shrub density (Table 127, 128). This indicates that a large proportion of the soil resource on these sites is devoted to shrub production. Additionally, the potential to produce herbaceous forage is reduced due to the area these shrubs occupy.

Saskatoon was used more consistently, and to a higher degree, than bitterbrush in all grazing periods by wildlife and cattle. However, available bitterbrush exceeded Saskatoon production by more than ten times on some sites (Table 127, 128). Despite higher levels of use on Saskatoon in most grazing periods, more bitterbrush biomass was likely eaten on these sites.

Elk and deer consistently browsed Saskatoon during all grazing periods in this study. Commonly, >50%, and as high as 72% of the available Saskatoon browse was eaten during wildlife grazing periods (Table 129, 130, 131, 132, 133, 134). Bitterbrush was not browsed as intensively by wildlife, compared to Saskatoon. Seasonal use ranged between 10% and 60%, but was more commonly between 10% and 40%. In Idaho, Peek et al. (1978) reported annual utilization estimates on bitterbrush which averaged 60% (range 33 - 84%) of the current growth removed.

Cattle commonly used both bitterbrush and Saskatoon at all sites in all years. Although cattle generally used a higher percentage of Saskatoon, more bitterbrush was available on all sites. Cattle diet composition contained more bitterbrush than Saskatoon, particularly in the Cattle Only Area at Skookumchuck Prairie (Table 23, 41, 59). No significant ($p > 0.20$) bitterbrush use was measured on any site in 1993, although cattle were fall grazed (Table 131, 132). Saskatoon was only used by cattle at Skookumchuck Prairie in the Cattle Only Area in 1993. Although cattle browsed in 1993, the increased precipitation produced more forage standing crop. The increased soil moisture extended the growing season and delayed the dormancy of grasses and forbs. This likely resulted in less browse consumption by cattle as they maintained intake levels with herbaceous forage. Holechek et al. (1981) concluded that browse increases proportionally in cattle diets in late-summer as grass species cure. The cured grasses have reduced crude protein levels, below critical levels for cattle.

Bitterbrush was used most consistently in the fall and winter by wildlife in this study. Kufeld (1973), in a review of 48 elk diet studies, determined that bitterbrush was an important
Table 134. Shrub use at Premier Ridge and Pickering Hills in 1994/95

Site	Date	Species	Shrub	% Use	Significance level
Premier Ridge	June 1994	Elk and Deer	Saskatoon	52	*
			Bitterbrush	29	
	July 1994	Cattle	Saskatoon	70	*
			Bitterbrush	18	***
	Nov 1995	Elk and Deer	Saskatoon	72	*
			Bitterbrush	23	***
	March 1995	Elk and Deer	Saskatoon	63	*
			Bitterbrush	28	
Pickering Hills	June 1994	Elk and Deer	Saskatoon	0	
			Bitterbrush	15	
	Sept 1994	Cattle	Saskatoon	0	
			Bitterbrush	0	
	Nov 1994	Elk and Deer	Saskatoon	0	
			Bitterbrush	0	
	March 1995	Elk and Deer	Saskatoon	28	
			Bitterbrush	0	

* Means significantly different at $p < 0.05$

** Means significantly different at $p < 0.10$

*** Means significantly different at $p < 0.20$

fall and winter browse for elk, but it was not important in spring or summer. Based on 99 diet studies, Kufeld et al. (1973), concluded that mule deer browsed bitterbrush in all periods, but bitterbrush was browsed heaviest in winter, summer, and fall.

Generally Saskatoon was used by ungulates in all seasons in this study. Kufeld et al. (1973) found that mule deer used moderate amounts of Saskatoon throughout the year. Saskatoon was described as a "highly valuable plant" for elk in winter, summer, and fall (Kufeld 1973). This diet review classified Saskatoon as a "valuable plant" in spring.

Cattle, deer, and elk did not browse Saskatoon and bitterbrush in the same way at all sites. Relative use of Saskatoon was more consistent at Skookumchuck Prairie, than at Premier Ridge or Pickering Hills. However, in the Wildlife Only Area at Skookumchuck Prairie, bitterbrush was not browsed significantly ($p > 0.20$) in any period in 1993 or 1994. In contrast, in the Combined Use Area in 1994, bitterbrush was browsed approximately 20% by cattle in July, and by elk and deer in November and March, 1995 (Table 133).

Bitterbrush and Saskatoon were not used consistently in all years. In 1992, both species of shrubs were browsed at all sites by cattle and wildlife, in all respective grazing periods, except cattle did not use bitterbrush at Pickering Hills (Table 129, 130). In contrast, in 1993, Saskatoon was used in all periods at the Skookumchuck Prairie sites, while bitterbrush was only browsed in June, by wildlife in the Combined Use Area (Table 131). At Premier Ridge and Pickering Hills in 1993, there was no spring (June) use by wildlife, or fall (October) use by cattle on either bitterbrush or Saskatoon (Table 132). Bitterbrush was used by wildlife in fall and winter at these sites, while Saskatoon was only used in winter (Table 132). This may be a response to availability of herbaceous forage, particularly for elk. For example, in 1993 elk and deer used >35% of available bitterbrush in fall and winter at Premier Ridge. Diet information indicates that most of this forage was eaten by deer as bitterbrush comprised nearly 30% of deer diet at Premier Ridge in 1993 (Table 32). In contrast, bitterbrush in elk diet never exceeded 1.0% in any year at Premier Ridge, although other browse species, including Saskatoon, are found in elk diets (Table 20, 38, 56).

Plant vigour can be affected by the intensity of browsing. Saskatoon was often eaten in excess of 50% of the available browse in all grazing periods. Saskatoon shrubs in the exclosures only averaged >1 meter in height at Pickering Hills (Table 125). The diameter of Saskatoon shrubs on these sites was nearly equal to the height. Saskatoon is described as a "tree or shrub - 0.5 to 10 meters in height" (Hitchcock and Cronquist 1973). Saskatoon shrubs on these sites likely regenerated from underground rhizomes following disturbance. Regenerating stems come from the portion of the root crown closest to the soil surface, usually within 1.5 meters of the main plant (Hemmer 1975 as cited in Thomson 1988). Garrison (1953) found that bitterbrush and ceanothus production was stimulated when many or all of the twig ends were clipped off once a year during the dormant period. The study also confirmed that continual terminal twig removal can become a degenerative process if carried on at too great an intensity or for too long a time. Garrison (1953) also noted that many shrubs in good condition will not show evidence of serious degeneration for a few years.

Levels of browse use at these sites may impact the composition of the plant community. Peek et al. (1978) studied vegetation inside and outside an exclosure in a ponderosa pine/bitterbrush community in Idaho. They concluded that utilization of bitterbrush by big game outside the exclosure served to maintain the productivity of bitterbrush and retard succession to climax, when compared to vegetation inside the exclosure.

Current forage allocation procedures do not attempt to quantify shrub production, or the amount of browse eaten by cattle, deer, and elk. Seasonal allocation procedures should include the shrub production on each site with the forage standing crop for a more complete estimation of the forage available. Seasonal diet information, together with the relative numbers of AUM's of cattle or wildlife on the site can be used to determine a more precise estimate of seasonal carrying capacity.

4.4 Plant Community Structure

Plant species cover and frequency data were collected at Skookumchuck Prairie, Premier Ridge, the Old Seeding at Peckhams Lake and Pickering Hills in 1991. Data were collected on both the grazed and ungrazed areas in August 1991 to provide baseline information to assess long-term changes in the flora under present and future grazing conditions.

4.4.1 All Sites - 1991

Skookumchuck Prairie

Floristically the four sites at Skookumchuck Prairie are relatively similar. Total grass averaged about 30% in all four areas (Table 135). Bluebunch wheatgrass was the dominant species at all sites except the Ungulate Exclosure. Bluebunch wheatgrass cover varied between 9% and 13% in the Combined Use, Cattle Only, and Wildlife Only Areas, but also represented nearly 5% of the Ungulate Exclosure. Kentucky and Canada bluegrass were present on all sites and dominated the grass composition in the Ungulate Exclosure (Table 135).

Forb cover in August 1991 ranged between about 9% in the Cattle Only Area to nearly 17% in the Ungulate Exclosure (Table 135). Relatively few forbs exceeded 1% of canopy cover. Western yarrow, timber milkvetch, and hairy gold aster were prominent forbs on all sites at Skookumchuck Prairie.

Tree and shrub cover was highest in the Combined Use Area and on the Ungulate Exclosure, where it reached nearly 19%. Cover was slightly lower on the Cattle Only and Wildlife Only Areas. Bitterbrush was the dominant shrub on all sites at Skookumchuck Prairie, ranging between <5% in the Cattle Only Area to >11% in the Ungulate exclosure.

Premier Ridge

Grass cover at Premier Ridge was similar to Skookumchuck Prairie as cover at both sites was approximately 30% (Table 136). However, the grass component at Premier Ridge is dominated by Kentucky bluegrass which accounts for more than 50% of the grass cover in both the grazed and ungrazed areas. Western needlegrass is the other dominant grass species. Bluebunch wheatgrass was represented in the grazed area but not in the exclosure. Rough fescue and Idaho fescue were not encountered in the area sampled.

Collectively, 23 forb species were identified between the grazed and ungrazed areas at Premier Ridge in 1991. Only creeping dogbane, however, accounted for more than 1% of cover in both areas (Table 136).

Tree and shrub cover exceeded 30% in both the grazed and ungrazed areas at Premier Ridge. Relatively few shrub species (7) were encountered on the transects. Indeed, shrub cover was dominated by bitterbrush, which accounted for >20% of canopy cover in both the grazed and ungrazed areas (Table 136). Saskatoon contributed nearly 5% to cover at both Premier Ridge sites.

Table 135. Cover and frequency of plant species at Skookumchuck Prairie in August 1991.

Species	Combined Use		Cattle Only		Wildlife Only		Exclosure	
	Cover	Freq	Cover	Freq	Cover	Freq	Cover	Freq
Grass and Grasslike								
<i>Agropyron spicatum</i>	9.7	61.0	11.7	72.0	12.6	78.0	4.6	43.0
<i>Agropyron trachycaulum</i>	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
<i>Bromus tectorum</i>	0.9	11.0	0.4	2.0	0.2	4.0	2.6	13.0
<i>Calamagrostis rubescens</i>	0.2	4.0	0.3	3.0	0.0	0.0	0.0	0.0
<i>Festuca idahoensis</i>	3.8	43.0	4.1	45.0	7.2	60.0	0.8	17.0
<i>Festuca scabrella</i>	2.7	25.0	1.8	17.0	1.1	10.0	0.6	8.0
<i>Koeleria cristata</i>	1.5	24.0	2.2	34.0	2.9	37.0	0.5	10.0
<i>Poa compressa</i>	4.4	31.0	2.7	23.0	0.6	9.0	7.1	63.0
<i>Poa pratensis</i>	2.8	21.0	1.8	16.0	1.6	17.0	9.5	51.0
<i>Poa sandbergii</i>	0.4	14.0	0.6	15.0	0.5	20.0	0.1	3.0
<i>Stipa columbiana</i>	0.2	2.0	0.0	0.0	0.2	1.0	0.0	0.0
<i>Stipa comata</i>	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Stipa occidentalis</i>	1.7	8.0	1.9	17.0	0.3	2.0	0.4	7.0
<i>Stipa richardsonii</i>	1.9	13.0	1.4	11.0	1.1	8.0	0.0	0.0
Total Grass and Grasslike	30.7		29.3		28.3		26.2	
Forbs								
<i>Achillea millefolium</i>	1.1	33.0	1.1	27.0	1.7	32.0	1.7	35.0
<i>Allium cernuum</i>	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0
<i>Androsace septentrionalis</i>	0.0	0.0	0.1	3.0	0.0	0.0	0.0	0.0
<i>Anemone multifida</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.0
<i>Anemone patens</i>	0.5	4.0	0.0	1.0	0.0	0.0	0.0	0.0
<i>Antennaria parvifolia</i>	0.3	8.0	0.9	9.0	0.9	13.0	0.1	2.0
<i>Apocynum androsaemifolium</i>	0.5	10.0	0.4	16.0	0.1	3.0	0.3	11.0
<i>Arabis holboelli</i>	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
<i>Astragalus miser</i>	2.2	28.0	1.1	15.0	4.7	31.0	5.7	39.0
<i>Campanula rotundifolia</i>	0.3	5.0	0.0	1.0	0.0	1.0	0.2	2.0
<i>Castilleja sulphurea</i>	0.2	2.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cerastium arvense</i>	0.0	0.0	0.0	0.0	0.2	6.0	0.0	0.0
<i>Chrysopsis villosa</i>	1.7	10.0	1.9	22.0	0.4	5.0	2.4	31.0

<i>Crepis atrabarba</i>	0.1	2.0	0.0	0.0	0.0	1.0	0.0	0.0
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Table 135. (continued)

Species	Combined Use		Cattle Only		Wildlife Only		Exclosure	
	Cover	Freq	Cover	Freq	Cover	Freq	Cover	Freq
Forbs (continued)								
<i>Erigeron pumilis</i>	0.3	11.0	0.8	20.0	0.7	18.0	0.1	3.0
<i>Eriogonum sulphuresecens</i>	0.0	0.0	0.2	6.0	1.2	19.0	0.0	1.0
<i>Fragaria virginiana</i>	0.4	6.0	0.3	8.0	0.1	4.0	0.2	3.0
<i>Heuchra cylindrica</i>	0.6	3.0	0.7	7.0	0.0	0.0	0.0	0.0
<i>Lithospermum ruderales</i>	0.6	1.0	0.2	3.0	0.4	1.0	0.4	1.0
<i>Lomatium triternatum</i>	0.0	0.0	0.1	2.0	0.0	1.0	0.0	1.0
<i>Orthocarpus luteus</i>	0.1	2.0	0.1	2.0	0.2	8.0	0.1	4.0
<i>Oxytropis campestris</i>	0.2	1.0	0.1	2.0	0.0	0.0	0.0	0.0
<i>Penstemon procerus</i>	1.1	10.0	0.5	9.0	0.6	7.0	0.1	2.0
<i>Phlox rigida</i>	0.1	3.0	0.4	6.0	0.8	18.0	0.1	2.0
<i>Potentilla hippiana</i>	0.9	10.0	0.1	5.0	0.1	2.0	4.5	40.0
<i>Senecio canus</i>	0.9	14.0	0.3	6.0	0.1	5.0	0.4	11.0
<i>Taraxacum officinale</i>	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Tragopogon pratense</i>	0.1	3.0	0.1	3.0	0.0	1.0	0.4	15.0
<i>Viola adunca</i>	0.1	4.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Zygadenus venenosus</i>	0.0	1.0	0.1	2.0	0.1	2.0	0.0	0.0
Total Forbs	14.7		9.1		12.3		16.8	
Trees and Shrubs								
<i>Amelanchier alnifolia</i>	2.9	18.0	2.0	21.0	1.7	32.0	2.1	9.0
<i>Arctostaphylos uva-ursi</i>	2.6	14.0	4.0	28.0	0.4	7.0	1.1	4.0
<i>Ceanothus velutinus</i>	0.1	2.0	0.2	1.0	0.0	0.0	0.0	0.0
<i>Pinus ponderosa</i>	4.0	11.0	2.4	9.0	1.6	6.0	0.0	0.0
<i>Populus tremuloides</i>	0.8	4.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Prunus virginiana</i>	0.4	9.0	0.8	7.0	0.1	5.0	0.3	6.0
<i>Purshia tridentata</i>	9.1	58.0	4.9	42.0	8.6	60.0	11.5	67.0
<i>Rosa</i> spp.	0.7	12.0	0.5	14.0	0.3	5.0	3.4	38.0
<i>Shepherdia canadensis</i>	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0
<i>Spirea betulifolia</i>	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0
Total Trees and Shrubs	18.2		14.8		12.7		18.4	

Table 135 (continued)

Species	Combined Use		Cattle Only		Wildlife Only		Exclosure	
	Cover	Freq	Cover	Freq	Cover	Freq	Cover	Freq
Others								
Bryophytes	20.3	91.0	24.6	95.0	32.3	95.0	32.0	91.0
Feces	2.5	50.0	3.5	60.0	2.6	51.0	3.0	41.0
Litter	49.3	100.0	39.5	100.0	36.0	100.0	53.9	100.0
Rock	7.1	68.0	8.2	66.0	5.6	50.0	3.6	50.0
Soil	9.4	68.0	12.9	84.0	9.9	77.0	5.8	66.0

Table 136. Cover and frequency of plant species at Premier Ridge in August 1991.

Species	Grazed		Ungrazed	
	Cover	Freq	Cover	Freq
Grass and Grasslike				
Agropyron spicatum	0.9	14.0	0.0	0.0
Agropyron trachycaulum	0.0	0.0	0.3	2.0
Bromus tectorum	0.9	8.0	0.0	0.0
Koeleria cristata	1.6	22.0	2.1	22.0
Poa compressa	2.0	18.0	3.1	42.0
Poa pratensis	15.9	86.0	17.2	98.0
Stipa columbiana	0.0	0.0	0.1	4.0
Stipa comata	0.2	6.0	0.7	6.0
Stipa occidentalis	7.7	72.0	9.8	80.0
Total Grass and Grasslike	29.2		33.3	
Forbs				
Achillea millefolium	0.5	10.0	0.4	6.0
Allium cernum	0.0	0.0	0.1	4.0
Antennaria dimorpha	0.6	4.0	0.0	0.0
Antennaria parvifolia	0.7	8.0	2.6	18.0
Anemone patens	0.1	4.0	0.1	2.0
Androsace septentrionalis	0.1	4.0	0.1	2.0
Apocynum androsaemifolium	2.0	38.0	1.6	44.0
Arabis holboellii	0.0	0.0	0.1	4.0
Aster campestris	0.1	2.0	1.9	10.0
Astragalus miser	0.3	10.0	0.2	6.0
Calochortus macrocarpum	0.0	0.0	0.1	4.0
Cerastium arvense	0.0	0.0	0.6	14.0
Chrysopsis villosa	0.4	6.0	0.8	10.0
Erigeron pumilis	0.7	26.0	0.8	20.0
Eriogonum heracleoides	0.0	0.0	0.1	4.0
Fragaria virginiana	0.1	2.0	0.0	0.0
Lepidium densiflorum	0.8	22.0	0.5	20.0
Lithospermum ruderales	0.8	2.0	0.4	6.0
Lotus corniculatus	0.0	0.0	0.8	10.0

Table 136 (continued)

Species	Grazed		Ungrazed	
	Cover	Freq	Cover	Freq
Forbs (continued)				
Oxytropis campestris	0.1	4.0	0.3	2.0
Penstemon procerus	0.1	2.0	0.0	0.0
Taraxacum officianale	0.0	0.0	0.1	2.0
Tragopogon pratense	0.4	14.0	0.2	6.0
Total Forbs	7.8		11.8	
Trees and Shrubs				
Amelanchier alnifolia	4.9	74.0	4.0	60.0
Populus tremuloides	0.3	12.0	0.7	8.0
Purshia tridentata	22.2	96.0	22.1	94.0
Rosa spp.	0.3	12.0	1.2	28.0
Shepherdia canadensis	1.1	6.0	0.7	8.0
Spirea betulifolia	0.8	22.0	0.1	4.0
Symphoricarpos albus	2.3	30.0	5.2	34.0
Total Trees and Shrubs	31.9		34.0	
Others				
Bryophytes	20.4	94.0	14.2	96.0
Feces	3.9	56.0	5.7	46.0
Litter	42.0	100.0	37.8	100.0
Rock	2.5	40.0	2.0	28.0
Soil	12.6	82.0	23.0	94.0

Pickering Hills

The plant communities are similar at Premier Ridge and Pickering Hills. Although a greater number of grass species were encountered on the Pickering Hills site, Kentucky bluegrass and western needlegrass are the dominant grass species in the grazed and ungrazed areas. Combined, these species comprise about 30% of the cover on these sites (Table 137). In the historical enclosure, grass cover is <20%. Kentucky bluegrass and pinegrass are the most common species.

Forb cover ranged between 11% and 19% at Pickering Hills (Table 137). Several weedy species were present on the Pickering Hills site. Fairy candelabra, spreading dogbane, and chickweed were the most prevalent species in the grazed area. In the ungrazed area chickweed comprised more than 10% of ground cover. Similarly, in the historical enclosure, spreading dogbane provides 10% of the ground cover. Knapweed was observed in the ungrazed area, but not recorded on the transects.

Shrub cover was highest on the historical enclosure (41.5%) and lowest in the ungrazed area (27.0%). At all three sites at Pickering Hills in 1991 bitterbrush was the dominant shrub comprising slightly >20% in the grazed area and in the historical enclosure (Table 137). Saskatoon, low Oregongrape, and rose were common shrubs on all three sites.

Peckhams Lake

Only data from the Old Seeding was available in 1991. Grass cover in the grazed area and enclosure was about 30% (Table 138). Orchardgrass was the dominant species at the Old Seeding where it was recorded at slightly >12% at both the grazed and ungrazed areas. Slender wheatgrass and smooth brome grass were the other dominant domestic species. Pinegrass and Idaho fescue were the most frequently encountered native grasses (Table 138).

Forb cover was nearly three times greater on the grazed area than on the ungrazed area at the Old Seeding in 1991. In the enclosure only common yarrow and wild strawberry exceeded 1% cover. In the grazed area, alfalfa and alsike clover were present but neither exceeded 2% cover (Table 138). Nuttall's pussytoes was the dominant forb in the grazed area where it supplied 8% of ground cover.

No tree species were encountered on the transects in either the grazed or ungrazed area. In the grazed area of the Old Seeding, bearberry and rose combined comprised less than 1% of canopy cover.

4.4.2 All Sites - 1992

Skookumchuck Prairie

Floristically the four sites at Skookumchuck Prairie are relatively similar. Total grass averaged about 30.0% in all four areas (Table 139). Bluebunch wheatgrass was the dominant grass in the Combined Use, Cattle Only and Wildlife Only Areas representing between 7% and 11% canopy cover. Canada bluegrass and Kentucky bluegrass were the dominant grasses in the Ungulate Enclosure but bluebunch wheatgrass was also present (Table 139). Although numerous forbs were present in all four areas, they generally represented only a small proportion of ground cover. Indeed, the number of forbs ranged from 18 in the Ungulate Enclosure to 25 in the Wildlife Only Area but cover never exceeded 20% in any area (Table 139). Highest forb cover occurred in the Combined Use Area.

Table 137. Cover and frequency of plant species at Pickering Hills in August 1991.

Species	Grazed		Ungrazed		Historical Exclosure	
	Cover	Freq	Cover	Freq	Cover	Freq
Grass and Grasslike						
Agropyron dasytachyum	0.0	0.0	0.3	10.0	0.8	20.0
Agropyron trachycaulum	0.1	4.0	0.0	0.0	0.9	8.0
Bromus tectorum	2.1	24.0	1.0	22.0	0.0	0.0
Calamagrostis rubescens	1.0	10.0	0.5	10.0	5.9	44.0
Festuca scabrella	0.0	0.0	0.0	0.0	1.1	8.0
Koeleria cristata	1.9	14.0	0.8	10.0	0.0	0.0
Poa compressa	1.7	28.0	1.3	20.0	0.6	12.0
Poa pratensis	23.8	98.0	16.0	100.0	8.1	94.0
Stipa columbiana	4.7	48.0	0.0	0.0	0.0	0.0
Stipa comata	0.0	0.0	0.6	4.0	0.0	0.0
Stipa occidentalis	7.4	54.0	14.9	88.0	1.3	12.0
Total Grass and Grasslike	42.7		35.4		18.7	
Forbs						
Achillea millefolium	0.3	14.0	0.5	20.0	0.5	10.0
Antennaria parvifolia	1.0	10.0	0.0	0.0	0.1	2.0
Androsace septentrionalis	7.3	72.0	0.0	0.0	0.0	0.0
Apocynum androsaemifolium	2.2	56.0	1.1	16.0	10.0	84.0
Astragalus miser	0.0	0.0	0.3	4.0	0.0	0.0
Balsamorhiza sagittata	0.1	2.0	0.6	4.0	0.0	0.0
Calochortus macrocarpum	0.2	8.0	1.4	14.0	0.0	0.0
Campanula rotundifolia	0.1	2.0	0.1	2.0	0.0	0.0
Cerastium arvense	3.3	32.0	10.1	82.0	0.0	0.0
Chenopodium le	0.0	0.0	0.3	4.0	0.0	0.0
Chrysopsis villosa	0.2	6.0	0.1	2.0	0.5	10.0
Fragaria virginiana	0.4	8.0	0.1	2.0	0.0	0.0
Lepidium densiflorum	0.0	0.0	0.1	2.0	0.0	0.0
Lithospermum ruderales	0.3	4.0	0.1	2.0	0.3	2.0
Lotus corniculatus	0.0	0.0	0.3	2.0	0.0	0.0
Orthocarpus luteus	0.0	0.0	0.1	2.0	0.0	0.0
Oxytropis campestris	0.0	0.0	0.9	6.0	0.0	0.0

Table 137. (continued)

Species	Grazed		Ungrazed		Historical Exclosure	
	Cover	Freq	Cover	Freq	Cover	Freq
Forbs (continued)						
Penstemon procerus	0.0	0.0	0.2	8.0	0.0	0.0
Potentilla hippiana	1.4	6.0	0.6	4.0	0.0	0.0
Sisyrinchium angustifolium	0.1	2.0	0.0	0.0	0.0	0.0
Taraxacum officinale	1.5	22.0	1.8	40.0	0.0	0.0
Tragopogon pratense	0.2	6.0	0.3	12.0	0.1	2.0
Verbascum thapsis	0.0	0.0	0.3	4.0	0.0	0.0
Viola adunca	0.0	0.0	0.0	0.0	0.3	14.0
Total Forbs	18.6		19.3		11.8	
Trees and Shrubs						
Amelanchier alnifolia	7.4	36.0	6.4	30.0	6.3	42.0
Arctostaphylus uva-ursi	0.0	0.0	0.0	0.0	3.8	16.0
Berberis repens	1.6	24.0	1.3	12.0	3.7	36.0
Ceanothus velutinus	2.0	22.0	2.3	30.0	0.4	8.0
Prunus virginiana	0.8	12.0	0.0	0.0	0.0	0.0
Purshia tridentata	20.9	80.0	12.4	68.0	20.4	88.0
Rosa spp.	3.4	28.0	1.4	24.0	5.4	78.0
Shepherdia canadensis	0.0	0.0	0.2	6.0	0.3	2.0
Spirea betulifolia	0.8	32.0	1.6	36.0	0.2	8.0
Symphoricarpus albus	0.0	0.0	1.4	24.0	1.0	20.0
Total Trees and Shrubs	36.9		27.0		41.5	
Others						
Bryophytes	21.1	94.0	11.6	84.0	0.8	22.0
Feces	5.2	60.0	2.2	48.0	1.1	16.0
Litter	35.8	100.0	23.4	100.0	88.8	102.0
Rock	0.9	16.0	2.3	34.0	0.1	2.0
Soil	4.0	50.0	11.1	92.0	2.4	56.0

Table 138. Cover and frequency of plant species at Peckhams Lake in August 1991.

Species	Old Seeding Grazed		Old Seeding Exclosure	
	Cover	Freq	Cover	Freq
Grass and Grasslike				
<i>Agrostis alba</i>	0.2	8.0	0.0	0.0
<i>Agropyron cristatum</i>	1.7	38.0	1.6	32.0
<i>Agropyron spicatum</i>	0.6	12.0	0.4	4.0
<i>Agropyron trachycaulum</i>	6.9	64.0	8.1	70.0
<i>Bromus inermis</i>	2.3	40.0	5.8	70.0
<i>Carex douglasii</i>	0.1	2.0	0.1	2.0
<i>Calamagrostis rubescens</i>	0.9	16.0	1.6	24.0
<i>Dactylis glomerata</i>	12.4	68.0	12.5	68.0
<i>Festuca idahoensis</i>	1.2	18.0	0.7	8.0
<i>Koeleria cristata</i>	0.1	2.0	0.0	0.0
<i>Poa compressa</i>	0.1	2.0	0.0	0.0
<i>Poa pratensis</i>	0.3	2.0	0.0	0.0
<i>Stipa richardsonii</i>	0.1	4.0	0.0	0.0
Total Grass and Grasslike	26.9		30.8	
Forbs				
<i>Achillea millefolium</i>	0.9	36.0	1.1	22.0
<i>Anemone multifida</i>	0.3	2.0	0.0	0.0
<i>Antennaria parvifolia</i>	8.0	42.0	0.0	0.0
<i>Anemone patens</i>	0.3	2.0	0.6	14.0
<i>Androsace septentrionalis</i>	0.1	2.0	0.1	2.0
<i>Aster campestris</i>	1.0	8.0	0.1	2.0
<i>Astragalus miser</i>	0.2	6.0	0.2	6.0
<i>Cerastium arvense</i>	1.0	30.0	0.2	8.0
<i>Eriogonum heracleoides</i>	0.1	4.0	0.0	0.0
<i>Filago arvensis</i>	0.0	0.0	0.2	6.0
<i>Fragaria virginiana</i>	2.8	40.0	2.0	20.0
<i>Geum triflorum</i>	0.7	6.0	0.0	0.0
<i>Lotus corniculatus</i>	0.7	8.0	0.0	0.0
<i>Medicago sativa</i>	1.2	10.0	0.8	10.0

Table 138. (continued)

Species	Old Seeding Grazed		Old Seeding Exclosure	
	Cover	Freq	Cover	Freq
Forbs (continued)				
Orthocarpus luteus	0.6	22.0	0.8	30.0
Penstemon procerus	0.2	6.0	0.6	4.0
Potentilla hippiana	0.9	14.0	0.5	8.0
Solidago spathulata	0.0	0.0	0.1	2.0
Taraxacum officianale	0.0	0.0	0.5	10.0
Trifolium hybridum	1.9	18.0	0.0	0.0
Trifolium repens	0.1	2.0	0.0	0.0
Verbascum thapsus	0.1	4.0	0.0	0.0
Viola adunca	0.8	22.0	0.7	6.0
Total Forbs	21.9		8.5	
Trees and Shrubs				
Arctostaphylos uva-ursi	0.4	6.0	0.0	0.0
Rosa spp.	0.1	4.0	0.0	0.0
Total Trees and Shrubs	0.5		0.0	
Others				
Bryophytes	9.6	98.0	5.6	86.0
Feces	1.9	16.0	0.7	8.0
Litter	37.5	100.0	53.6	100.0
Rock	1.6	52.0	1.4	56.0
Soil	33.2	96.0	24.9	92.0

Table 139. Cover and frequency of plant species at Skookumchuck Prairie in June 1992.

Species	Combined Use		Cattle Only		Wildlife Only		Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike								
<i>Agropyron spicatum</i>	7.3	52.0	8.2	57.0	11.0	72.0	3.5	29.0
<i>Bromus tectorum</i>	0.8	10.0	0.0	0.0	0.5	6.0	1.8	11.0
<i>Calamagrostis rubescens</i>	0.0	1.0	0.5	5.0	0.0	0.0	0.0	0.0
<i>Carex douglasii</i>	0.2	1.0	0.0	1.0	0.0	0.0	0.0	0.0
<i>Festuca idahoensis</i>	2.8	26.0	4.8	33.0	9.6	66.0	1.4	7.0
<i>Festuca scabrella</i>	4.2	36.0	3.2	23.0	1.2	10.0	2.3	19.0
<i>Koeleria cristata</i>	1.8	31.0	1.6	35.0	3.9	50.0	1.8	22.0
<i>Poa compressa</i>	4.6	25.0	2.5	12.0	0.6	6.0	10.9	59.0
<i>Poa pratensis</i>	5.2	34.0	4.5	21.0	2.2	15.0	9.4	52.0
<i>Poa sandbergii</i>	0.1	4.0	0.5	10.0	0.2	8.0	0.0	0.0
<i>Stipa columbiana</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
<i>Stipa comata</i>	0.4	8.0	0.3	9.0	1.3	16.0	0.0	1.0
<i>Stipa occidentalis</i>	0.3	6.0	0.8	11.0	0.0	1.0	0.0	0.0
<i>Stipa richardsonii</i>	3.5	20.0	4.4	20.0	2.6	12.0	0.2	1.0
Total Grass and Grasslike	31.2		31.3		33.1		31.3	
Forbs								
<i>Achillea millefolium</i>	2.8	42.0	1.6	23.0	1.9	22.0	3.0	37.0
<i>Allium cernuum</i>	0.1	2.0	0.0	1.0	0.0	0.0	0.0	1.0
<i>Anemone patens</i>	0.4	3.0	0.0	0.0	0.0	0.0	0.2	1.0
<i>Antennaria microphylla</i>	0.6	8.0	1.2	14.0	0.8	10.0	0.0	0.0
<i>Apocynum androsaemifolium</i>	0.2	6.0	0.1	5.0	0.0	1.0	0.3	11.0
<i>Arabis holboellii</i>	0.3	12.0	0.3	14.0	0.1	2.0	0.0	0.0
<i>Astragalus miser</i>	1.9	26.0	1.2	19.0	4.4	35.0	4.3	34.0
<i>Calochortus macrocarpum</i>	0.0	0.0	0.0	0.0	0.0	1.0	0.1	2.0
<i>Campanula rotundifolia</i>	0.4	8.0	0.0	1.0	0.0	1.0	0.2	2.0
<i>Cerastium arvense</i>	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0
<i>Chrysopsis villosa</i>	1.1	11.0	1.9	25.0	0.4	5.0	2.5	24.0
<i>Crepis atrabarba</i>	0.1	2.0	0.0	0.0	0.0	0.0	0.0	1.0
<i>Erigeron pumilis</i>	0.9	14.0	1.1	28.0	2.0	34.0	0.1	4.0
<i>Eriogonum umbellatum</i>	0.0	0.0	0.2	4.0	1.6	13.0	0.0	0.0

Table 139. (continued)

Species	Combined Use		Cattle Only		Wildlife Only		Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)								
<i>Fragaria virginiana</i>	0.6	8.0	0.6	8.0	0.3	4.0	0.0	0.0
<i>Heuchra cylindrica</i>	0.3	4.0	0.3	4.0	0.0	0.0	0.0	1.0
<i>Lappula echinata</i>	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
<i>Lepidium densiflorum</i>	0.0	1.0	0.1	2.0	0.0	1.0	0.0	1.0
<i>Lewisia rediviva</i>	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
<i>Lithospermum ruderales</i>	0.8	3.0	0.0	0.0	0.4	1.0	0.0	0.0
<i>Lotus corniculatus</i>	0.0	0.0	0.0	0.0	0.1	2.0	0.0	0.0
<i>Orthocarpus luteus</i>	0.0	0.0	0.0	0.0	0.1	4.0	0.0	0.0
<i>Oxytropis campestris</i>	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Penstemon confertus</i>	1.2	15.0	0.1	5.0	0.6	5.0	0.0	0.0
<i>Penstemon procerus</i>	0.1	2.0	0.3	3.0	0.0	0.0	0.0	0.0
<i>Phlox rigida</i>	0.3	5.0	0.6	8.0	1.9	18.0	0.3	3.0
<i>Potentilla</i> spp.	1.7	14.0	0.5	9.0	0.3	5.0	4.8	40.0
<i>Senecio canus</i>	1.5	19.0	0.3	9.0	0.1	2.0	0.2	6.0
<i>Taraxacum officinale</i>	0.5	10.0	0.3	8.0	0.1	3.0	0.1	3.0
<i>Tragopogon pratense</i>	0.4	7.0	0.3	6.0	0.1	2.0	1.0	11.0
<i>Viola adunca</i>	0.3	7.0	0.0	0.0	0.0	0.1	0.0	0.0
<i>Zygadenus venenosus</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
Unknown	0.1	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Forbs	16.6		11.0		15.2		17.1	
Trees and Shrubs								
<i>Amelanchier alnifolia</i>	1.8	18.0	0.8	20.0	0.5	9.0	1.9	9.0
<i>Arctostaphylos uva-ursi</i>	2.8	22.0	3.6	25.0	0.9	6.0	0.4	2.0
<i>Ceanothus velutinus</i>	0.0	1.0	0.2	1.0	0.0	0.0	0.0	0.0
<i>Philadelphus lewisii</i>	0.1	2.0	0.1	2.0	0.0	0.0	0.0	0.0
<i>Pinus ponderosa</i>	4.7	10.0	4.1	11.0	2.9	7.0	0.0	0.0
<i>Populus tremuloides</i>	0.2	2.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Prunus virginiana</i>	0.1	2.0	0.0	0.0	0.3	5.0	0.0	0.0
<i>Purshia tridentata</i>	8.9	60.0	5.1	40.0	6.0	55.0	12.4	59.0
<i>Rosa</i> spp.	0.5	11.0	0.4	11.0	0.1	2.0	2.5	35.0

Table 139. (continued)

Species	Combined Use		Cattle Only		Wildlife Only		Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Trees and Shrubs (continued)								
Shepherdia canadensis	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Spirea Betulifolia	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Symphoricarpus albus	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Trees and Shrubs	19.1		14.3		10.7		17.2	
Others								
Bryophytes	23.0	88.0	22.9	89.0	28.5	98.0	24.0	94.0
Cattle feces	0.6	4.0	0.2	1.0	0.0	0.0	0.0	0.0
Deer feces	0.0	1.0	0.0	1.0	0.2	1.0	0.0	0.0
Elk feces	1.8	31.0	1.4	24.0	2.5	40.0	0.0	0.0
Litter	47.8	100.0	46.0	98.0	34.8	100.0	56.8	100.0
Rock	6.4	61.0	6.8	57.0	6.6	45.0	3.6	42.0
Soil	9.3	84.0	14.4	87.0	16.0	94.0	5.1	57.0

Shrub cover ranged from nearly 11% in the Wildlife Only Area to slightly <20% in the Combined Use Area. Bitterbrush was the dominant shrub on all four sites with its frequency ranging from 40% in the Cattle Only Area to 60% in the Combined Use Area. Other common shrubs among the sites include Saskatoon, bearberry and rose (Table 139).

Premier Ridge

The plant community at Premier Ridge (38 species) is generally less diverse than at Skookumchuck Prairie (58 species). Although six and seven grasses were present in the grazed and ungrazed areas, respectively, Kentucky bluegrass and western needlegrass accounted for nearly 90% of the grass cover (Table 140). Rough fescue and Idaho fescue were not present on the area sampled although they do occur on the site. Similarly, bluebunch wheatgrass is not present in the exclosure but does occur infrequently in the grazed area (Table 140).

Forbs comprised the largest number of species in both the exclosure (19 species) and on the grazed area (18 species) but they contributed the least to cover compared to grasses and shrubs (Table 140). Shaggy fleabane was the most frequent forb at Premier Ridge followed by dandelion and common yarrow.

Shrub cover was similar between the grazed area and the exclosure at Premier Ridge with bitterbrush dominating in both areas (Table 140). Other shrubs that occurred frequently in both areas included Saskatoon, rose, and shiny-leaf spirea.

Pickering Hills

The composition of the plant community at Pickering Hills is very similar to Premier Ridge, especially regarding grass and shrub composition (Table 141). Again, Kentucky bluegrass and western needlegrass were the dominant grass species comprising nearly 85% of grass cover in the grazed area and the new exclosure, respectively. Kentucky bluegrass and pinegrass were the dominant grass species in the historical exclosure. Canada bluegrass, prairie Junegrass and needle-and-thread also were frequent in both areas (Table 141).

Like at Premier Ridge, forbs accounted for the greatest number of species in the flora at Pickering Hills, but they contributed least to cover in both the grazed and the ungrazed exclosures (Table 141). Dandelion and common peppergrass were the most frequent forbs in the exclosure followed by common yarrow and diffuse knapweed. Dandelion also occurred most frequently in the grazed area followed by common yarrow, spreading dogbane and common peppergrass. Although knapweed occurred in the grazed area at Pickering Hills, it was not encountered on the transects. Knapweed represented 3.0% of cover in the new exclosure. The historical exclosure had the highest percent forb cover of the three sites but the cover was composed primarily of spreading dogbane.

Bitterbrush was the most frequent shrub in the grazed area and both the new and historical exclosures at Pickering Hills contributing about 19%, 13%, and 18% of total cover in the three areas, respectively (Table 141). Rose and Saskatoon in the grazed area, Saskatoon and buckbrush in the new exclosure, and Saskatoon, bearberry, low Oregongrape, rose, spirea, and snowberry provided cover in the grazed area, the new exclosure, and the historical exclosure respectively (Table 141).

Table 140. Cover and frequency of plant species at Premier Ridge in June 1992.

Species Name	Grazed		Exclosure	
	% Cover	Freq	% Cover	Freq
Grass and Grasslike				
Agropyron spicatum	0.4	6.0	0.0	0.0
Carex douglasii	0.1	2.0	0.0	0.0
Festuca idahoensis	0.1	2.0	0.6	6.0
Koeleria cristata	1.5	24.0	1.0	10.0
Poa compressa	1.1	16.0	0.4	6.0
Poa pratensis	20.5	98.0	26.9	94.0
Poa sandbergii	0.0	0.0	0.3	2.0
Stipa columbiana	0.6	14.0	0.8	12.0
Stipa occidentalis	10.0	76.0	12.6	76.0
Total Grass and Grasslike	34.3		42.6	
Forbs				
Achillea millefolium	0.6	12.0	0.4	8.0
Allium cernuum	0.0	0.0	0.4	8.0
Antennaria dimorpha	0.3	4.0	0.3	4.0
Antennaria microphylla	0.3	2.0	0.3	4.0
Antennaria parvifolia	0.3	2.0	0.3	2.0
Anemone multifida	0.0	0.0	0.3	4.0
Anemone patens	0.3	4.0	0.0	0.0
Apocynum androsaemifolium	0.3	2.0	0.0	0.0
Astragalus miser	0.4	8.0	0.1	4.0
Calochortus macrocarpum	0.2	8.0	0.1	2.0
Collinsia parviflora	0.1	2.0	0.0	0.0
Crepis atrabarba	0.1	2.0	0.1	2.0
Echium vulgare	0.1	4.0	0.3	14.0
Erigeron pumilis	0.9	28.0	0.7	28.0
Lithospermum ruderales	0.8	4.0	0.7	8.0
Oxytropis campestris	0.4	6.0	0.6	4.0
Penstemon confertus	0.0	0.0	0.1	2.0
Penstemon procerus	0.2	8.0	0.8	12.0
Potentilla hippiana	0.1	2.0	0.0	0.0

Table 140. (continued)

Species Name	Grazed		Exclosure	
	% Cover	Freq	% Cover	Freq
Forbs (continued)				
Solidago spathulata	0.0	0.0	0.3	4.0
Taraxacum officinale	0.3	14.0	0.9	18.0
Tragopogon pratense	0.8	10.0	0.7	8.0
Unknown	0.4	6.0	0.4	6.0
Total Forbs	6.9		7.8	
Trees and Shrubs				
Amelanchier alnifolia	2.6	74.0	3.8	64.0
Arctostaphylos uva-ursi	0.1	2.0	0.0	0.0
Purshia tridentata	15.6	96.0	16.6	92.0
Rosa spp.	0.4	18.0	0.9	34.0
Shepherdia canadensis	0.3	2.0	0.4	6.0
Spiraea betulifolia	0.7	18.0	0.6	12.0
Symphoricarpus albus	0.6	6.0	0.9	14.0
Total Trees and Shrubs	20.3		23.2	
Others				
Bryophytes	21.0	98.0	18.4	98.0
Cattle feces	0.3	2.0	0.0	0.0
Deer feces	0.1	2.0	0.0	0.0
Elk feces	3.5	52.0	0.0	0.0
Litter	32.5	100.0	36.8	100.0
Rock	2.4	36.0	1.8	20.0
Soil	15.3	86.0	14.9	82.0

Table 141. Cover and frequency of plant species at Pickering Hills in June 1992.

Species Name	Grazed	Exclosure		Historical Exclosure		
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike						
Agropyron dasytachyum	0.1	4.0	0.2	8.0	3.2	12.0
Agropyron trachycaulum	0.1	2.0	0.0	0.0	1.0	10.0
Bromus tectorum	0.3	2.0	1.2	8.0	0.0	0.0
Calamagrostis rubescens	0.0	0.0	0.0	0.0	6.8	36.0
Carex douglasii	0.0	0.0	0.1	2.0	0.1	2.0
Festuca idahoensis	0.1	2.0	0.0	0.0	0.0	0.0
Festuca scabrella	0.0	0.0	0.0	0.0	0.8	2.0
Koeleria cristata	1.0	10.0	1.6	16.0	0.1	2.0
Poa compressa	3.2	30.0	1.8	12.0	0.4	6.0
Poa pratensis	18.1	96.0	21.7	88.0	12.4	86.0
Stipa columbiana	1.1	16.0	3.3	28.0	2.0	18.0
Stipa occidentalis	15.6	82.0	20.3	88.0	1.2	8.0
Total Grass and Grasslike	39.6		50.2		28.0	
Forbs						
Achillea millefolium	1.3	22.0	1.0	32.0	0.3	10.0
Antennaria microphylla	0.2	6.0	0.1	4.0	0.1	4.0
Antennaria parvifolia	0.6	6.0	0.1	4.0	0.3	2.0
Antennaria rosea	0.1	2.0	0.0	0.0	0.0	0.0
Apocynum androsaemifolium	0.8	22.0	0.0	0.0	14.1	88.0
Arabis holboellii	0.1	2.0	0.1	2.0	0.0	0.0
Astragalus miser	0.4	6.0	0.3	4.0	0.0	0.0
Calochortus apiculatus	0.2	8.0	0.4	8.0	0.0	0.0
Campanula rotundifolia	0.0	0.0	0.0	0.0	0.1	2.0
Centaurea diffusa	0.0	0.0	3.0	16.0	0.0	0.0
Cerastium arvense	0.0	0.0	0.1	2.0	0.0	0.0
Chrysopsis villosa	0.0	0.0	0.1	2.0	0.0	0.0
Collinsia parviflora	0.0	0.0	0.1	2.0	0.0	0.0
Cynoglossum officianale	0.3	2.0	0.3	4.0	0.0	0.0
Fragaria virginiana	0.7	8.0	0.1	4.0	0.9	6.0
Lepidium densiflorum	0.5	20.0	1.2	48.0	0.0	0.0

Table 141 (continued)

Species Name	Grazed	Exclosure		Historical Exclosure		
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)						
Lithospermum ruderales	0.3	4.0	0.3	2.0	0.3	4.0
Lomatium triternatum	0.0	0.0	0.1	4.0	0.0	0.0
Penstemon confertus	0.1	2.0	0.0	0.0	0.0	0.0
Potentilla hippiana	0.8	10.0	0.4	6.0	0.0	0.0
Sisyrinchium angustifolium	0.0	0.0	0.1	2.0	0.0	0.0
Solidago spathulata	0.1	2.0	0.0	0.0	0.0	0.0
Taraxacum officinale	3.0	48.0	4.6	52.0	0.0	0.0
Tragopogon pratense	0.1	2.0	0.1	4.0	0.3	2.0
Trifolium hybridum	0.0	0.0	0.1	2.0	0.0	0.0
Verbascum thapsis	0.0	0.0	0.1	2.0	0.0	0.0
Viola adunca	0.0	0.0	0.1	4.0	0.0	0.0
Zygadenus venenosus	0.1	2.0	0.0	0.0	0.0	0.0
Total Forbs	9.7		12.8		16.4	
Trees and Shrubs						
Amelanchier alnifolia	2.1	24.0	4.7	24.0	7.6	36.0
Arctostaphylos uva-ursi	0.0	0.0	0.0	0.0	7.6	36.0
Berberis repens	1.3	20.0	0.5	10.0	9.9	56.0
Ceanothus velutinus	0.6	12.0	6.3	40.0	1.0	10.0
Prunus virginiana	0.5	10.0	0.3	2.0	0.0	0.0
Purshia tridentata	19.4	78.0	13.1	62.0	18.4	84.0
Rosa spp.	2.4	26.0	1.3	22.0	3.8	52.0
Shepherdia canadensis	0.0	0.0	0.4	8.0	0.3	2.0
Spirea betulifolia	0.9	18.0	1.3	42.0	3.0	40.0
Symphoricarpos albus	0.7	8.0	2.2	26.0	2.0	24.0
Total Trees and Shrubs	27.9		30.1		53.6	

Table 141. (continued)

Species Name	Grazed	Exclosure		Historical Exclosure		
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Others						
Bryophytes	21.0	98.0	19.3	96.0	6.7	70.0
Feces	4.1	68.0	0.0	0.0	0.1	2.0
Litter	33.8	100.0	53.5	98.0	79.8	100.0
Rock	0.6	24.0	1.5	20.0	0.1	4.0
Soil	6.3	62.0	5.7	72.0	1.5	22.0

Peckhams Lake

The flora at Peckhams Lake is distinctly different than at the other three locations. This area has been under development since the early 1970s to convert unproductive forest into range for wildlife and cattle. Early developments focused on clearing the forest and seeding the areas to domestic forage species. More recently, however, these developments have tried to provide a mosaic of seeded openings with a forest stand left to provide escape and thermal cover for wildlife and cattle.

Two sites were sampled at Peckhams Lake. The "Old Seeding" was developed in 1986 and the "New Seeding" was planted in 1991. Grasses and forbs dominate the grazed areas and exclosures on both seedings while shrubs occur infrequently on both areas (Table 142).

In the Old Seeding smooth brome, slender wheatgrass and orchardgrass were the most frequent domestic grasses (Table 142). These three species collectively contributed nearly 80% of total grass cover in both the grazed and ungrazed areas. Native grasses, such as pinegrass, Idaho fescue, prairie Junegrass, and Richardson's needlegrass were present on the site but generally as a minor component of the stand. Pinegrass was the most frequently occurring native grass on the site but it provided only slightly more than 1% of total cover in the grazed area and 7% in the exclosure (Table 142).

In contrast to the Old Seeding, orchardgrass and perennial ryegrass were the dominant domestic grasses on the New Seeding in both the grazed area and the exclosure (Table 142). Indeed, orchardgrass provided 70 - 75% of total grass cover on the grazed area and exclosure in itself. Pinegrass, prairie Junegrass, and Richardson's needlegrass were the most frequent native grasses in the stand, but combined, they provided about 3% and 7% of ground cover in the grazed area and exclosure, respectively (Table 142).

Forbs, as a group, contributed between 20 - 33% ground cover in the Old Seeding exclosure and the New Seeding exclosure, respectively (Table 142). Native forbs were most prevalent in all four areas sampled but alfalfa and alsike clover were present in both exclosures and in the grazed areas (Table 142). Indeed, alsike clover provided nearly 70% of forb cover in the New Seeding exclosure in June 1992. Introduced weeds, such as filago and field chickweed were frequent in most areas sampled, but generally provided less than 2% ground cover. Common yarrow and Nuttall's pussy-toes were the most frequent native forbs especially in the grazed portion of the Old Seeding (Table 142). Timber milkvetch occurred frequently in the grazed part of the New Seeding but contributed 1% or less to ground cover on all four areas.

Total shrub cover accounted for less than 2% of total cover at Peckhams Lake. Bearberry was the most dominant shrub throughout the area sampled but it provided <2% cover in the exclosure at the New Seeding (Table 142).

4.4.3 All Sites - 1993

Skookumchuck Prairie

As in 1991 and 1992, the four sites at Skookumchuck Prairie were similar floristically in 1993. Total grass cover was lower than in 1991 and 1992, ranging from about 25% in the Wildlife Only Area to almost 30% in the Ungulate Exclosure (Table 135, 139, 143). Idaho fescue was the dominant grass in the Cattle Only and Wildlife Only Areas and ranged from nearly 2% to 10% among sites. Kentucky bluegrass was the dominant grass in the Combined Use Areas and the Ungulate Exclosure ranging from 2.4% to 11.2%. Bluebunch wheatgrass ranged from nearly 3% to 4.5% over all sites.

Table 142. Cover and frequency of plant species at Peckhams Lake in June 1992.

Species Name	Old Seeding Grazed		Old Seeding Exlosure		New Seeding Grazed		New Seeding Exlosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike								
Agrostis alba	0.0	0.0	0.0	0.0	0.1	2.0	0.0	0.0
Agropyron cristatum	2.3	32.0	0.9	8.0	0.0	0.0	0.1	2.0
Agropyron trachycaulum	5.8	44.0	7.3	42.0	0.2	6.0	1.6	16.0
Bromus inermis	5.3	62.0	13.1	86.0	0.8	12.0	0.3	4.0
Bromus tectorum	0.0	0.0	0.0	0.0	0.1	2.0	0.0	0.0
Calamagrostis rubescens	1.3	20.0	7.1	50.0	0.1	2.0	1.3	12.0
Carex douglasii	0.1	2.0	0.1	2.0	0.0	0.0	0.0	0.0
Dactylis glomerata	5.3	46.0	7.2	38.0	13.6	98.0	21.9	92.0
Festuca idahoensis	0.3	10.0	0.4	8.0	0.2	6.0	0.1	4.0
Koeleria cristata	0.4	6.0	0.0	0.0	0.1	2.0	0.2	6.0
Lolium perenne	0.0	0.0	0.0	0.0	3.0	42.0	1.5	32.0
Phleum pratense	0.0	0.0	0.3	2.0	0.1	2.0	0.1	4.0
Poa pratensis	0.0	0.0	0.1	2.0	0.9	8.0	0.4	6.0
Stipa richardsonii	0.1	2.0	0.0	0.0	0.3	2.0	0.4	6.0
Total Grass and Grasslike	20.9		36.5		19.5		29.4	
Forbs								
Achillea millefolium	2.5	48.0	3.8	36.0	0.4	6.0	0.7	8.0
Antennaria microphylla	0.8	2.0	0.1	2.0	0.1	2.0	0.0	0.0
Antennaria parvifolia	5.5	52.0	0.8	12.0	0.9	8.0	1.5	20.0
Anemone patens	1.1	6.0	0.0	0.0	0.1	4.0	0.3	2.0
Apocynum androsaemifolium	0.1	2.0	0.0	0.0	0.0	0.0	0.1	4.0
Arabis holboellii	0.1	4.0	0.1	2.0	0.1	2.0	0.1	2.0
Astragalus miser	0.3	12.0	0.3	4.0	0.8	22.0	1.0	12.0
Calochortus macrocarpum	0.1	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Campanula rotundifolia	0.0	0.0	0.1	2.0	0.0	0.0	0.0	0.0
Cerastium arvense	1.0	32.0	1.6	24.0	0.0	0.0	1.1	16.0
Collinsia parviflora	0.1	2.0	0.2	6.0	0.2	8.0	0.6	12.0
Crepis atrabarba	0.0	0.0	0.0	0.0	0.1	4.0	0.0	0.0
Filago arvensis	2.5	38.0	1.4	36.0	1.0	28.0	0.7	18.0

Table 142. (continued)

Species Name	Old Seeding Grazed		Old Seeding Exlosure		New Seeding Grazed		New Seeding Exlosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)								
Fragaria virginiana	3.3	40.0	2.7	28.0	0.2	8.0	0.6	14.0
Geum triflorum	0.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Medicago sativa	0.3	2.0	5.6	28.0	0.6	12.0	2.2	26.0
Penstemon confertus	0.2	8.0	0.7	8.0	0.0	0.0	0.2	6.0
Penstemon procerus	1.0	22.0	0.3	4.0	0.0	0.0	1.5	12.0
Potentilla hippiana	0.6	12.0	0.1	4.0	0.1	4.0	0.1	4.0
Taraxacum officinale	0.4	8.0	0.8	12.0	0.4	6.0	0.0	0.0
Trifolium hybridum	1.3	14.0	1.4	14.0	0.1	2.0	22.2	80.0
Trifolium repens	0.0	0.0	0.3	2.0	0.0	0.0	0.0	0.0
Verbascum thapsis	0.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Viola adunca	1.2	28.0	1.1	16.0	0.1	4.0	0.1	2.0
Total Forbs	24.3		21.4		24.7		33.0	
Trees and Shrubs								
Amelanchier alnifolia	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.0
Arctostaphylos uva-ursi	0.3	4.0	0.0	0.0	0.2	6.0	1.4	16.0
Rosa spp.	0.2	6.0	0.1	2.0	0.1	2.0	0.4	8.0
Total Trees and Shrubs	0.5		0.1		0.3		1.9	
Others								
Bryophytes	16.5	94.0	13.6	92.0	0.0	0.0	0.0	0.0
Cattle feces	1.1	16.0	0.3	2.0	0.0	0.0	0.0	0.0
Elk feces	0.3	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Litter	28.5	100.0	44.5	100.0	10.1	98.0	18.1	100.0
Rock	2.5	58.0	3.0	58.0	4.9	98.0	3.8	84.0
Soil	26.6	98.0	15.7	84.0	57.8	98.0	36.3	98.0

Table 143. Cover and frequency of plant species at Skookumchuck Prairie in June 1993.

Species	Combined Use		Cattle Only		Wildlife Only		Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike								
Agropyron spicatum	4.3	34.0	4.4	34.0	4.5	47.0	2.9	27.0
Agropyron trachycaulum	1.3	7.0	0.0	0.0	0.0	1.0	0.2	6.0
Carex douglasii	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0
Calamagrostis rubescens	0.0	1.0	1.2	8.0	0.0	0.0	0.0	0.0
Festuca idahoensis	2.0	23.0	5.5	31.0	9.7	66.0	1.1	9.0
Festuca scabrella	4.7	40.0	4.7	28.0	0.9	10.0	3.2	18.0
Koeleria cristata	1.6	24.0	2.5	34.0	3.1	39.0	1.1	19.0
Poa compressa	2.7	23.0	0.8	11.0	0.3	7.0	7.5	50.0
Poa pratensis	5.3	29.0	3.2	19.0	2.4	14.0	11.2	61.0
Poa sandbergii	0.2	6.0	0.2	8.0	0.3	11.0	0.1	4.0
Stipa comata	0.0	0.0	0.1	4.0	0.2	7.0	0.0	0.0
Stipa occidentalis	0.0	1.0	0.3	2.0	0.1	2.0	0.2	1.0
Stipa richardsonii	4.4	22.0	2.8	18.0	3.3	18.0	0.6	5.0
Total Grass and Grasslike	26.5		25.7		24.8		28.1	
Forbs								
Achillea millefolium	2.9	40.0	2.4	30.0	2.2	23.0	3.5	39.0
Allium cernuum	0.1	2.0	0.0	1.0	0.0	0.0	0.0	1.0
Anemone patens	0.2	2.0	0.0	1.0	0.0	0.0	0.0	1.0
Antennaria microphylla	0.7	14.0	2.2	19.0	1.2	14.0	0.1	3.0
Apocynum androsaemifolium	0.3	2.0	0.3	3.0	0.0	0.0	0.2	3.0
Arabis holboellii	0.2	9.0	0.3	13.0	0.2	8.0	0.1	2.0
Astragalus miser	3.4	34.0	2.0	24.0	6.6	37.0	4.7	36.0
Calochortus apiculatus	0.1	2.0	0.0	0.0	0.0	1.0	0.0	0.0
Calochortus macrocarpum	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0
Castilleja thompsonii	0.1	3.0	0.0	0.0	0.0	0.0	0.2	2.0
Chrysopsis villosa	1.4	8.0	2.2	23.0	0.4	3.0	2.4	27.0
Crepis atrabarba	0.1	3.0	0.0	1.0	0.0	1.0	0.0	1.0
Erigeron pumilus	1.1	20.0	2.0	28.0	2.0	37.0	0.1	3.0
Eriogonum umbellatum	0.0	0.0	0.2	3.0	0.9	14.0	0.0	0.0
Fragaria virginiana	0.5	9.0	0.3	8.0	0.3	2.0	0.3	5.0

Table 143. (continued)

Species	Combined Use		Cattle Only		Wildlife Only		Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)								
Heuchra cylindrica	0.3	4.0	0.2	4.0	0.0	0.0	0.3	2.0
Lewisia rediviva	0.0	0.0	0.0	0.0	0.1	2.0	0.0	0.0
Lithospermum ruderales	0.6	1.0	0.0	0.0	0.2	1.0	0.0	1.0
Lomatium triternatum	0.0	1.0	0.3	9.0	0.1	4.0	0.1	2.0
Medicago lupulina	0.0	0.0	0.0	0.0	0.9	3.0	0.0	0.0
Oxytropis campestris	0.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Penstemon confertus	0.7	8.0	0.8	10.0	0.4	8.0	0.1	3.0
Penstemon procerus	0.2	7.0	0.2	2.0	0.0	0.0	0.0	0.0
Phlox rigida	0.2	3.0	1.0	9.0	1.8	21.0	0.2	4.0
Potentilla sulphurea	1.6	14.0	0.5	11.0	0.2	4.0	4.0	41.0
Senecio canus	0.6	14.0	0.3	5.0	0.2	1.0	0.2	9.0
Taraxacum officinale	0.2	7.0	0.2	8.0	0.1	3.0	0.0	1.0
Tragopogon pratense	0.4	11.0	0.5	10.0	0.1	2.0	0.4	10.0
Viola adunca	0.1	3.0	0.0	0.0	0.0	1.0	0.0	0.0
Total Forbs	16.2		15.9		17.9		16.9	
Trees and Shrubs								
Amelanchier alnifolia	2.7	20.0	0.7	14.0	0.4	8.0	2.1	8.0
Arctostaphylos uva-ursi	4.0	18.0	5.0	24.0	0.7	5.0	0.7	3.0
Ceanothus velutinus	0.0	1.0	0.4	1.0	0.0	0.0	0.0	0.0
Philadelphus lewisii	0.0	1.0	0.0	1.0	0.0	0.0	0.3	5.0
Pinus ponderosa	6.2	11.0	5.3	10.0	4.2	9.0	0.0	0.0
Populus tremuloides	0.2	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Prunus virginiana	0.1	3.0	0.2	1.0	0.1	4.0	0.0	0.0
Purshia tridentata	12.5	62.0	7.9	42.0	12.5	60.0	14.9	69.0
Rosa spp.	0.3	7.0	0.3	8.0	0.0	1.0	1.5	28.0
Shepherdia canadensis	0.0	0.0	0.2	1.0	0.0	0.0	0.0	0.0
Total Trees and Shrubs	26.0		20.0		17.9		19.5	

Table 143. (continued)

Species	Combined Use		Cattle Only		Wildlife Only		Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Others								
Bryophytes	13.5	84.0	16.8	76.0	14.6	81.0	17.1	86.0
Cattle feces	0.3	3.0	0.2	1.0	0.0	0.0	0.0	0.0
Deer feces	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Elk feces	0.6	13.0	0.0	0.0	0.6	20.0	0.0	0.0
Litter	43.2	100.0	41.7	100.0	33.3	99.0	59.2	99.0
Rock	6.0	54.0	7.2	55.0	5.2	46.0	3.0	35.0
Soil	10.7	74.0	11.2	76.0	15.0	91.0	4.8	53.0

The total number of unique forb species found on the four sites equaled twenty-nine in 1993. Of these twenty-nine species, only common yarrow, timber milkvetch, hairy golden aster, shaggy fleabane, spiny phlox, and sulphur cinquefoil exceeded 1% cover at one or more of the sites. Forb cover never exceeded 20% on any site. Highest total forb cover was in the Wildlife Only Area (Table 143).

Shrub cover ranged from <18% in the Wildlife Only Area to 26% in the Combined Use Area, which was higher than in 1992 (Table 139, 143). Bitterbrush dominated shrub cover at all sites with cover ranging from about 8% to 15%. Percent cover of bitterbrush was increased over 1992 at all sites at Skookumchuck Prairie (Table 139, 143). Frequency of bitterbrush in 1993 was similar to frequency in 1992 in the Combined Use and Cattle Only Areas, while it was lower in the Wildlife Only Area, and higher in the Ungulate Exclosure (Table 139, 143).

Premier Ridge

At Premier Ridge the plant community was represented by 38 species, approximately equal in number to the plant community in 1991 and 1992 (Table 136, 140, 144). Kentucky bluegrass and western needlegrass were the dominant species, ranging from more than 10% to over 22%. Prairie junegrass was the only other grass to exceed 1% cover at both the grazed and ungrazed sites. Canada bluegrass in the grazed area, and needle-and-thread and Richardson's needlegrass in the exclosure were the only other grass species to exceed 1% cover. Traces of rough fescue were found in the grazed area.

Forbs comprised the largest number of species and the lowest cover in 1993 at Premier Ridge (Table 144). Shaggy fleabane was the most common forb at both sites. Timber milkvetch and rosy pussytoes were the only other forb species to contribute more than 1% to cover.

Bitterbrush was the dominant shrub at Premier Ridge. Indeed, frequency exceeded 90% in both the grazed area and the exclosure. Saskatoon cover was >4% in both areas, but most other shrubs contributed <1% to canopy cover (Table 144).

Pickering Hills

Grass cover was very similar at Pickering Hills in 1993 in both the grazed and ungrazed areas, ranging between 32% and 36% (Table 145). Grass cover in the historical exclosure was lower (19.8%).

Dandelion, chickweed, and spreading dogbane were the only forbs with cover to exceed 1% in the grazed area, but none exceeded 3% cover. Dandelion and knapweed both equaled 4% cover in the new exclosure. Moreover, spreading dogbane is the dominant forb in the historical exclosure (Table 145).

Bitterbrush dominated cover at Pickering Hills in all three areas sampled (Table 145). Saskatoon, low Oregon grape, and buckbrush were all more prevalent inside exclosures than on the grazed area. Indeed, Saskatoon and low Oregon grape contributed twice the amount to cover in the historical exclosure compared to the grazed area. Similarly, buckbrush was >8% in the new exclosure but less than 1% in the grazed area. Other common shrubs contributing to cover are rose, soapberry, birch-leaved spirea and snowberry.

Table 144. Cover and frequency of plant species at Premier Ridge in June 1993.

Species	Grazed		Exclosure	
	% Cover	Freq	% Cover	Freq
Grass And Grasslike				
Agropyron spicatum	0.2	8.0	0.0	0.0
Festuca scabrella	0.1	2.0	0.0	0.0
Koeleria cristata	1.8	30.0	1.1	16.0
Poa compressa	1.0	12.0	0.3	4.0
Poa pratensis	16.4	86.0	22.3	98.0
Stipa columbiana	0.9	14.0	0.8	2.0
Stipa comata	0.0	0.0	1.3	0.0
Stipa occidentalis	12.6	76.0	10.1	74.0
Stipa richardsonii	0.0	0.0	1.4	8.0
Total Grass and Grasslike	33.0		37.3	
Forbs				
Achillea millefolium	0.6	14.0	0.4	8.0
Antennaria microphylla	0.6	6.0	1.5	22.0
Apocynum androsaemifolium	0.6	6.0	0.3	4.0
Arabis holboellii	0.2	6.0	0.3	14.0
Astragalus miser	1.3	22.0	0.5	10.0
Calochortus apiculatus	0.0	0.0	0.2	6.0
Calochortus macrocarpum	0.2	8.0	0.0	0.0
Cerastium arvense	0.1	2.0	0.2	6.0
Chrysopsis villosa	0.6	12.0	0.4	8.0
Crepis atrabarba	0.0	0.0	0.1	2.0
Erigeron pumilis	1.9	36.0	1.0	40.0
Fragaria virginiana	0.1	2.0	0.0	0.0
Lithospermum ruderales	0.8	2.0	0.7	8.0
Medicago lupulina	0.0	0.0	0.1	2.0
Oxytropis campestris	0.3	4.0	0.3	2.0
Penstemon confertus	0.0	0.0	0.3	2.0
Penstemon procerus	0.0	0.0	0.7	8.0
Solidago spathulata	0.0	0.0	0.3	2.0
Taraxacum officinale	0.2	8.0	0.6	22.0

Table 144. (continued)

Species	Grazed		Exclosure	
	% Cover	Freq	% Cover	Freq
Forbs (continued)				
Tragopogon pratense	0.6	14.0	0.8	10.0
Zygadenus venenosus	0.0	0.0	0.1	2.0
Total Forbs	8.1		8.8	
Trees and Shrubs				
Amelanchier alnifolia	5.7	70.0	4.1	62.0
Arctostaphylos uva-ursi	0.1	2.0	0.0	0.0
Ceanothus velutinus	0.6	12.0	0.0	0.0
Purshia tridentata	21.5	94.0	20.6	90.0
Rosa spp.	0.3	12.0	0.8	32.0
Shepherdia canadensis	0.8	4.0	0.7	8.0
Spirea betulifolia	0.5	10.0	0.0	0.0
Symphoricarpus albus	0.3	2.0	2.5	22.0
Total Trees and Shrubs	29.8		28.7	
Others				
Bryophytes	18.5	94.0	8.6	98.0
Cattle feces	0.1	4.0	0.0	0.0
Deer feces	0.1	4.0	0.0	0.0
Elk feces	1.6	34.0	0.0	0.0
Litter	27.6	100.0	43.5	100.0
Rock	1.5	32.0	1.8	32.0
Soil	10.2	88.0	11.7	80.0

Table 145. Cover and frequency of plant species at Pickering Hills in June 1993.

Species	Grazed		Exclosure		Historical Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike						
<i>Agropyron dasytachyum</i>	0.1	4.0	0.7	8.0	1.7	18.0
<i>Agropyron trachycaulum</i>	0.0	0.0	0.3	4.0	0.4	6.0
<i>Bromus tectorum</i>	0.3	2.0	0.0	0.0	0.0	0.0
<i>Calamagrostis rubescens</i>	0.1	4.0	0.6	4.0	6.2	32.0
<i>Festuca scabrella</i>	0.0	0.0	0.8	2.0	1.3	2.0
<i>Koeleria cristata</i>	1.5	18.0	1.9	16.0	0.1	2.0
<i>Poa compressa</i>	1.5	12.0	1.3	10.0	0.1	4.0
<i>Poa pratensis</i>	14.3	98.0	16.6	94.0	7.1	66.0
<i>Poa sandbergii</i>	0.3	2.0	0.0	0.0	0.0	0.0
<i>Stipa columbiana</i>	0.9	14.0	1.6	26.0	0.4	8.0
<i>Stipa occidentalis</i>	13.3	84.0	12.1	82.0	2.5	22.0
<i>Stipa richardsonii</i>	0.1	2.0	0.0	0.0	0.0	0.0
Total Grass and Grasslike	32.4		35.9		19.8	
Forbs						
<i>Achillea millefolium</i>	0.6	14.0	1.4	24.0	0.3	14.0
<i>Androsace septentrionalis</i>	0.4	18.0	0.0	0.0	0.0	0.0
<i>Antennaria microphylla</i>	0.4	6.0	0.2	6.0	0.1	4.0
<i>Antennaria parvifolia</i>	0.7	8.0	0.0	0.0	0.0	0.0
<i>Apocynum androsaemifolium</i>	1.3	10.0	0.6	4.0	4.7	24.0
<i>Arabis holboellii</i>	0.1	4.0	0.1	2.0	0.0	0.0
<i>Aster conspicuous</i>	0.0	0.0	0.3	2.0	0.0	0.0
<i>Astragalus miser</i>	0.0	0.0	0.4	6.0	0.0	0.0
<i>Calochortus apiculatus</i>	0.4	8.0	0.8	10.0	0.0	0.0
<i>Castilleja thompsonii</i>	0.1	2.0	0.1	2.0	0.0	0.0
<i>Centaurea diffusa</i>	0.0	0.0	4.0	14.0	0.0	0.0
<i>Cerastium arvense</i>	1.9	46.0	0.3	14.0	0.0	0.0
<i>Chrysopsis villosa</i>	0.0	0.0	0.1	2.0	0.0	0.0
<i>Fragaria virginiana</i>	0.4	6.0	0.3	4.0	0.1	4.0
<i>Lepidium densiflorum</i>	0.6	24.0	0.4	16.0	0.0	0.0
<i>Lithospermum ruderales</i>	0.3	2.0	0.6	4.0	0.0	0.0

Table 145. (continued)

Species	Grazed		Exclosure		Historical Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)						
Lomatium triternatum	0.1	2.0	0.4	6.0	0.0	0.0
Medicago lupulina	0.0	0.0	0.1	2.0	0.0	0.0
Penstemon confertus	0.1	2.0	0.0	0.0	0.0	0.0
Potentilla hippiana	0.0	0.0	0.1	2.0	0.1	2.0
Potentilla sulphurea	0.9	8.0	0.6	4.0	0.0	0.0
Taraxacum officinale	2.8	44.0	4.8	52.0	0.0	0.0
Tragopogon pratense	0.1	2.0	0.1	2.0	0.1	4.0
Viola adunca	0.0	0.0	0.1	2.0	0.0	0.0
Zygadenus venenosus	0.0	0.0	0.3	4.0	0.1	2.0
Total Forbs	11.2		16.1		5.5	
Trees and Shrubs						
Amelanchier alnifolia	3.5	18.0	4.2	22.0	7.7	30.0
Arctostaphylos uva-ursi	0.0	0.0	0.0	0.0	8.1	28.0
Berberis repens	3.5	22.0	2.4	10.0	10.4	42.0
Ceanothus velutinus	0.5	10.0	7.6	46.0	0.4	6.0
Prunus virginiana	0.5	10.0	0.8	2.0	0.3	10.0
Purshia tridentata	21.0	72.0	16.8	64.0	23.8	86.0
Rosa spp.	2.7	20.0	1.1	16.0	4.0	50.0
Shepherdia canadensis	0.0	0.0	1.2	8.0	0.1	4.0
Spirea betulifolia	1.2	18.0	1.1	26.0	2.0	28.0
Symphoricarpus albus	0.6	6.0	2.7	28.0	2.8	42.0
Total Trees and Shrubs	33.5		37.9		59.6	
Others						
Bryophytes	10.5	88.0	6.3	82.0	2.8	54.0
Cattle feces	1.5	10.0	0.0	0.0	0.0	0.0
Deer feces	0.4	16.0	0.0	0.0	0.2	6.0
Elk feces	0.8	20.0	0.0	0.0	0.0	0.0

Table 145. (continued)

Species	Grazed		Exclosure		Historical Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Others (continued)						
Litter	31.7	100.0	70.3	100.0	84.3	100.0
Rock	1.5	28.0	1.1	14.0	0.3	2.0
Soil	15.7	84.0	2.8	50.0	0.4	18.0

Peckhams Lake

In the Old Seeding, smooth brome, slender wheatgrass and orchardgrass were the most frequent domestic grasses (Table 146). Native grasses, such as pinegrass, Idaho fescue, prairie Junegrass, and Richardson's needlegrass were present on the site but generally as minor components of the stand. Pinegrass was the most frequently occurring native grass.

In contrast to 1992, perennial ryegrass was absent from the plant community in June, 1993 in the New Seeding (Table 146). Orchardgrass dominated cover on the New Seeding in both the grazed area and the enclosure. Pinegrass, prairie Junegrass, and Richardson's needlegrass were frequent native grasses in the stand (Table 146).

Forbs contributed >25% to ground cover in the Old Seeding enclosure and New Seeding enclosure in 1993 (Table 146). Native forbs were most prevalent in all four areas sampled but alfalfa and alsike clover still dominated both the enclosure and in the grazed area. Indeed, alsike clover provided >16% of ground cover in the New Seeding enclosure and grazed area in June 1993. Introduced weeds, such as filago and field chickweed were still present, but generally provided <2% ground cover. Common yarrow and Nuttall's pussy-toes were the most frequent native forbs especially in the grazed part of the Old Seeding (Table 146).

Total shrub cover accounted for <2% of total cover at all sites at Peckhams Lake, except the New Enclosure. Bearberry was the most dominant shrub throughout the area in 1993 but it provided <2% cover in the enclosure at the New Seeding (Table 146).

4.4.4 All Sites - 1994

Skookumchuck Prairie

Grass and grasslike plants, at Skookumchuck Prairie, ranged from almost 50% cover in the Wildlife Only Area to nearly 60% in the Ungulate Enclosure (Table 147). Most grass species contributed more to cover in 1994 than in previous years of the study. Canada and Kentucky bluegrass continued to be prominent in the Combined Use Area and in the Ungulate enclosure (Table 147). Bluebunch wheatgrass and Idaho fescue were dominant grasses the Wildlife Only and Cattle Only Areas, respectively (Table 147). Grass cover was approximately 20% higher in 1994 than in 1991 (Table 135, 147). Generally, cover of rough fescue, Idaho fescue, prairie Junegrass, Canada bluegrass, and Kentucky bluegrass increased at all sites at Skookumchuck Prairie. Conversely, cover of bluebunch wheatgrass decreased at all sites between 1991 and 1994 (Table 135, 147). These species, however, did not all respond in the same way in all the Skookumchuck Prairie sites, presumably due to the different grazing treatments. In the Cattle Only and Wildlife Only Areas, Canada bluegrass cover was about the same in 1991 and 1994, but in the Combined Use Area and the Ungulate Enclosure cover was approximately double in 1994. Similarly, rough fescue cover did not increase in the Wildlife Only Area between 1991 and 1994, but in the Combined Use Area, Cattle Only Area, and Ungulate Enclosure cover increased by as much as three times (Table 135, 147). In the Cattle Only Area and the Ungulate Enclosure rough fescue frequency approximately doubled between 1991 and 1994 (Table 135, 147).

Forb cover was approximately 20% at all sites at Skookumchuck Prairie in 1994, higher than in 1991, 1992, and 1993 (Table 135, 143, 147). However, most forbs contributed less than 1% to total cover. Only common yarrow, timber milkvetch, and low pussytoes contributed more than 2% to cover in 1994.

Bitterbrush was the dominant shrub at all sites at Skookumchuck Prairie in 1994. Although bitterbrush cover has increased at all the Skookumchuck Prairie sites between 1991

Table 146. Cover and frequency of plant species at Peckhams Lake in June 1993.

Species	Old Seeding Grazed		Old Seeding Exclosure		New Seeding Grazed		New Seeding Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike								
Agropyron cristatum	3.3	26.0	0.3	2.0	1.4	14.0	0.0	0.0
Agropyron smithii	0.1	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Agropyron trachycaulum	3.8	32.0	4.8	26.0	0.0	0.0	0.0	0.0
Bromus inermis	7.9	70.0	18.0	88.0	1.1	16.0	1.0	12.0
Calamagrostis rubescens	1.8	32.0	4.2	32.0	0.0	0.0	1.5	10.0
Carex douglasii	0.0	0.0	0.1	2.0	0.0	0.0	0.0	0.0
Carex spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.0
Dactylis glomerata	8.9	60.0	6.0	28.0	23.3	98.0	27.1	94.0
Festuca idahoensis	0.7	8.0	0.3	2.0	1.0	10.0	0.0	0.0
Festuca scabrella	0.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Koeleria cristata	0.9	8.0	0.0	0.0	0.1	4.0	0.0	0.0
Poa compressa	0.1	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Poa pratensis	1.2	8.0	0.0	0.0	0.0	0.0	0.6	4.0
Poa sandbergii	0.0	0.0	0.0	0.0	0.1	2.0	0.0	0.0
Stipa occidentalis	0.0	0.0	0.0	0.0	0.1	2.0	0.0	0.0
Stipa richardsonii	0.3	2.0	0.0	0.0	0.9	8.0	0.6	4.0
Total Grass and Grasslike	29.3		33.7		28.0		30.9	
Forbs								
Achillea millefolium	5.6	52.0	5.6	48.0	0.6	4.0	1.0	10.0
Androsace septentrionalis	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.0
Anemone multifida	0.8	2.0	0.0	0.0	0.0	0.0	0.3	2.0
Antennaria microphylla	0.6	6.0	0.3	4.0	0.0	0.0	0.0	0.0
Antennaria parvifolia	10.4	60.0	2.0	22.0	1.1	8.0	2.9	26.0
Anemone patens	0.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Arabis holboellii	0.1	2.0	0.0	0.0	0.1	2.0	0.0	0.0
Arnica cordifolia	0.0	0.0	0.1	4.0	0.0	0.0	0.1	2.0
Astragalus miser	0.0	0.0	0.0	0.0	0.0	0.0	0.3	4.0
Castilleja thompsonii	0.3	2.0	0.0	0.0	0.3	2.0	0.0	0.0
Cerastium arvense	0.6	26.0	0.8	20.0	0.3	10.0	1.4	44.0

Table 146. (continued)

Species	Old Seeding Grazed		Old Seeding Exclosure		New Seeding Grazed		New Seeding Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)								
Cirsium spp.	0.0	0.0	0.0	0.0	0.3	2.0	0.0	0.0
Erigeron pumilis	0.0	0.0	0.0	0.0	0.1	2.0	0.0	0.0
Filago arvensis	0.3	10.0	0.1	2.0	0.1	4.0	0.1	4.0
Fragaria virginiana	4.4	38.0	4.3	34.0	0.6	6.0	1.5	20.0
Geum triflorum	1.4	6.0	0.0	0.0	0.0	0.0	0.0	0.0
Medicago lupulina	0.7	8.0	0.0	0.0	0.7	8.0	0.2	6.0
Medicago sativa	4.7	22.0	4.1	10.0	3.0	26.0	4.4	30.0
Penstemon confertus	1.0	10.0	1.9	8.0	0.1	4.0	0.8	12.0
Penstemon procerus	2.0	20.0	1.1	6.0	0.3	2.0	1.5	12.0
Potentilla hippiana	0.7	8.0	1.5	10.0	0.3	4.0	0.0	0.0
Taraxacum officinale	0.0	0.0	0.6	4.0	0.1	4.0	0.0	0.0
Tragopogon pratense	0.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Trifolium hybridum	4.9	22.0	3.1	18.0	17.5	76.0	16.3	68.0
Viola adunca	2.6	34.0	0.6	16.0	0.0	0.0	0.0	0.0
Total Forbs	41.7		26.1		25.5		30.9	
Trees and Shrubs								
Arctostaphylos uva-ursi	0.8	4.0	0.1	2.0	0.6	6.0	1.5	14.0
Rosa spp.	0.4	6.0	0.0	0.0	0.3	2.0	0.6	4.0
Total Trees and Shrubs	1.2		0.1		0.9		2.1	
Others								
Bryophytes	15.3	100.0	13.5	94.0	3.0	58.0	5.8	94.0
Cattle feces	0.3	4.0	0.0	0.0	0.3	4.0	0.0	0.0
Deer feces	0.0	0.0	0.0	0.0	0.3	2.0	0.0	0.0
Elk feces	0.1	2.0	0.0	0.0	0.1	4.0	0.0	0.0
Litter	23.6	100.0	55.9	100.0	17.9	100.0	33.5	100.0
Rock	1.8	52.0	2.2	36.0	4.2	88.0	1.7	68.0
Soil	14.7	100.0	4.4	70.0	35.5	100.0	27.4	100.0

Table 147. Cover and frequency of plant species at Skookumchuck Prairie in 1994.

Species	Combined Use		Cattle Only		Wildlife Only		Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike								
Agropyron spicatum	8.3	44.0	8.5	47.0	7.3	43.0	5.0	27.0
Agropyron trachycaulum	0.2	1.0	0.0	0.0	0.2	1.0	0.0	0.0
Calamagrostis rubescens	0.8	6.0	0.7	3.0	0.0	0.0	0.0	0.0
Carex spp.	0.3	3.0	0.0	1.0	0.0	1.0	0.0	0.0
Festuca idahoensis	5.9	27.0	8.1	37.0	18.8	66.0	3.3	11.0
Festuca scabrella	5.3	27.0	7.2	28.0	1.5	10.0	4.8	15.0
Koeleria cristata	4.4	33.0	7.7	46.0	9.8	56.0	2.8	15.0
Poa compressa	9.1	32.0	3.0	13.0	1.1	6.0	19.6	58.0
Poa pratensis	8.7	33.0	7.9	20.0	5.7	19.0	23.1	59.0
Poa sandbergii	0.2	8.0	0.1	3.0	0.0	1.0	0.0	1.0
Stipa columbiana	0.2	1.0	0.0	0.0	0.0	0.0	0.4	1.0
Stipa comata	0.0	0.0	0.4	8.0	0.6	10.0	0.0	0.0
Stipa occidentalis	0.8	6.0	0.2	1.0	0.2	1.0	0.0	0.0
Stipa richardsonii	7.7	24.0	8.1	23.0	3.8	13.0	0.2	1.0
Total Grass and Grasslike	51.9		51.9		49.0		59.2	
Forbs								
Achillea millefolium	4.2	39.0	3.5	33.0	6.5	33.0	5.7	34.0
Allium cernuum	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
Anemone patens	0.3	2.0	0.3	2.0	0.2	1.0	0.2	1.0
Antennaria dimorpha	0.5	6.0	1.9	7.0	0.0	0.0	0.0	0.0
Antennaria microphylla	0.9	8.0	1.9	16.0	1.3	13.0	0.4	3.0
Apocynum androsaemifolium	0.0	1.0	0.2	2.0	0.0	0.0	0.0	0.0
Arabis holboellii	0.2	6.0	0.2	9.0	0.1	4.0	0.1	3.0
Astragalus miser	2.3	19.0	2.7	22.0	4.2	25.0	2.3	16.0
Calochortus apiculatus	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Calochortus macrocarpum	0.0	1.0	0.0	0.0	0.1	3.0	0.0	1.0
Campanula rotundifolia	0.3	2.0	0.0	1.0	0.1	2.0	0.0	1.0
Castilleja sulphurea	0.5	5.0	0.0	0.0	0.0	0.0	0.0	0.0
Chrysopsis villosa	0.7	8.0	2.8	21.0	0.8	6.0	2.7	20.0
Crepis atrabarba	0.3	4.0	0.2	3.0	0.0	1.0	0.0	1.0

Table 147. (continued)

Species	Combined Use		Cattle Only		Wildlife Only		Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)								
Dodecatheon pauciflorum	0.0	0.0	0.2	3.0	0.1	2.0	0.0	0.0
Erigeron pumilus	0.1	2.0	0.3	7.0	0.1	3.0	0.0	0.0
Eriogonum umbellatum	0.0	0.0	0.2	3.0	1.4	11.0	0.0	0.0
Fragaria virginiana	1.3	9.0	0.9	9.0	0.4	3.0	0.4	1.0
Gaillardia aristata	0.0	0.0	0.2	1.0	0.0	0.0	0.0	0.0
Heuchra cylindrica	1.1	5.0	0.6	6.0	0.0	1.0	0.2	1.0
Lewisia rediviva	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Lithospermum ruderales	0.4	1.0	0.0	0.0	0.4	1.0	0.2	2.0
Lomatium triternatum	0.0	0.0	0.4	7.0	0.2	1.0	0.3	2.0
Medicago lupulina	0.2	1.0	0.0	0.0	0.4	3.0	0.0	0.0
Penstemon confertus	1.5	14.0	0.6	5.0	0.7	4.0	0.6	4.0
Penstemon procerus	0.6	5.0	0.4	3.0	0.0	0.0	0.0	0.0
Phlox rigida	0.6	5.0	1.3	8.0	2.0	17.0	0.2	2.0
Potentilla sulphurea	1.3	12.0	1.2	9.0	1.0	5.0	4.7	36.0
Senecio canus	1.4	15.0	0.7	8.0	0.2	4.0	0.5	4.0
Taraxacum officinale	0.4	10.0	0.5	11.0	0.1	4.0	0.1	2.0
Tragopogon pratense	0.9	9.0	0.8	10.0	0.5	4.0	0.9	11.0
Viola adunca	0.4	7.0	0.0	0.0	0.2	1.0	0.0	0.0
Total Forbs	20.4		22.0		21.0		19.5	
Trees and Shrubs								
Amelanchier alnifolia	5.0	20.0	1.6	18.0	1.2	10.0	1.7	7.0
Arctostaphylos uva-ursi	8.1	22.0	9.7	25.0	2.2	7.0	1.5	5.0
Ceanothus velutinus	0.2	2.0	0.4	1.0	0.0	0.0	0.0	0.0
Philadelphus lewisii	0.2	2.0	0.0	0.0	0.0	0.0	0.8	7.0
Pinus ponderosa	6.4	12.0	8.2	14.0	4.7	9.0	0.0	0.0
Populus tremuloides	0.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Prunus virginiana	0.1	4.0	0.5	2.0	0.3	3.0	0.0	0.0
Purshia tridentata	15.6	60.0	11.4	45.0	18.0	61.0	17.5	65.0
Rosa spp.	1.4	9.0	0.4	5.0	0.0	0.0	3.8	33.0
Shepherdia canadensis	0.0	0.0	0.2	1.0	0.0	0.0	0.0	0.0

Total Trees and Shrubs	37.2	32.4	26.4	25.3
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Table 147. (continued)

Species	Combined Use		Cattle Only		Wildlife Only		Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Others (continued)								
Bryophytes	18.8	86.0	21.1	82.0	23.3	86.0	21.9	84.0
Elk feces	0.3	3.0	0.0	0.0	0.6	3.0	0.0	0.0
Litter	47.6	100.0	43.6	100.0	41.8	99.0	67.7	100.0
Rock	9.5	57.0	8.8	62.0	6.1	45.0	3.1	22.0
Soil	8.2	65.0	8.8	72.0	12.3	71.0	1.5	27.0

and 1994, frequency was about equal at all sites (Table 135, 147). Saskatoon cover increased in the Combined Use Area and was stable in the Cattle Only Area and Ungulate Exclosure. In the Wildlife Only Area, however, both cover and frequency decreased between 1991 and 1994 (Table 135, 147). Other common shrubs include, bearberry, and rose. Ponderosa pine has increased in cover from 1991 to 1994 at the Cattle Only, Wildlife Only, and Combined Use Areas (Table 135, 147).

Bryophytes provided similar cover in 1994 as in 1991 except in the Wildlife Only Area and the Ungulate Exclosure where bryophyte cover was lower (Table 135, 147). The amount of litter cover in 1994 was very similar to cover in 1991 in the Combined Use and Cattle Only Areas, while it increased in the Wildlife Only Area and in the Ungulate Exclosure.

Premier Ridge

Plant cover at Premier Ridge increased between 1991 and 1994 (Table 136, 140, 144, 148). Similar to Skookumchuck Prairie, grasses increased cover most, especially the bluegrasses and western needlegrass (Table 148). However, frequency of either species did not increase between 1991 and 1994 (Table 136, 148). Fescues did not appear on the transect in either the grazed or ungrazed areas. Moreover, bluebunch wheatgrass exhibited the same cover in 1994 as in 1991, but frequency declined (Table 136, 148).

Forb cover exceeded 10% in both the grazed and ungrazed areas at Premier Ridge in 1994 (Table 148). Although several forb species contributed more than 1% to total cover, only common yarrow and shaggy fleabane exceeded 2% (Table 148). Forb cover was nearly double in the grazed area in 1994, compared to 1991. In the exclosure forb cover was equal between these two years (Table 136, 148).

Shrub cover was dominated by bitterbrush, especially in the grazed area. Other important shrubs such as Saskatoon, rose, soopolallie, and snowberry were all more prevalent in the exclosure than in the grazed area (Table 148). Shrub cover increased between 1991 and 1994 at Premier Ridge although the largest increase was in the grazed area (Table 136, 148). Most of the increase in cover in the grazed area came from bitterbrush and Saskatoon. Frequency of the two shrubs was relatively equal between 1991 and 1994. In contrast, bitterbrush cover and frequency declined in the exclosure. The increases in canopy cover in the exclosure between 1991 and 1994 came from Saskatoon, rose, soopolallie, and snowberry (Table 136, 148).

Bryophyte cover was lower in the exclosure than on the grazed area, in all years (Table 136, 140, 144, 148). Litter, however, provided nearly twice as much ground cover in 1994, compared to 1991. Moreover, bare soil in the exclosure occupied <5% in 1994, compared to the grazed site (>8%) (Table 148). In 1991, bare soil was 12.6% and 23.0% in the grazed and ungrazed areas, respectively (Table 136).

Pickering Hills

Similar to Premier Ridge, plant cover at Pickering Hills increased in 1994 compared to 1991. Cover of grass and grasslike plants was more than double in the new exclosure, and nearly triple in the historical exclosure between 1991 and 1994 (Table 137, 149). Most of the increase in grass cover came from Kentucky bluegrass and western needlegrass. Indeed, in the grazed area in 1994, western needlegrass cover was nearly four times greater than in 1991 (Table 137, 149). Other grass species such as thick-spiked wheatgrass, prairie Junegrass, and

Columbia needlegrass have increased their cover, but they generally comprise <5% of the plant community.

Table 148. Cover and frequency of plant species at Premier Ridge in June 1994.

Species	Grazed		Exclosure	
	% Cover	Freq	% Cover	Freq
Grass and Grasslike				
<i>Agropyron spicatum</i>	0.9	8.0	0.3	2.0
<i>Agropyron trachycaulum</i>	0.0	0.0	0.9	6.0
<i>Koeleria cristata</i>	2.8	22.0	3.7	14.0
<i>Poa compressa</i>	2.0	14.0	0.8	2.0
<i>Poa pratensis</i>	35.7	100.0	39.4	96.0
<i>Poa sandbergii</i>	0.1	2.0	0.0	0.0
<i>Stipa columbiana</i>	11.5	20.0	1.5	20.0
<i>Stipa comata</i>	0.0	0.0	0.3	2.0
<i>Stipa occidentalis</i>	20.3	84.0	23.0	78.0
<i>Stipa richardsonii</i>	0.0	0.0	0.6	4.0
Total Grass and Grasslike	63.3		70.5	
Forbs				
<i>Achillea millefolium</i>	2.0	20.0	0.8	10.0
<i>Agoseris glauca</i>	0.0	0.0	0.1	2.0
<i>Allium cernuum</i>	0.0	0.0	0.1	2.0
<i>Anemone multifida</i>	0.3	2.0	0.6	4.0
<i>Anemone patens</i>	0.1	2.0	0.0	0.0
<i>Antennaria microphylla</i>	1.5	10.0	0.4	8.0
<i>Apocynum androsaemifolium</i>	0.3	4.0	0.3	2.0
<i>Astragalus miser</i>	1.8	20.0	0.8	10.0
<i>Calochortus macrocarpum</i>	0.2	8.0	0.0	0.0
<i>Chrysopsis villosa</i>	1.5	10.0	1.5	12.0
<i>Crepis atrabarba</i>	0.0	0.0	0.3	2.0
<i>Erigeron compositus</i>	0.1	2.0	0.0	0.0
<i>Erigeron pumilus</i>	3.0	42.0	1.5	14.0
<i>Fragaria virginiana</i>	0.3	2.0	0.0	0.0
<i>Gaillardia aristata</i>	0.1	2.0	0.0	0.0
<i>Lithospermum ruderales</i>	1.5	4.0	1.6	6.0
<i>Lomatium triternatum</i>	0.3	2.0	0.0	0.0

Medicago lupulina	0.3	2.0	0.3	2.0
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Table 148. (continued)

Species	Grazed		Exclosure	
	% Cover	Freq	% Cover	Freq
Forbs (continued)				
Oxytropis campestris	0.3	4.0	0.0	0.0
Penstemon procerus	0.0	0.0	1.9	10.0
Solidago spathulata	0.0	0.0	0.3	2.0
Taraxacum officinale	0.3	10.0	0.2	8.0
Tragopogon pratense	1.3	12.0	0.9	8.0
Trifolium repens	0.1	4.0	0.0	0.0
Verbascum thapsis	0.0	0.0	0.1	2.0
Viola adunca	0.0	0.0	0.1	2.0
Total Forbs	15.3		11.8	
Trees and Shrubs				
Amelanchier alnifolia	7.4	78.0	8.3	54.0
Purshia tridentata	32.8	96.0	19.8	70.0
Rosa spp.	0.9	16.0	2.5	28.0
Shepherdia canadensis	0.8	4.0	1.9	6.0
Spirea betulifolia	0.6	6.0	0.6	6.0
Symphoricarpus albus	2.1	14.0	5.9	24.0
Total Trees and Shrubs	44.6		39.0	
Others				
Bryophytes	19.0	96.0	12.6	86.0
Elk feces	0.1	4.0	0.0	0.0
Litter	44.5	100.0	71.1	98.0
Rock	2.8	24.0	1.5	10.0
Soil	8.3	66.0	3.3	44.0

Table 149. Cover and frequency of plant species at Pickering Hills in June 1994.

Species	Grazed		Exclosure		Historical Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike						
<i>Agropyron dasytachyum</i>	1.0	4.0	1.5	12.0	5.3	16.0
<i>Agropyron trachycaulum</i>	0.6	4.0	0.0	0.0	2.5	8.0
<i>Calamagrostis rubescens</i>	0.0	0.0	1.5	10.0	15.7	56.0
<i>Festuca idahoensis</i>	0.3	2.0	0.0	0.0	0.0	0.0
<i>Festuca scabrella</i>	0.0	0.0	0.0	0.0	2.5	4.0
<i>Koeleria cristata</i>	3.5	24.0	5.3	14.0	0.8	2.0
<i>Phleum pratense</i>	0.0	0.0	0.8	2.0	0.6	4.0
<i>Poa compressa</i>	1.3	12.0	1.0	4.0	0.3	2.0
<i>Poa pratensis</i>	34.3	94.0	29.1	86.0	20.3	72.0
<i>Stipa columbiana</i>	2.3	16.0	0.7	8.0	0.0	0.0
<i>Stipa occidentalis</i>	28.8	88.0	33.1	82.0	5.3	28.0
<i>Stipa richardsonii</i>	0.0	0.0	0.0	0.0	0.8	2.0
Total Grass and Grasslike	72.1		73.0		54.1	
Forbs						
<i>Achillea millefolium</i>	3.2	28.0	2.8	20.0	0.6	6.0
<i>Allium cernuum</i>	0.1	2.0	0.0	0.0	0.0	0.0
<i>Antennaria microphylla</i>	1.6	14.0	0.0	0.0	0.6	4.0
<i>Apocynum androsaemifolium</i>	2.5	22.0	0.0	0.0	4.3	16.0
<i>Arabis holboellii</i>	0.1	2.0	0.0	0.0	0.0	0.0
<i>Aster conspicuus</i>	0.0	0.0	0.8	2.0	5.8	30.0
<i>Astragalus miser</i>	0.0	0.0	0.6	4.0	0.0	0.0
<i>Balsamorhiza sagittata</i>	0.0	0.0	0.8	2.0	0.0	0.0
<i>Calochortus apiculatus</i>	0.5	10.0	0.2	6.0	0.1	2.0
<i>Centaurea diffusa</i>	0.0	0.0	3.5	14.0	0.0	0.0
<i>Cerastium arvense</i>	0.2	6.0	0.0	0.0	0.0	0.0
<i>Chrysopsis villosa</i>	0.1	2.0	0.3	2.0	0.3	2.0
<i>Cirsium</i> spp.	0.1	4.0	0.0	0.0	0.0	0.0
<i>Filago arvensis</i>	0.1	4.0	0.0	0.0	0.0	0.0
<i>Fragaria virginiana</i>	2.0	12.0	0.6	4.0	1.4	6.0
<i>Lithospermum ruderales</i>	0.3	4.0	0.3	2.0	0.6	4.0

Table 149. (continued)

Species	Grazed		Exclosure		Historical Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)						
Medicago lupulina	0.3	2.0	0.6	4.0	0.0	0.0
Penstemon confertus	0.3	2.0	0.0	0.0	0.3	2.0
Potentilla sulphurea	1.6	8.0	1.2	8.0	0.0	0.0
Silene douglasii	0.0	0.0	0.3	2.0	2.2	8.0
Solidago spathulata	0.3	2.0	0.0	0.0	0.0	0.0
Taraxacum officinale	2.5	42.0	0.3	4.0	0.0	0.0
Tragopogon pratense	0.1	2.0	0.0	0.0	0.3	4.0
Verbascum thapsis	0.1	2.0	0.0	0.0	0.0	0.0
Vicia americana	0.1	2.0	0.0	0.0	0.0	0.0
Zygadenus venenosus	0.0	0.0	0.6	6.0	0.0	0.0
Total Forbs	16.1		12.9		16.5	
Trees and Shrubs						
Amelanchier alnifolia	5.3	26.0	7.3	20.0	11.1	32.0
Arctostaphylos uva-ursi	0.0	0.0	0.3	2.0	8.4	24.0
Berberis repens	2.3	20.0	2.2	8.0	15.6	40.0
Ceanothus velutinus	0.6	6.0	9.1	38.0	2.3	8.0
Prunus virginiana	0.4	6.0	0.8	2.0	0.0	0.0
Purshia tridentata	29.6	76.0	23.0	74.0	37.6	90.0
Rosa spp.	4.1	28.0	2.2	16.0	12.9	56.0
Shepherdia canadensis	0.0	0.0	0.9	6.0	0.3	2.0
Spirea betulifolia	2.5	32.0	3.5	26.0	4.9	24.0
Symphoricarpus albus	1.8	12.0	7.2	28.0	5.8	26.0
Total Trees and Shrubs	46.6		56.5		98.9	

Table 149. (continued)

Species	Grazed		Exclosure		Historical Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Others						
Bryophytes	8.9	86.0	6.2	66.0	4.4	32.0
Deer feces	0.3	2.0	0.0	0.0	0.1	4.0
Elk feces	0.4	8.0	0.0	0.0	0.0	0.0
Litter	43.5	98.0	81.1	100.0	83.3	100.0
Rock	0.9	16.0	0.9	8.0	0.3	2.0
Soil	9.0	76.0	2.2	30.0	1.7	18.0

Forbs contributed the most species to the plant community at Pickering Hills in 1994. Similar to 1991, 1992, and 1993, however, forbs contributed the least amount of ground cover (Table 137, 141, 145, 149). Common yarrow, spreading dogbane, and wild strawberry all contributed >2% to cover in the grazed area. Common yarrow and knapweed were the most prevalent forbs in the new exclosure. In the historical exclosure spreading dogbane, showy aster, and Douglas' silene were the only forbs to exceed 2% ground cover (Table 149).

Forb cover decreased slightly in the grazed area and in the new exclosure between 1991 and 1994, while increasing slightly in the historical exclosure (Table 137, 149). Annuals, such as fairy candelabra in the grazed area and chickweed in the new exclosure, which were prevalent in 1991 were not recorded in 1994. In contrast, diffuse knapweed was not recorded on the transects in 1991, but was 3.5% cover in the new exclosure in 1994. Similarly, showy aster was not noted in the historical exclosure in 1991, but comprised nearly 6% of cover in 1994 (Table 137, 149).

Bitterbrush was still the dominant shrub at Pickering Hills in 1994. Cover of all species of shrubs increased in 1994 (Table 149). Indeed, tree and shrub cover in the historical exclosure approached 100%, and was dominated by bitterbrush (approximately 40%) (Table 149). Shrub cover increased at all three sites between 1991 and 1994. Total cover of trees and shrubs more than doubled in the new and historical exclosures, while it only increased about 10% in the grazed area (Table 137, 149). Except for Saskatoon and chokecherry in the grazed area, all major shrubs increased cover between 1991 and 1994 (Table 137, 149). Saskatoon, low Oregongrape, bitterbrush, rose, and snowberry all contributed to increased total forb cover.

The contribution of bryophytes to total cover was higher in the grazed area, compared to both the new and the historical exclosures (Table 149). Bryophytes in 1994 were lower, compared to 1991, in the grazed area and the new exclosure. In contrast, bryophyte cover in the historical exclosure were higher in 1994 than 1991. Litter cover was nearly 45% in the grazed area, but almost twice that in both the new and historical exclosures (Table 149). Litter cover was about equal in 1991 and 1994 in the historical exclosure, but higher in the grazed area and in the new exclosure (Table 137, 149). Bare soil was approximately four times higher in the grazed area than in the exclosures. Bare soil increased from 4.0% in 1991 to 9.0% in 1994 in the grazed area.

Peckhams Lake

Grass cover in the New Seeding ranged from slightly more than 40% to just over 50% in 1994. Domestic species dominated the grass component of the plant community at the New Seeding with orchardgrass still the most conspicuous grass. This species provided >30% cover on both the grazed and ungrazed areas (Table 150). Total grass cover more than doubled between 1992 and 1994 in the New Seeding grazed area, and increased by approximately 10% in the New Seeding exclosure (Table 142, 150). Orchardgrass, smooth brome grass, pinegrass, rough fescue, and Idaho fescue all increased cover between 1992 and 1994, but most of the increase came from orchardgrass (Table 142, 150).

In the Old Seeding, total cover of grass and grasslike species was slightly >60% for both the grazed area and the exclosure. In contrast to the New Seeding, at the Old Seeding smooth brome grass was the dominant grass in 1994 (Table 150). Cover of grass and grasslike species more than doubled between 1991 and 1994 (Table 138, 150). Crested wheatgrass, smooth brome grass, and Idaho fescue increased cover the most. In contrast, orchardgrass cover

Table 150. Cover and frequency of plant species at Peckhams Lake in June 1994.

Species	Old Seeding Grazed		Old Seeding Exclosure		New Seeding Grazed		New Seeding Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike								
Agropyron cristatum	7.7	38.0	3.6	18.0	0.0	0.0	0.0	0.0
Agropyron dasytachyum	0.6	6.0	0.0	0.0	0.0	0.0	0.0	0.0
Agropyron trachycaulum	7.2	36.0	7.8	28.0	0.1	2.0	0.9	8.0
Bromus inermis	26.0	96.0	36.3	92.0	5.4	40.0	1.9	16.0
Calamagrostis rubescens	0.0	0.0	9.4	26.0	1.4	6.0	4.1	20.0
Carex spp.	0.6	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Dactylis glomerata	8.4	52.0	3.7	20.0	36.8	96.0	31.3	94.0
Festuca idahoensis	6.0	36.0	0.0	0.0	1.3	12.0	0.0	0.0
Festuca rubra	1.4	6.0	0.0	0.0	4.5	32.0	0.3	2.0
Festuca scabrella	0.0	0.0	0.6	4.0	0.6	4.0	0.0	0.0
Koeleria cristata	1.3	10.0	0.0	0.0	0.6	4.0	0.0	0.0
Phleum pratense	0.0	0.0	0.0	0.0	0.3	2.0	0.0	0.0
Poa compressa	0.3	2.0	0.0	0.0	0.0	0.0	0.6	4.0
Poa pratensis	2.1	8.0	0.0	0.0	0.3	2.0	0.0	0.0
Stipa richardsonii	0.0	0.0	0.0	0.0	0.6	4.0	2.1	8.0
Total Grass and Grasslike	61.6		61.4		51.9		41.2	
Forbs								
Achillea millefolium	4.9	48.0	4.3	34.0	1.5	20.0	1.0	22.0
Agoseris glauca	0.0	0.0	0.0	0.0	0.1	2.0	0.0	0.0
Allium cernuum	0.0	0.0	0.0	0.0	0.0	0.0	0.3	2.0
Androsace septentrionalis	0.0	0.0	0.0	0.0	0.1	2.0	0.0	0.0
Anemone multifida	0.6	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Anemone patens	0.3	2.0	0.0	0.0	0.6	4.0	0.6	4.0
Antennaria microphylla	4.4	22.0	0.3	2.0	0.0	0.0	0.1	2.0
Antennaria parvifolia	19.4	60.0	6.0	26.0	1.9	8.0	4.2	22.0
Astragalus miser	0.0	0.0	0.0	0.0	0.1	4.0	0.0	0.0
Campanula rotundifolia	0.0	0.0	0.0	0.0	0.1	2.0	0.0	0.0
Calochortus apiculatus	0.1	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Cerastium arvense	0.1	4.0	0.0	0.0	0.6	14.0	0.1	4.0

Table 150. (continued)

Species	Old Seeding Grazed		Old Seeding Exclosure		New Seeding Grazed		New Seeding Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)								
Dodecatheon pauciflorum	0.0	0.0	0.0	0.0	0.1	4.0	0.0	0.0
Fragaria virginiana	6.8	44.0	7.6	46.0	1.4	16.0	4.3	32.0
Galium boreale	0.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Geum triflorum	1.0	4.0	0.0	0.0	0.1	4.0	0.0	0.0
Heuchra cylindrica	1.0	4.0	0.0	0.0	0.1	2.0	0.0	0.0
Lathyrus nevadensis	0.0	0.0	0.0	0.0	0.3	4.0	2.9	18.0
Medicago lupulina	0.0	0.0	0.0	0.0	0.8	10.0	0.0	0.0
Medicago sativa	0.4	6.0	0.3	2.0	3.5	14.0	2.0	18.0
Penstemon confertus	1.3	10.0	2.0	12.0	1.0	10.0	0.6	4.0
Penstemon procerus	4.3	24.0	1.4	6.0	1.0	4.0	1.7	10.0
Potentilla gracilis	1.3	10.0	2.8	14.0	1.6	16.0	0.1	2.0
Potentilla hippiana	0.0	0.0	0.3	2.0	0.0	0.0	0.0	0.0
Potentilla sulphurea	0.1	2.0	0.1	2.0	0.0	0.0	0.0	0.0
Solidago spathulata	0.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Taraxacum officinale	0.3	12.0	1.4	14.0	1.1	46.0	0.3	4.0
Trifolium hybridum	2.5	22.0	0.3	4.0	3.0	32.0	0.6	6.0
Trifolium repens	0.0	0.0	0.0	0.0	0.6	6.0	0.0	0.0
Vicia americana	3.2	14.0	0.3	4.0	2.5	20.0	1.9	16.0
Viola adunca	2.1	24.0	1.9	14.0	0.2	8.0	1.9	34.0
Total Forbs	54.7		29.0		22.3		22.6	
Trees and Shrubs								
Amelanchier alnifolia	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.0
Arctostaphylos uva-ursi	0.1	2.0	0.1	2.0	0.2	6.0	3.2	30.0
Prunus virginiana	0.0	0.0	0.1	2.0	0.0	0.0	0.0	0.0
Pseudotsuga menziesii	0.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Rosa spp.	0.2	8.0	0.1	2.0	0.1	2.0	1.0	20.0
Total Trees and Shrubs	0.6		0.3		0.3		4.3	

Table 150. (continued)

Species	Old Seeding Grazed		Old Seeding Exclosure		New Seeding Grazed		New Seeding Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Others								
Bryophytes	19.3	94.0	18.0	76.0	18.6	98.0	12.9	96.0
Elk feces	0.0	0.0	0.0	0.0	0.1	2.0	0.0	0.0
Litter	30.9	100.0	65.8	100.0	39.8	100.0	61.2	100.0
Rock	2.8	40.0	2.2	16.0	3.0	52.0	2.0	32.0
Soil	7.6	76.0	3.5	42.0	12.0	84.0	8.2	84.0

decreased between 1991 and 1994 in both the grazed and ungrazed areas at the Old Seeding (Table 137, 150).

Forb cover in the grazed and ungrazed areas in the New Seeding was almost identical in 1994. Alsike clover and alfalfa were still the dominant domestic species while common yarrow, Nuttall's pussytoes, wild strawberry, and dandelion were the most common native forbs (Table 150). Forb cover was approximately equal in the New Seeding grazed area between 1991 and 1994, while cover decreased about 10% in the New Seeding exclosure (Table 142, 150). Most of the decrease in the exclosure came from alsike clover. Western yarrow, Nuttall's pussytoes, wild strawberry, alfalfa, and alsike clover all increased in the grazed area of the New Seeding between 1991 and 1994 (Table 142, 150).

Forb cover was similar in 1994 at both sites in the New Seeding and the Old Seeding exclosure. Forb cover in the grazed area of the Old Seeding, however, was nearly 55%, although Nuttall's pussytoes represented nearly 20% cover itself. Other dominant forbs included common yarrow, rosy pussytoes, wild strawberry, and small-flowered penstemon (Table 150). Forb cover more than doubled in the grazed area, and more than tripled in the exclosure, between 1991 and 1994 (Table 138, 150). Cover of common yarrow, wild strawberry, small-flowered penstemon, and alsike clover increased in both the grazed and ungrazed portions of the Old Seeding between 1991 and 1994 (Table 138, 150). In contrast, timber milkvetch and alfalfa decreased.

Browse species are not as prevalent at Peckhams Lake as at the other sites. The highest tree and shrub component was in the exclosure at the New Seeding, and this was primarily bearberry, although traces of rose and Douglas-fir were recorded on the grazed portion of the Old Seeding in 1994 (Table 150).

Bryophyte cover was similar among all four sites in 1994. Bryophyte cover was two to three times higher in the Old Seeding between 1991 and 1994. In the New Seeding bryophyte cover increased from zero to nearly 19% and 13% in the grazed and ungrazed areas, respectively (Table 138, 150). Litter cover in the exclosures exceeded cover in the grazed areas by >100% and 50% in the New and Old Seedings, respectively in 1994 (Table 150). Litter cover was similar in the Old Seeding in 1994, compared to 1991 (Table 138, 150). In contrast, litter increased between two and three times on the New Seeding between 1992 and 1994 (Table 142, 150). Bare soil in the Old and New Seeding exclosures was <50% and <70%, respectively, of the grazed areas. Bare soil decreased at all sites between 1991 and 1994.

4.4.5 Skookumchuck Historical Exclosure - 1951-1991

Plant community information from 1951 were not available. McLean and Tisdale (1972), however, reported that data collected by the B.C. Ministry of Forests when the original exclosure was constructed, indicate that the site was dominated by Sandberg bluegrass and low pussytoes in association with prairie Junegrass and needle-and-thread. Bluebunch wheatgrass and rough fescue were not reported on the site.

In 1960, Sandberg's bluegrass, prairie Junegrass, bluebunch wheatgrass, and needle-and-thread were the predominant grasses in the grazed area. Grass cover was >50% (Table 151). In the exclosure in 1960, Sandberg's bluegrass, prairie Junegrass, and needle-and-thread were prominent in the plant community, but bluebunch wheatgrass had more than doubled in frequency and increased to nearly one-quarter of the plant cover. Rough fescue had increased in both cover and frequency when compared to the grazed transect.

Table 151. Cover and frequency of plant species at the Skookumchuck historical enclosure - grazed area, 1960-1991.

	1960		1970		1982		1991	
	(August 9)		(November 18)		(July 28)		(August 7)	
Species	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike								
Agropyron spicatum	6.8	26.0	13.0	62.0	14.0	54.0	7.6	44.0
Festuca idahoensis	0.0	0.0	0.0	0.0	0.0	0.0	0.5	20.0
Festuca scabrella	0.0	0.0	T	2.0	T	2.0	0.9	8.0
Koeleria cristata	16.6	90.0	20.0	94.0	5.0	66.0	0.9	24.0
Poa pratensis	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6
Poa sandbergii	26.2	98.0	10.0	94.0	0.0	0.0	0.4	0.6
Stipa comata	4.2	68.0	34.0	98.0	47.0	100.0	13.9	100.0
Total Grass and Grasslike	53.8		77.0		66.0		24.4	
Forbs								
Achillea millefolium	0.4	6.0	0.0	0.0	2.0	14.0	0.1	2.0
Allium cernumm	0.1	2.0	0.0	0.0	T	2.0	0.0	0.0
Anemone patens	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.0
Antennaria dimorpha	26.4	98.0	8.0	58.0	T	2.0	0.6	16.0
Antennaria microphylla	0.0	0.0	0.0	0.0	4.0	58.0	3.0	50.0
Antennaria parviflora	1.3	6.0	9.0	34.0	0.0	0.0	0.0	0.0
Arabis hoboellii	1.3	14.0	T	14.0	T	18.0	0.0	0.0
Astragalus miser	0.0	0.0	0.0	0.0	1.0	18.0	0.6	4.0
Calochortus macrocarpus	0.0	0.0	0.0	0.0	T	2.0	0.0	0.0
Chysopsis villosa	0.0	0.0	0.0	0.0	T	2.0	0.0	0.0
Erigeron pumilus	1.2	30.0	4.0	54.0	4.0	90.0	0.2	8.0
Eriogonum umbellatum	1.4	38.0	2.0	22.0	T	2.0	0.1	2.0
Gaillardia aristata	0.0	0.0	0.0	0.0	1.0	16.0	0.0	0.0
Geum trifolium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lomatium macrocarpum	0.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocarpus luteus	0.0	0.0	0.0	0.0	0.0	0.0	1.2	48.0
Orthocarpus tenuifolium	0.0	0.0	0.0	0.0	T	2.0	0.0	0.0
Phlox rigida	1.1	14.0	3.0	22.0	2.0	40.0	3.1	46.0
Potentilla spp.	0.0	0.0	0.0	0.0	0.0	0.0	1.3	22.0
Senecio canus	0.0	0.0	0.0	0.0	2.0	34.0	1.9	44.0

Table 151. (continued)

Species	1960 (August 9)		1970 (November 18)		1982 (July 28)		1991 (August 7)	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
<i>Solidago canadensis</i>	1.2	20.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Taraxacum officianale</i>	0.0	0.0	1.0	20.0	T	4.0	0.0	0.0
<i>Tragopogon pratense</i>	0.0	0.0	T	2.0	T	4.0	0.0	0.0
<i>Zygadenus venosus</i>	0.0	0.0	0.0	0.0	T	2.0	0.2	8.0
Total Forbs	34.7		27.0		16.0		12.4	
Trees and Shrubs								
<i>Pinus ponderosa</i>	0.0	0.0	0.0	0.0	T	2.0	0.1	2.0
Others								
Bryophytes	0.0	0.0	0.0	0.0	0.0	0.0	18.9	100.0
Litter	0.0	0.0	0.0	0.0	0.0	0.0	24.3	100.0
Rock	0.0	0.0	0.0	0.0	0.0	0.0	2.3	72.0
Soil	0.0	0.0	0.0	0.0	0.0	0.0	32.9	100.0
Feces	0.0	0.0	0.0	0.0	0.0	0.0	1.6	26.0

Forbs provided more than triple the cover in the grazed area than in the enclosure (Table 151, 152). Low pussytoes was the dominant forb species on both sites. Nuttall's pussytoes, Holboell's rockcress, shaggy fleabane, sulphur buckwheat, spiny phlox, and goldenrod each contributed more than 1% cover on the grazed area. No tree or shrub cover was recorded in 1960. By 1970, grass cover had increased to >75% in the grazed area. The principal grasses that increased included needle-and-thread, bluebunch wheatgrass and prairie Junegrass (Table 151), primarily at the expense of Sandberg bluegrass. In the enclosure, the percentage grass cover was similar to the grazed area, but the relative cover among species differed from the grazed area. Both bluebunch wheatgrass and rough fescue more than doubled in cover between 1960 and 1970 (Table 152). In contrast, prairie Junegrass, Sandberg's bluegrass, and needle-and-thread all declined from a collective cover of nearly 60% in 1960 to 15% in 1970 (Table 152).

Forb cover decreased slightly in the grazed area, and increased slightly in the ungrazed area in 1970, when compared to 1960. The same species predominated except, spiny phlox had increased to 11% in 1970, from 0% in 1960 (Table 152). Tree and shrub cover was unchanged except bearberry was encountered as a trace species in the enclosure.

Grass cover was lower in the grazed area in 1982 than in 1970. Prairie Junegrass and Sandberg bluegrass were the two species that declined most in cover. Prairie Junegrass also decreased in frequency (Table 151). In contrast, needle-and-thread maintained the same frequency and increased in cover between 1970 and 1982 (Table 151).

In the enclosure, grass cover also declined from 90% in 1970 to just over 75% in 1982 (Table 152). Bluebunch wheatgrass cover decreased to less than 13% in 1982 from 55% in 1970, and frequency was reduced from nearly 100% to <70% (Table 152). Conversely, rough fescue increased in cover nearly three times and more than doubled in frequency (Table 152). Forb cover of the grazed area in 1982 was less than in 1970 or 1960, while forb cover in the enclosure was higher (Table 151, 152). Ponderosa pine occurred as a trace species on the grazed area (Table 151).

In 1991, at the Skookumchuck historical enclosure, grass and forb cover declined in both the grazed area and the enclosure, when compared to cover in 1982 (Table 151, 152). Needle-and-thread, bluebunch wheatgrass, and prairie Junegrass all declined in 1991 compared to 1982 which resulted in a decline in total grass cover in the grazed area. Frequency and cover of bluebunch wheatgrass and prairie junegrass also declined in the enclosure (Table 152). Both rough fescue and bluebunch wheatgrass contributed less to cover in the enclosure than on the grazed area. Between 1982 and 1991 however, Idaho fescue increased from 1% to nearly 8% while its frequency quadrupled (Table 152).

Forb cover was lower in 1991 than in 1960, 1970, and 1982 in both the grazed area and the enclosure. The same species dominated the site as in earlier sampling periods (Table 151, 152). Pussytoes, owl clover, spiny phlox, cinquefoil species, and prairie groundsel contributed more than 1% cover in the grazed area. Pussytoes, spiny phlox, and prairie groundsel were dominant forbs in the enclosure.

Tree and shrub cover in the grazed area was unchanged from 1982 to 1991. In contrast, ponderosa pine cover in the enclosure changed from 0% in 1982 to 2.5% in 1991. Ponderosa pine occurred in 14% of the plots in 1991, compared to 0% in 1982.

Table 152. Cover and frequency of plant species at the Skookumchuck historical enclosure - ungrazed area, 1960-1991.

Species	1960 (August 9)		1970 (November 18)		1982 (July 28)		1991 (August 7)	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike								
Agropyron spicatum	24.7	72.0	55.0	96.0	12.7	68.0	5.4	52.0
Festuca idahoensis	0.0	0.0	0.0	0.0	1.0	18.0	7.9	80.0
Festuca scabrella	6.0	36.0	20.0	48.0	58.8	98.0	23.8	94.0
Koeleria cristata	23.4	94.0	9.0	72.0	4.2	58.0	1.0	20.0
Poa sandbergii	17.5	100.0	5.0	50.0	0.1	4.0	0.3	12.0
Stipa comata	16.7	74.0	1.0	4.0	0.0	0.0	0.0	0.0
Total Grass and Grasslike	88.3		90.0		76.8		38.4	
Forbs								
Achillea millefolium	0.1	2.0	0.0	0.0	2.9	46.0	0.6	22.0
Allium cernuum	0.6	4.0	0.0	0.0	T	2.0	0.0	0.0
Androsace septentrionalis	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.0
Anemone patens	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.0
Antennaria dimorpha	10.5	94.0	T	2.0	T	2.0	0.0	0.0
Antennaria parviflora	0.0	0.0	6.0	30.0	7.6	54.0	2.6	34.0
Arabis hoboellii	0.3	14.0	0.0	0.0	0.2	8.0	0.0	0.0
Astragalus miser	0.0	0.0	0.0	0.0	1.9	26.0	0.2	8.0
Calochortus macrocarpus	0.0	0.0	0.0	0.0	T	2.0	0.1	2.0
Crepis atrabarba	0.0	0.0	0.0	0.0	T	8.0	0.0	0.0
Erigeron compositus	0.0	0.0	0.0	0.0	T	2.0	0.0	0.0
Erigeron pumilus	0.7	8.0	0.0	0.0	0.2	6.0	0.0	0.0
Eriogonum flavum	0.8	12.0	1.0	6.0	0.0	0.0	0.0	0.0
Eriogonum heracleoides	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.0
Geum triflorum	0.0	0.0	0.0	0.0	T	2.0	0.0	0.0
Lomatium macrocarpum	0.3	4.0	T	2.0	0.4	4.0	0.0	0.0
Lomatium triternatum	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.0
Orthocarpus luteus	0.0	0.0	0.0	0.0	0.0	0.0	0.5	10.0
Orthocarpus tenuifolium	0.0	0.0	0.0	0.0	0.1	4.0	0.0	0.0
Phlox rigida	0.0	0.0	11.0	60.0	10.5	62.0	4.8	54.0
Senecio canus	0.0	0.0	0.0	0.0	3.4	40.0	1.1	34.0

Table 152. (continued)

Species	1960 (August 9)		1970 (November 18)		1982 (July 28)		1991 (August 7)	
	% Cover	Freq	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)								
Taraxacum officinale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tragopogon pratense	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zygadenus venosus	0.0	0.0	0.0	0.0	0.0	0.0	0.1	4.0
Total Forbs	13.3		18.0		27.2		10.4	
Trees and Shrubs								
Arctostaphylos uva-ursi	0.0	0.0	T	2.0	0.0	0.0	0.0	0.0
Pinus ponderosa	0.0	0.0	0.0	0.0	0.0	0.0	2.5	14.0
Total Trees and Shrubs	0.0		T		0.0		2.5	
Others								
Bryophytes	0.0	0.0	0.0	0.0	0.0	0.0	37.7	100.0
Litter	0.0	0.0	0.0	0.0	0.0	0.0	53.5	100.0
Rock	0.0	0.0	0.0	0.0	0.0	0.0	0.5	10.0
Soil	0.0	0.0	0.0	0.0	0.0	0.0	0.8	22.0

4.4.6 Skookumchuck Historical Exclosure - 1992 - 1994

Skookumchuck Historical Exclosure - 1992

In 1992, the old exclosure was dominated by Idaho fescue and rough fescue (Table 153). Other grass species, such as bluebunch wheatgrass, needle-and-thread, and Sandberg bluegrass are less dominant species in the flora. In the grazed area, needle-and-thread dominates contributing over 50% of the grass cover. Bluebunch wheatgrass and prairie Junegrass comprise most of the other 50% of the grass cover. In contrast, the grass cover in the new exclosure, which had been protected from grazing for one year before this sampling, was actually higher than in the old exclosure. Equal amounts of bluebunch wheatgrass and needle-and-thread dominate the grass cover.

The grazed area has the highest forb content of the three sites. Prostrate forbs such as rosy pussytoes, shaggy fleabane, spiny phlox, sulphur cinquefoil, prairie groundsel, and dandelion dominate the site. The same species exist in the new and old exclosures, but the overall forb cover is lower than for the grazed area (Table 153).

No shrubs were recorded on any of the sites although ponderosa pine occurred sparsely in the old exclosure (4.4% cover), and on the grazed area (<1%) (Table 153).

Skookumchuck Historical Exclosure - 1993

Grass cover varied among sites in 1993. Grass cover was higher in the old exclosure and lower in the new exclosure, when compared to 1992 (Table 154). Conversely, cover was approximately equal at the grazed area between 1992 and 1993. Idaho and rough fescue cover increased over 1992 in the old exclosure while bluebunch wheatgrass decreased (Table 153, 154). Bluebunch wheatgrass cover decreased in the grazed area and the new exclosure also. Needle-and-thread cover was approximately equal in the new exclosure and the grazed area.

Forb cover was also higher at all sites in 1993 compared to 1992, and cover on the grazed area remained highest among the three sites (Table 154). The same prostrate forb species were still dominant; rosy pussytoes, shaggy fleabane, spiny phlox, sulphur cinquefoil, prairie groundsel, and dandelion.

As in 1992, the only shrubs or trees encountered in the sampling on this site in 1993 was ponderosa pine in the old exclosure. In 1993 this tree species increased both in cover and frequency over 1992 (Table 153, 154).

Skookumchuck Historical Exclosure - 1994

Grass cover increased at all three sites in 1994 compared to 1991, 1992, and 1993 (Table 151, 152, 153, 154, 155). Cover in the grazed area, while higher than in 1992 (>30%) and 1993 (45%), was less than in either of the exclosures. Cover of all species increased in 1994, including prairie Junegrass at all sites. Indeed, needle-and-thread increased in both the new exclosure and on the grazed area, while Idaho and rough fescue both increased cover in the old exclosure (Table 155). Forb cover was approximately equal on the three sites in 1994 (Table 155). In contrast to the previous years, the plant communities in the grazed area and the old exclosure had similar forb cover. Western yarrow, low pussytoes, spiny phlox, and prairie groundsel were all higher in the old exclosure in 1994.

While trees and shrubs are still a minor component of the plant community on this site, Ponderosa pine cover (nearly 13%) and frequency (20%) increased in 1994 over both 1992 and 1993. In fact, cover more than doubled in 1994 compared to 1993 (Table 153, 154, 155).

Table 153. Cover and frequency of plant species at the Skookumchuck historical enclosure in 1992.

Species Name	Old Exclosure		Grazed Area		New Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike						
Agropyron spicatum	3.8	36.0	8.6	48.0	20.6	82.0
Festuca idahoensis	11.5	76.0	0.1	4.0	0.2	6.0
Festuca scabrella	22.6	96.0	0.2	6.0	1.0	12.0
Koeleria cristata	0.7	18.0	4.9	76.0	6.4	78.0
Poa compressa	0.0	0.0	0.0	0.0	0.3	2.0
Poa sandbergii	0.2	6.0	0.2	6.0	0.1	2.0
Stipa comata	0.2	8.0	14.8	100.0	19.4	94.0
Total Grass and Grasslike	39.0		28.8		48.0	
Forbs						
Achillea millefolium	1.6	36.0	0.6	14.0	0.3	12.0
Allium cernuum	0.1	2.0	0.1	4.0	0.1	4.0
Anemone patens	0.3	4.0	0.0	0.0	0.0	0.0
Antennaria microphylla	3.4	38.0	4.0	70.0	1.5	32.0
Arabis holboellii	0.0	0.0	0.2	6.0	0.1	4.0
Astragalus miser	2.8	32.0	0.4	8.0	1.0	12.0
Calochortus macrocarpum	0.0	0.0	0.1	2.0	0.0	0.0
Crepis atrabarba	0.6	14.0	0.0	0.0	0.0	0.0
Echium vulgare	0.0	0.0	0.1	2.0	0.0	0.0
Erigeron pumilis	0.0	0.0	2.3	50.0	1.1	36.0
Eriogonum umbellatum	0.3	4.0	0.1	4.0	1.5	32.0
Gaillardia aristata	0.0	0.0	0.2	6.0	0.0	0.0
Lewisia rediviva	0.0	0.0	0.0	0.0	0.1	2.0
Lomatium macrocarpum	0.0	0.0	0.0	0.0	0.1	4.0
Orthocarpus luteus	0.4	16.0	0.9	36.0	0.3	14.0
Phlox rigida	4.9	48.0	2.5	38.0	1.1	14.0
Potentilla spp.	0.0	0.0	3.0	30.0	0.1	2.0
Senecio canus	1.1	46.0	3.8	70.0	2.4	46.0
Taraxacum officinale	0.1	4.0	3.3	72.0	2.7	66.0
Tragopogon pratense	0.3	2.0	0.3	10.0	0.8	10.0
Zygadenus venenosus	0.1	4.0	0.0	0.0	0.0	0.0

Table 153. (continued)

Species Name	Old Exclosure		Grazed Area		New Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)						
Total Forbs	16.0		21.9		13.2	
Trees and Shrubs						
Pinus ponderosa	4.4	14.0	0.8	2.0	0.0	0.0
Others						
Bryophytes	35.3	100.0	25.1	100.0	36.0	100.0
Cattle feces	0.0	0.0	1.1	8.0	0.0	0.0
Deer feces	0.0	0.0	0.1	2.0	0.0	0.0
Elk feces	0.0	0.0	0.4	8.0	0.0	0.0
Litter	48.1	100.0	15.5	98.0	27.4	100.0
Rock	1.5	12.0	2.2	66.0	2.5	40.0
Soil	5.5	80.0	30.2	98.0	23.7	96.0

Table 154 . Cover and frequency of plant species at the Skookumchuck historical enclosure in 1993.

Species Name	Old Exclosure		Grazed Area		New Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike						
Agropyron spicatum	2.4	36.0	5.7	42.0	13.7	78.0
Festuca idahoensis	11.3	74.0	0.0	0.0	0.0	0.0
Festuca scabrella	30.5	94.0	0.1	2.0	1.7	10.0
Koeleria cristata	1.7	28.0	5.9	86.0	4.7	76.0
Poa compressa	0.0	0.0	0.0	0.0	0.3	2.0
Poa pratensis	0.0	0.0	0.1	4.0	0.0	0.0
Poa sandbergii	0.2	6.0	0.0	0.0	0.0	0.0
Stipa comata	0.0	0.0	16.9	100.0	16.8	90.0
Total Grass and Grasslike	46.1		28.7		37.2	
Forbs						
Achillea millefolium	1.8	32.0	1.1	14.0	0.4	8.0
Allium cernuum	0.1	2.0	0.0	0.0	0.0	0.0
Anemone patens	0.3	4.0	0.0	0.0	0.0	0.0
Antennaria microphylla	5.3	54.0	4.7	58.0	3.0	32.0
Arabis holboellii	0.0	0.0	0.6	22.0	0.4	16.0
Astragalus miser	4.2	32.0	1.5	14.0	1.0	10.0
Calochortus apiculatus	0.0	0.0	0.0	0.0	0.1	2.0
Calochortus macrocarpum	0.3	12.0	0.2	8.0	0.1	4.0
Crepis atrabarba	1.1	14.0	0.0	0.0	0.0	0.0
Dodecatheon pauciflorum	0.1	2.0	0.0	0.0	0.0	0.0
Erigeron pumilis	0.0	0.0	5.2	56.0	2.8	42.0
Eriogonum umbellatum	0.3	2.0	0.3	4.0	1.5	38.0
Gaillardia aristata	0.0	0.0	0.8	22.0	0.0	0.0
Lewisia rediviva	0.0	0.0	0.1	2.0	0.8	10.0
Lomatium macrocarpum	0.0	0.0	0.0	0.0	0.6	6.0
Lomatium triternatum	0.3	2.0	0.1	2.0	0.6	12.0
Orthocarpus luteus	0.0	0.0	0.1	4.0	0.0	0.0
Orthocarpus tenuifolius	0.1	4.0	1.4	56.0	1.0	40.0
Phlox rigida	5.3	54.0	2.8	44.0	1.6	16.0
Potentilla spp.	0.0	0.0	2.7	26.0	0.0	0.0

Table 154. (continued)

Species Name	Old Exclosure		Grazed Area		New Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)						
Potentilla recta	0.0	0.0	0.0	0.0	1.0	4.0
Senecio canus	1.2	38.0	4.9	68.0	2.6	34.0
Taraxacum officinale	0.1	4.0	2.0	48.0	4.1	64.0
Tragopogon pratense	0.3	2.0	0.5	10.0	1.7	18.0
Zygadenus venenosus	1.8	40.0	1.1	26.0	0.6	16.0
Total Forbs	22.6		30.1		23.9	
Trees and Shrubs						
Pinus ponderosa	6.2	20.0	0.8	2.0	0.0	0.0
Others						
Bryophytes	44.1	98.0	24.4	98.0	43.7	100.0
Cattle feces	0.0	0.0	0.6	6.0	0.0	0.0
Deer feces	0.0	0.0	0.1	2.0	0.0	0.0
Elk feces	0.0	0.0	0.5	10.0	0.0	0.0
Litter	37.9	98.0	15.9	100.0	31.0	100.0
Rock	0.8	12.0	2.5	80.0	1.5	30.0
Soil	2.9	56.0	36.1	100.0	9.4	86.0

Table 155. Cover and frequency of plant species at Skookumchuck historical exclosure in 1994.

Species Name	Old Exclosure		Grazed Area		New Exclosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Grass and Grasslike						
Agropyron spicatum	8.1	42.0	6.4	36.0	23.0	84.0
Festuca idahoensis	25.0	84.0	0.1	2.0	0.3	2.0
Festuca scabrella	32.3	80.0	1.0	4.0	3.8	10.0
Koeleria cristata	4.7	32.0	14.0	92.0	14.5	82.0
Poa compressa	0.0	0.0	0.0	0.0	0.3	2.0
Poa pratensis	0.0	0.0	0.9	6.0	0.0	0.0
Poa sandbergii	0.1	4.0	0.1	2.0	0.0	0.0
Stipa comata	0.0	0.0	25.8	96.0	28.1	90.0
Total Grass and Grasslike	70.2		48.3		70.0	
Forbs						
Achillea millefolium	4.3	34.0	2.2	18.0	1.7	10.0
Allium cernuum	0.3	12.0	0.1	2.0	0.3	2.0
Antennaria dimorpha	0.6	6.0	0.8	4.0	0.0	0.0
Antennaria microphylla	8.3	48.0	4.6	54.0	3.7	28.0
Anemone patens	0.6	6.0	0.0	0.0	0.0	0.0
Arabis holboellii	0.1	2.0	0.3	12.0	0.8	12.0
Astragalus miser	2.2	18.0	1.6	16.0	1.1	6.0
Calochortus macrocarpum	0.6	22.0	0.1	2.0	0.0	0.0
Chrysopsis villosa	0.0	0.0	0.1	2.0	0.0	0.0
Crepis atrabarba	0.9	8.0	0.0	0.0	0.0	0.0
Dodecatheon pauciflorum	0.0	0.0	0.1	2.0	0.0	0.0
Erigeron pumilis	0.0	0.0	1.9	24.0	4.1	44.0
Eriogonum umbellatum	0.3	2.0	0.3	2.0	1.8	20.0
Gaillardia aristata	0.1	4.0	1.4	16.0	0.0	0.0
Lewisia rediviva	0.0	0.0	0.0	0.0	0.3	4.0
Lomatium macrocarpum	0.0	0.0	0.0	0.0	0.9	6.0
Lomatium triternatum	0.1	4.0	0.0	0.0	0.2	8.0
Medicago lupulina	0.0	0.0	0.0	0.0	0.3	2.0
Orthocarpus luteus	0.0	0.0	0.1	2.0	0.0	0.0
Phlox rigida	7.6	48.0	6.7	50.0	2.0	20.0

Table 155. (continued)

Species Name	Old Exlosure		Grazed Area		New Exlosure	
	% Cover	Freq	% Cover	Freq	% Cover	Freq
Forbs (continued)						
Potentilla sulphurea	0.0	0.0	2.0	30.0	0.3	4.0
Senecio canus	2.5	40.0	6.9	60.0	5.1	56.0
Taraxacum officinale	0.7	28.0	0.3	12.0	1.2	28.0
Tragopogon pratense	0.6	4.0	0.6	6.0	3.2	30.0
Viola adunca	0.1	2.0	0.0	0.0	0.0	0.0
Zygadenus venenosus	2.0	38.0	0.2	8.0	0.2	8.0
Total Forbs	31.9		30.3		27.2	
Trees and Shrubs						
Pinus ponderosa	12.9	32.0	0.9	6.0	0.0	0.0
Others						
Bryophytes	30.4	98.0	26.2	100.0	34.0	100.0
Elk feces	0.0	0.0	1.4	6.0	0.0	0.0
Litter	58.3	100.0	22.0	100.0	49.1	100.0
Rock	0.9	18.0	2.5	58.0	2.3	32.0
Soil	1.9	36.0	17.8	100.0	8.6	80.0

4.5 Range Condition Assessment

In a problem analysis on range condition and trend in B.C., Pitt (1984) concluded that range condition and trend has been defined traditionally with succession or forage production criteria, thereby producing inconsistent application and interpretation of range condition terminology and techniques. Depending on professional background and management objectives, resource personnel in B.C. often imply other meanings to range condition. These meanings may include, "forage production, proper forage utilization, seral stage, forage quality, plant vigour, stocking rates, animal productivity, soil erosion, presence of noxious weeds, or winter carrying capacity for wildlife".

Sampson (1919) stated that the most rational and reliable way to detect overgrazing is to recognize the replacement of one type of plant cover by another. Dyksterhuis (1949), concluded "Attempts to base a quantitative system on production showed: 1) there was often as much fluctuation in production on one site from year to year as there was difference between sites in the same year, 2) relative coverage fluctuated less from year to year than forage production, 3) climaxes which are different floristically may produce essentially the same amount of forage per unit of surface area".

Dyksterhuis (1949) combined the principles of earlier workers into a practical system for classifying the condition of rangeland based on quantitative ecology. In this model all possible states of the vegetation can be arrayed on a single continuum, from heavily-grazed, early succession, poor condition to ungrazed, climax, excellent condition (Westoby et al. 1989). Range condition is the technical term for the vegetation's position on this continuum. This succession approach is widely used operationally. However, Dyksterhuis (1949) noted that the system should not be dependent on current vegetation so that both current and potential range conditions could be recognized, and that different principles apply when determining condition of rangeland and lands with forest climax.

Heady (1973) presented the concept of multiple steady states resulting from human activities such as grazing, introduction of new herbivores and plants, fertilization etc. and stated "Permanent alterations in rangeland ecosystems should be recognized as such when their removal becomes impossible in practical terms (Heady 1973, as cited in Laycock 1994)". Hall (1978) concluded "traditional range management concepts do not apply well to forested ecosystems because livestock are not the only factors affecting density and composition of vegetation". Clearly, in the East Kootenay where we have multiple grazers, and the majority of grazing is on forest lands, "range condition" should be defined in relation to management objectives for a particular site.

Westoby et al. (1989) proposed the state and transition model. They concluded that in many situations rangeland dynamics can be described by a set of discrete "states" of the vegetation on one piece of ground and a set of discrete "transitions" between states. Laycock (1991), advanced the concept of multiple stable states and thresholds between these states.

The Society for Range Management Task Group on Unity in Concept and Terminology (1995) recommended: 1) evaluations of rangelands should be made from the basis of the same land unit classification, the ecological site, 2) plant communities likely to occur on that site should be evaluated for protection of that site against accelerated erosion (Soil Conservation Rating (SCR)), and 3) selection of a desired plant community (DPC) should be made considering both SCR and management objectives for the site. This approach also recognizes that vegetation changes may occur as a result of many factors other than grazing, such as fire, lack of fire, extreme weather events, climatic change, invasion of exotic species. When shrubs

or trees replace grasses due to heavy grazing (or other "disturbances"), the changes may not be spontaneously reversible. Multiple steady states are possible instead of a single climax condition (SRM Task Group 1995).

This report does not focus on classification systems but rather with species change at the sites studied. Fluctuations in production or cover with weather conditions are to be expected and accounted for in range management. However, significant changes in species composition, are likely linked to past and current wildlife and cattle management practices. Grazed and ungrazed areas, and the composition of the plant communities in the different years, are compared to determine if trends can be identified following four years of monitoring.

4.5.1 Skookumchuck Prairie

At Skookumchuck Prairie in 1991, the plant communities in the Combined Use, Cattle Only, and Wildlife Only Areas and in the Ungulate Exclosure were statistically similar ($p < 0.05$), except for the comparison between the Ungulate Exclosure and the Wildlife Only Area ($p > 0.20$) (Table 156). The Wildlife Only Area had higher bluebunch wheatgrass and Idaho fescue cover, than in the Ungulate Exclosure (Table 135). In the Ungulate Exclosure, Canada and Kentucky bluegrass, hairy gold aster, bitterbrush, and Saskatoon had the highest cover. These two sites, however, were similar to both the Combined Use and Cattle Only Areas as bluebunch wheatgrass, Idaho fescue, Canada bluegrass, timber milkvetch, Saskatoon and bitterbrush ranked highest in the plant communities on each site (Table 135, 156).

In 1994, after four years during which each site had been subjected to a different grazing regime, all sites were statistically similar ($p < 0.05$) when compared (Table 157). The plant communities in the Ungulate Exclosure and the Wildlife Only Area were statistically similar in 1994 because rough fescue, prairie Junegrass, and common yarrow had higher cover in the Ungulate Exclosure in 1994 than in 1991 (Table 135, 147).

Significant changes in the ranking of the vegetation were not detected statistically at any site between 1991 and 1994 (Table 158). The trend for the plant community in the Ungulate Exclosure is toward the plant communities at the other Skookumchuck Prairie sites. Cheatgrass decreased, and rough fescue, Idaho fescue, and prairie Junegrass have all increased in the exclosure with four years exclusion from grazing (Table 135, 147).

4.5.2 Premier Ridge

Spearman's rank correlation compared the grazed and ungrazed sites at Premier Ridge between 1991 and 1994. The comparisons between the plant communities on these sites in 1991 and 1994, indicate the ranking of the plant species in the grazed and ungrazed areas are still similar ($p < 0.05$) after four years (Table 159).

Two comparisons, however, were not positively correlated ($p > 0.20$). The 1994 ungrazed site was not positively correlated with either the 1991 grazed or 1991 ungrazed sites. In the ungrazed 1994 site the only evident change in herbaceous species was an increase in canopy cover of the dominant species, Kentucky bluegrass and western needlegrass. Bitterbrush, as the dominant shrub, also increased somewhat. However, canopy cover of Saskatoon more than doubled, while rose, soopolallie, and snowberry cover also increased (Table 136, 148). The trend in the ungrazed area appears to be increased cover of shrubs and grass species already dominant on the site.

Table 156. Spearman's rank correlation statistic for Skookumchuck Prairie in 1991.

	Combined Use	Cattle Only	Wildlife Only	Ungulate Exclosure
Combined Use	1.000			
Cattle Only	0.792 ^a	1.000		
Wildlife Only	0.630 ^a	0.702 ^a	1.000	
Ungulate Exclosure	0.604 ^a	0.502 ^a	0.273 ^c	1.000

Table 157. Spearman's rank correlation statistic for Skookumchuck Prairie in 1994.

	Combined Use	Cattle Only	Wildlife Only	Ungulate Exclosure
Combined Use	1.000			
Cattle Only	0.732 ^a	1.000		
Wildlife Only	0.615 ^a	0.695 ^a	1.000	
Ungulate Exclosure	0.612 ^a	0.558 ^a	0.472 ^a	1.000

Table 158. Spearman's rank correlation statistic for Skookumchuck Prairie in 1991 and 1994.

	Combined Use 1991	Cattle Only 1991	Wildlife Only 1991	Ungulate Exclosure 1991
Combined Use 1994	0.652 ^a			
Cattle Only 1994		0.663 ^a		
Wildlife Only 1994			0.558 ^a	
Ungulate Exclosure 1994				0.546 ^a

^a p<0.05

^b p<0.10

^c p<0.20

Table 159. Spearman's rank correlation statistic for Premier Ridge in 1991 and 1994.

	Grazed 1991	Ungrazed 1991	Grazed 1994	Ungrazed 1994
Grazed 1991	1.000			
Ungrazed 1991	0.566 ^a	1.000		
Grazed 1994	0.259 ^b	0.284 ^b	1.000	
Ungrazed 1994	0.145	0.200	0.620 ^a	1.000

^a p<0.05

^b p<0.10

4.5.3 Pickering Hills

At Pickering Hills in 1991, the grazed area and the new exclosure had similar ($p < 0.05$) communities. The historical exclosure, however, did not exhibit significant ($p > 0.20$) relationships with either the new exclosure or the grazed area (Table 160). Bitterbrush, spreading dogbane, Kentucky bluegrass, Saskatoon, pinegrass, and low Oregon grape were the dominant species in the historical exclosure (Table 137). In the grazed area, Kentucky bluegrass, bitterbrush, western needlegrass, Saskatoon, spreading dogbane, and Columbia needlegrass were dominant (Table 137). The same species exhibited the highest cover in the new exclosure, except for spreading dogbane, and with the addition of chickweed.

Conversely, in 1994, all comparisons among the grazed area, the new exclosure, and the historical exclosure were statistically similar (Table 161). The vegetation in the grazed area was ranked similar to the vegetation in both exclosures. Kentucky bluegrass, bitterbrush, western needlegrass, and Saskatoon were the most prevalent species in the grazed area and the new exclosure. Bearberry and low Oregon grape were more common in the historical exclosure in 1994 than in the grazed area, and western needlegrass was more common in the grazed area (Table 150).

When the plant communities on each site from 1991 are compared with those on the same site in 1994, all comparisons were positively correlated (Table 162). The highest correlation coefficient, indicating the least change in the plant community, was noted in the historical exclosure. Conversely, the lowest correlation coefficient was calculated for the new exclosure. Some changes, such as the cover increases of knapweed and buckbrush, were evident between 1991 and 1994 in the new exclosure. The species composition in the new exclosure in 1994, however, was still dominated by Kentucky bluegrass, western needlegrass, bitterbrush, and Saskatoon resulting in similar rankings of the vegetation by the correlation procedure (Table 150, 162).

4.5.4 Peckhams Lake

The plant communities in both the Old and New Seedings were compared in the 1991 and 1992, respectively, the baseline sampling years. At the Old Seeding, the grazed and ungrazed sites were positively correlated ($p < 0.05$) in 1991, as were the grazed and ungrazed sites in the New Seeding in 1992 (Table 163, 164). Positive correlations were also detected between the ungrazed Old Seeding site and both the grazed ($p < 0.10$) and ungrazed ($p < 0.10$) New Seeding sites (Table 163). The ungrazed Old Seeding site was not significantly ($p > 0.20$) correlated with either New Seeding site. The principal differences were in the much larger cover of orchardgrass at both sites in the New Seeding, and more cover of slender wheatgrass and Nuttall's pussytoes in the grazed Old Seeding site (Table 138, 142).

In 1994, the ranking of the plant species were the same and communities in the grazed and ungrazed areas of the two seedings were still statistically similar (Table 164). Additionally, in 1994, the ranking of species in the grazed area of the New Seeding was similar ($p < 0.10$) to the grazed portion of the Old Seeding (Table 164). While domestic species are still prevalent in the New Seeding, the New and Old Seedings are becoming more alike as native grasses and forbs re-enter the plant community in the New Seeding. Species such as pinegrass, Idaho fescue, Richardson's needlegrass, small-flowered penstemon, common yarrow, Nuttall's pussytoes, early-blue violet, and wild strawberry have increased in cover and frequency in the New Seeding between 1992 and 1994 (Table 142, 150).

Table 160. Spearman's rank correlation statistic for Pickering Hills in 1991.

	Grazed 1991	Ungrazed 1991	Historical Ungrazed 1991
Grazed 1991	1.000		
Ungrazed 1991	0.471 ^a	1.000	
Historical Ungrazed 1991	0.166	0.173	1.000

Table 161. Spearman's rank correlation statistic for Pickering Hills in 1994.

	Grazed 1994	Ungrazed 1994	Historical Ungrazed 1994
Grazed 1994	1.000		
Ungrazed 1994	0.598 ^a	1.000	
Historical Ungrazed 1994	0.495 ^a	0.557 ^a	1.000

Table 162. Spearman's rank correlation statistic for Pickering Hills in 1991 and 1994.

	Grazed 1991	Ungrazed 1991	Historical Ungrazed 1991
Grazed 1994	0.424 ^a		
Ungrazed 1994		0.319 ^a	
Historical Ungrazed 1994			0.721 ^a

^a p<0.05

^b p<0.10

Table 163. Spearman's rank correlation statistic for Peckhams Lake in 1991/92.

	Old Seeding Grazed - 1991	Old Seeding Ungrazed - 1991	New Seeding Grazed - 1992	New Seeding Ungrazed - 1992
Old Seeding Grazed - 1991	1.000			
Old Seeding Ungrazed - 1991	0.593 ^a	1.000		
New Seeding Grazed - 1992	0.010	0.287 ^b	1.000	
New Seeding Ungrazed - 1992	0.138	0.264 ^b	0.352 ^a	1.000

Table 164. Spearman's rank correlation statistic for Peckhams Lake in 1994.

	Old Seeding Grazed - 1994	Old Seeding Ungrazed - 1994	New Seeding Grazed - 1994	New Seeding Ungrazed - 1994
Old Seeding Grazed - 1994	1.000			
Old Seeding Ungrazed - 1994	0.439 ^a	1.000		
New Seeding Grazed - 1994	0.288 ^b	0.402 ^a	1.000	
New Seeding Ungrazed - 1994	0.174	0.452 ^a	0.532 ^a	1.000

^a p<0.05^b p<0.10

Correlations between all sites at Peckhams Lake from 1991 to 1994 are presented in Table 165. All comparisons between the first measurements in 1991 or 1992 and the last measurements in 1994, indicate the plant communities were similar (Table 165). It does not appear as though grazing by cattle and wildlife has significantly changed the species composition of the plant communities in the New or Old Seedings, during this study (Table 138, 142, 150).

4.5.5 Skookumchuck Historical Exclosure

Monitoring the plant communities at the three-way exclosure at Skookumchuck Prairie between 1991 and 1994 has not demonstrated species change in the plant community. Enclosing vegetation, which was previously subjected to grazing, will result in increases in cover and plant vigour. But to see significant change in species composition will require a longer time-frame. The Skookumchuck Historical Exclosure provides the best indication of this time-frame. Forty-five years have elapsed since this exclosure was erected in 1951. In the grazed area, the plant community in 1960 was similar to the plant community in 1994. Moreover, all comparisons between different periods were positively correlated (Table 166). This indicates that very little has changed in terms of species composition in the 45 years since these transects were established (Table 151). Indeed, in 1994 as in 1960, prairie Junegrass and needle-and-thread were still the dominant grasses and prostrate forbs such as low pussytoes, shaggy fleabane, and spiny phlox are still prevalent (Table 151, 155). The composition of the plant community has fluctuated somewhat, however as several of the correlations are significant to $p < 0.10$ and $p < 0.20$ (Table 151, 166).

In contrast, in the exclosure significant change occurred in almost every interval. The 1960 plant community was not positively correlated with any of the later sampling periods (Table 167). McLean and Tisdale (1972) described the plant community as having advanced from poor to fair condition in less than 10 years (1951 to 1960) and to excellent condition within 20 years (1951 to 1970). This resulted from increases in bluebunch wheatgrass and rough fescue and decreases in Sandberg bluegrass, needle-and-thread, and low pussytoes. They also reported improvements in the grazed area. The area had received heavy spring and fall grazing for many years. In 1950 the grazing management was adjusted to reduce the stocking rate and delay spring turn-out (McLean and Tisdale 1972).

The first incidence of similarity between plant communities in the historical exclosure at Skookumchuck Prairie was between 1970 and 1982. By 1982, rough fescue and bluebunch wheatgrass were dominant and co-dominant grass species, respectively (Table 152). However, the plant community in 1970 was not similar to the plant community in either 1991 or 1994 (Table 167). This indicates further species change occurred between 1970 and 1991. Between 1982 and 1991, Idaho fescue cover increased from 1% to nearly 8% cover and bluebunch wheatgrass cover declined further from nearly 13% to slightly $>5\%$ (Table 152). Although the site is still considered to be in excellent range condition, bluebunch wheatgrass has been largely replaced by rough and Idaho fescue (Table 152). The trend appears to be toward further change. Between 1982 and 1994, Idaho fescue cover has increased from 1% and occurrence in 18% of the plots, to 25% cover and a frequency of $>80\%$ (Table 152, 155). In contrast, rough fescue cover has decreased from nearly 60% in 1982 (frequency=98%), to $>30\%$ cover and frequency of 80% (Table 152, 155). Although plant community composition in 1982 was similar ($p < 0.05$) to both the 1991 and 1994 communities (Table 167), ponderosa pine has invaded the

site in that period, increasing from 0% cover (frequency=0%) in 1982, to 2.5% cover (frequency=14%), to

Table 165. Spearman's rank correlation statistic for Peckhams Lake in 1991/92 and 1994.

	Old Seeding Grazed - 1991	Old Seeding Ungrazed - 1991	New Seeding Grazed - 1992	New Seeding Ungrazed - 1992
Old Seeding Grazed - 1994	0.305 ^b			
Old Seeding Ungrazed - 1994		0.423 ^a		
New Seeding Grazed - 1994			0.295 ^b	
New Seeding Ungrazed - 1994				0.532 ^a

Table 166. Spearman's rank correlation statistic for the grazed plant community at the Skookumchuck Historical Exclosure, 1960-1994.

	1960	1970	1982	1991	1994
1960	1.000				
1970	0.641 ^a	1.000			
1982	0.339 ^c	0.343 ^c	1.000		
1991	0.361 ^b	0.354 ^c	0.446 ^a	1.000	
1994	0.499 ^a	0.391 ^b	0.699 ^a	0.532 ^a	1.000

Table 167. Spearman's rank correlation statistic for the ungrazed plant community at the Skookumchuck Historical Exclosure, 1960-1994.

	1960	1970	1982	1991	1994
1960	1.000				
1970	0.360	1.000			
1982	0.007	0.504 ^a	1.000		
1991	0.150	0.181	0.408 ^a	1.000	
1994	0.166	0.268	0.744 ^a	0.454 ^a	1.000

^a p<0.05

^b $p < 0.10$

^c $p < 0.20$

nearly 13% cover in 1994 (Table 151, 152, 155).

4.5.6 Discussion

With exclusion from grazing, and fire also in this case, about ten years are required for significant vegetation species change at Skookumchuck Prairie. Approximately 30 to 40 years are required for a predominantly herbaceous plant community to recover from poor range condition (low-seral stage) and stabilize at something approaching climax. McLean and Tisdale (1972) reported the longer time required to progress from poor to fair condition, than from fair to good, has important ecological and management implications. With regard to EKTAW Committee problems and objectives they are; 1) impact of grazing by multiple species - more likely that key forage species will be repeatedly defoliated - this will delay improvements in range condition, more impact on poor to fair sites; 2) impact of stocking rates and wildlife distribution - rangeland in good to excellent condition will withstand heavier levels of use; 3) temporal demands - when these rangelands are used has implications for the vigour of the key forage plants; 4) a rangeland in good to excellent condition provides the manager with more options on season of use, intensity of use, and stocking rates; 5) potential natural communities are more apparent with a rangeland in good to excellent condition; 6) desired plant communities, as specified in Forest Practices Code legislation, are more attainable, with range in good to excellent range condition; 7) recovery rates of poor to fair condition rangelands are likely to be slower with multi-species grazing, than with a single species.

McLean and Tisdale (1972) also identified long periods of complete rest are not usually an economically acceptable form of range rehabilitation, especially if livestock production is the only goal. Other values, however, especially wildlife winter/spring range, are also important on these low-elevation plant communities, so complete rest is not a management option. With complete rest from grazing ungulates, and barring disturbance by fire, the potential natural community on this grassland site in the Ponderosa Pine Zone may be a ponderosa pine forest.

Different classification systems would provide different interpretations of the plant communities at the three-way exclosure at Skookumchuck Prairie, based on the "climax" plant community identified by that system. For example, in the Combined Use Area at Skookumchuck Prairie, in 1992, the total cover of the "decreasers", bluebunch wheatgrass, Idaho fescue, and rough fescue (McLean and Marchand 1968), equaled 14.3% cover, and 21.4% of the cover on the site. Under the Dyksterhuis (1949) system this plant community would be likely be described as being in fair range condition. Recovery prospects on such a site are good (McLean and Tisdale 1972). However, to improve range condition by one class, with total exclusion from grazing, will require approximately 10 years. Livestock can be excluded if that is the goal, but the problem in excluding wildlife remains; wildlife distribute themselves according to many biotic and abiotic factors including forage availability.

The Dyksterhuis classification system was designed to evaluate the effects of a single grazer on plant community dynamics. The data from this study confirm that deer, elk, and cattle eat different forage species, in different proportions, and to different levels of utilization. Consequently, the impacts of multiple grazers on the plant community may be different than for a single grazer. Hence, the multiple steady state concept is likely more useful in describing herbivore effects on the plant communities in the East Kootenay.

Ecological classification would likely designate the plant community in the Combined Use Area in 1992 as being in a mid-seral stage. Seral stages are defined as "the relatively transitory communities which develop under ecological succession" (Odum 1971 cited in SRM Task Group 1995). This system assumes that seral stages lead to a climax community, defined as "the final or stable biotic community in a succession series; it is self-perpetuating and in equilibrium with the physical habitat" (Odum 1971 as cited by the SRM Task Group 1995). Similarly, traditional ecological concepts do not apply to the East Kootenay situation, where multiple grazing species are present. Current ecological theory allows for multiple steady states, discontinuous and irreversible transitions, non-equilibrium communities, and stochastic effects in succession (Westoby et al. 1989).

The concept of multiple steady states is likely more useful in describing plant communities and predicting vegetation trends in the East Kootenay. In the example above, the vegetation in the Combined Use Area would have a designation of Soil Conservation Rating (SCR) and percentage of Desired Plant Community (DPC) (SRM Task Group 1995). These indicators are based on several premises; 1) rangeland condition assessment should be based on sound ecological principles and scientific information, 2) site potential must be recognized in evaluating rangeland condition status, 3) "sustainability" is the fundamental goal of rangeland management and sustainable management depends primarily on the conservation of the soil, 4) if current vegetation on a site meets the requirement to provide adequate soil protection, its desirability should be determined by how it meets other management goals, not by its presumed succession status.

At Premier Ridge and Pickering Hills the "range condition" model does not apply. On these forested sites, a higher succession stage is not equivalent to higher range condition. A higher seral stage would result in more forest cover. The plant communities at Premier Ridge and Pickering Hills most likely fit the description of lower succession stable states. The relative absence of bluebunch wheatgrass, rough fescue, and Idaho fescue, and the dominance of bitterbrush, Kentucky bluegrass, and western needlegrass on these sites represents a steady state which most likely resulted from past grazing. Friedel (1991) describes one readily recognized threshold as the one separating grass from woody vegetation. While Premier Ridge and Pickering Hills are open forests rather than grassland, the dominance of bitterbrush and other shrubs represents a stable state. A difficult threshold exists between the current vegetation and one with more bunchgrasses and fewer shrubs, particularly when the current stable state is at least partially maintained by grazing. Peek et al. (1978) found wildlife use of bitterbrush maintained its productivity and retarded the succession of the site to climax. It may not be possible to return these sites to a higher range condition or seral stage simply by altering the grazing system. Factors such as weather events, fire, chemical treatment, mechanical treatment, or seeding of desirable perennial grasses, may be required to enable these ecosystems to cross the threshold to a more desirable stable state (Laycock 1991).

Although Premier Ridge and Pickering Hills are dominated by bitterbrush, rather than sagebrush, some useful parallels can be drawn between the two species. The dominance of sagebrush represents a stable state which resists changes in livestock grazing management to move it across the threshold, toward a more open grass/sagebrush state (Laycock 1991). Protection from grazing sometimes results in an increase in total cover or production of grasses, forbs, and shrubs without any change in species composition or range condition (Laycock 1994). During the short time vegetation was studied at Premier Ridge and Pickering Hills this is the trend.

From the data collected at Peckhams Lake it appears as though it is possible to meet forage production objectives with domestic forages, and retain some native species diversity. The plant community at Peckhams Lake meets requirements for both cattle and wildlife production. Additionally, the value of wood products removed from the site in the past, and in the future, can not be discounted. Before establishment of these seedings the plant community was an stagnated Interior Douglas-fir site, over-stocked with juvenile understory trees. The potential natural community in this case met few management goals, with the exception of some standing wood volume. Growth and yield had essentially ceased on this site. If desired plant community objectives are merely to produce forage, then productive domestic forage species should be considered.

Revegetation in the past several decades has concentrated on successfully establishing a few vigorous exotic grasses. To establish more diverse plant communities we need to better understand the succession processes associated with plant establishment and community development (Call and Roundy 1991). Attempts to establish more diverse communities have often been unsuccessful due to differential adaptability, response to herbivory, and competitiveness of the seeded species. Call and Roundy (1991) recommended measuring and modeling the physical environment in relation to biological responses of key species. This will enable better understanding of the quantitative effects of different factors on the establishment and persistence of functional synthetic communities.

The "state and transition" (Westoby et al. 1989), "stable state and threshold" (Laycock 1991, Friedel 1991), and the "desired plant community" (SRM Task Group 1995) are similar and compatible concepts of vegetation change. The various plant community types possible on an ecological site are the "states" and the management actions required to move from one community to another are the "transitions" or "thresholds" (SRM Task Group 1995). The DPC concept originated in an effort to establish vegetation goals which were relevant to management objectives. Regardless of the concept used, or the products these sites provide, resource managers must consider ecological principles and limitations in their selection of desired plant communities.

In the low-elevation forests of the East Kootenay, potential natural communities could be anything from grassland to closed forest, or a mosaic of all types. Integrated resource management recognizes different sites have different capabilities. Multiple use need not occur on every site, but within landscape units in the Ponderosa pine and Interior Douglas-fir Biogeoclimatic zones rangeland, timber, and recreational values could be optimized by allowing management objectives to determine the desirable plant communities.

5.0 Recommendations

Most of the controversy in the East Kootenay has revolved around allocation of forage among deer, elk and cattle. The main areas of concern addressed by this study are diet similarity and forage use (which also includes browse). While these two factors are important, other factors need to be considered in making land use and forage allocation decisions.

Borman and Pyke (1994), indicate that the Bureau of Land Management in the United States has been considering the use of the "Desired Plant Community" (DPC) approach for managing ranges in the U.S. One of the values of this concept is that the DPC is defined in terms of human values (including economic and social values), and not in terms of "pristine" conditions that may have occurred (and may not be achievable now) at some arbitrary time in the past. This approach would be appropriate in the East Kootenay for 3 reasons and would fit in well with the Trench Plan.

First, it is likely that low-intensity ground fires, returning at 10 - 20 year intervals, maintained the Ponderosa Pine and Interior Douglas-fir forests in the trench as a mosaic of grassland, open forest, and dense forest. Additionally, some of the open range in the East Kootenay was derived from the fires in 1920's. Pursuing a "pristine" or climax model, with an attendant policy of complete fire suppression, means that forest encroachment, which has contributed greatly to the current forage shortfall in the East Kootenay, could be left unabated until a "climax" forest regenerates. Most would agree that this is unacceptable.

Secondly, this approach clearly points to the future. What has happened in the past, and even the present, is irrelevant to future goals and objectives except that our activities in the past may make future goals more difficult to accomplish.

Third, managing for multiple steady states (sustainable plant communities) means that plant communities other than climax can be justified, providing they are socially acceptable to stake holders. The one exception however, that the author and the SRM Task Group on Unity in Concepts and Terminology (1995) recommend, is that all desired plant communities must be effective in preventing accelerated soil erosion, independent of the use of the site. When soil erosion becomes unacceptable, the site is considered unsustainable no matter what the objectives of the plan are.

Protecting the site is the first priority to meet any land management objectives. The disparity between forage supply and animal numbers must be rectified. Forage allocation then is not simply dividing the biomass available on a site among principal ungulates. Rather, it is the process of providing a sustainable environment which meets specific land management objectives. Obviously, these objectives may change over time.

5.1 Diet Composition

Overview

Ungulate diets can comprise up to 30 to 60 species over the year. Seasonally, foraging seems to be limited to about 18 to 25 species. Approximately one dozen key forage species are major contributors to all grazers diet (bluebunch wheatgrass, Idaho fescue, rough fescue, bluegrasses, needlegrasses, orchardgrass, brome grass, small-flowered penstemon, alfalfa/clover, Saskatoon, buckbrush, low Oregon grape, soopolallie, Douglas-fir).

Implications

Livestock and wildlife goals are difficult to achieve because there is not a land management focus on producing enough of the key forage species. Instead the focus is on producing products such as timber, cow/calf, and hunting opportunities.

Recommendations

Resource managers should adopt a philosophy which recognizes the potential production capabilities and limitations for certain attributes on each site. The desired plant community (DPC) is an objective which recognizes, and is a function of, the capabilities and limitations of the site. The DPC concept should be integrated with the Trench Plan polygons (B.C. Forest Service 1988).

Manage land to achieve DPC status. For example, improving range condition (higher seral state), increased wildlife and livestock carrying capacity, and specified timber types and anticipated harvest volume can all be objectives within the DPC. The attributes necessary to produce the desired products are agreed upon in landscape-level planning. This type of planning approach avoids *ad hoc* management and unrealistic objectives.

5.2 Diet Overlap

Overview

Elk and cattle diets are similar between periods. The shorter the interval between their respective grazing periods, the more apt elk and cattle diets are to be significantly similar. Structure of diets was similar among years and sites for all ungulate species. This indicates all ungulates have a degree of diet fidelity - this is an important planning tool for integrated management. Major differences in diets among sites relates to availability. For example, elk prefer low Oregon grape at Pickering Hills, while at Peckhams Lake Douglas-fir is more prominent in elk diet than at other sites.

Diet patterns are consistent among years, but availability can be affected seasonally. Some forage species are only used in some seasons, while others are used all year. Availability depends on:

1. presence or absence of forage species
2. season of use
3. previous use
4. physical conditions (snow, shrub layer, etc)

Implications

In the past there has been an over-emphasis on potential competition between grazers for "grass and grasslike" species. Ungulates are selective where possible, so competition for specific plant species is possible between deer, elk and cattle. Large ungulates, however, are also adaptable so they can alter their foraging habits to match forage availability. There has also been an under-emphasis on;

1. lack of available forage - including carryover for site protection,
2. overuse in key areas,
3. ungulate distribution - especially livestock which are constrained in their movement by fences and the location of water sources,
4. effect of repeated defoliation on key plant species and the plant community.

Aside from a decline in the quality of the habitat, animal productivity will suffer. Berg and Hudson (1972), working on foothills ranges in southern Alberta, concluded "measurements of overlap must be accompanied by long-term measures of animal productivity - measures which are very rarely available for large ungulates". Irwin et al. (1994), reviewed the effects of long-term grazing by big game and livestock in the Blue Mountains of Oregon. They identified negative feedback effects on the productivity of elk and cattle populations as a result of herbivore-induced vegetation changes. These effects included; 1) cattle do not achieve desired weight gains on summer allotments, 2) long-term declines in elk calf survival, 3) density-dependent juvenile elk mortality and, 4) decreased summer diet quality and winter forage availability.

Recommendations

Intraspecific dietary overlap between seasons (eg. fall elk with winter elk), and interspecific overlap between seasons (eg spring elk with summer cattle) should be included in forage allocation. Competition results if key forage species are used in common and are in short supply - determine this as part of allocation procedures. Diet similarity between elk and cattle is most likely to occur when cattle are grazed in early spring or late fall. To avoid overuse on key species avoid cattle grazing in pastures located on the critical portion of the winter/spring range in these periods. Evaluate an area's carrying capacity based on the amount of key forage and browse species (from seasonal diets) which are located in that area. Forage should be allocated seasonally due to varying forage availability among seasons and differences in foraging behavior among ungulate species.

Diet overlap by forage species followed by allocation strictly on the basis of biomass is not suitable. Generalized AUM equivalents should be devised for each species and for each grazing period. Scarnecchia (1985) recommended the AUM concept is best used as a measure of potential forage intake, and that it be retained as an intraspecific tool, rather than an interspecific one. Attempts to define animal-unit-equivalents are subject to variability in season of use, stocking density, and stocking rate (Scarnecchia 1985). Conversely, Hobbs and Carpenter (1986) argue that the animal unit concept is useless unless defined in relation to a specific grazing animal.

For our purposes, I believe we can incorporate the strengths from both arguments. We have confirmed that elk and cattle use several forage species in common, but generally in different seasons. Our challenge is in meeting the needs of both classes of animals, yet also managing the vegetation such that it too is sustainable. These AU's for both cattle and wildlife must include measures of potential intake, but they must also include the composition of the intake, and the effect of providing that AU on the forage resource. Also, potential effects on other animal species which use the resource should be included in calculations where appropriate.

Knowledge from other jurisdictions can be included in the assessment of the AU impact. For example, in Montana, Dragt and Havstad (1987) found no deleterious effects of summer cattle grazing (stocking rate 3.7 ha/AU - no forage standing crop information given) upon winter forage quality of bluebunch wheatgrass, rough fescue, and Idaho fescue for elk winter forage. Grover and Thompson (1986), also working in Montana, found that elk selected spring feeding sites which had been previously grazed (previous year) by cattle and which supported relatively dense stands of bunchgrasses. This suggests some integrated management principles which could be incorporated in defining AU's for cattle, deer, and elk.

5.3 Forage Production and Use

Overview

Total Standing Crop (TSC) is highly dependent on the precipitation during the growing season, and to a lesser extent, precipitation in the previous growing season. In other jurisdictions positive results have been achieved using a 50% "rule of thumb" for forage removal objectives. At the Bridge Creek WMA in Oregon, 50% of the forage production is allocated to grazing (25% elk/25% cattle), while the remaining 50% is allocated for the plants and other uses (Anderson and Scherzinger 1975). In this study total use by wildlife and cattle combined ranged from slightly <50% to >90% of the TSC. Combined forage use was less than the 50% "rule of thumb" allocation level in only one case of fifteen. In four cases combined use ranged between 50% and 60%. In the remaining ten cases combined use exceeded 60%. Wildlife used consistent amounts of forage in spring. However, litter accumulation may affect the availability of new growth. Wildlife will then switch to a pasture grazed by cattle in the previous summer or fall.

Cattle also used consistent amounts of forage. Use is closely tied to stocking rate unless there is a distribution problem or a diet change away from herbaceous vegetation. Fall wildlife use may be impacted by a lower Seasonal Standing Crop (SSC), particularly if cattle are grazed in late summer and fall. Some authors attribute lower use to reduced standing crop, while others claim elk preferably avoid pastures in which cattle have recently grazed. Wildlife used all pastures in winter, regardless of whether the pasture had been previously grazed by cattle. Pastures with the highest SSC received the most use. Smith et al. (1992) found that the most productive plant communities received the most use as ungulates selected for forage abundance. However, changes in plant community structure due to use has been shown to prevent grazing animals from maintaining intake levels. Removal of even 26 - 27% of the forage in a low producing ecosystem may decrease acceptability. Elk grazed preferentially in winter, but will alter their foraging to include more browse if herbaceous forage is less available. Low amounts of carryover remain in March resulting in less litter to protect the site. This leads to increased potential for soil erosion, lower water infiltration rate, soil compaction, and lower soil fertility.

Implications

More than 50% of the Total Standing Crop was grazed by combined wildlife and livestock use in all years. "Safe" levels of use were exceeded. Key forage plants were repeatedly defoliated. This leads to decreased vigour of the "decreaser" species (eg. rough fescue, Saskatoon) increases in cover and frequency by "increaser" species (eg. bitterbrush), and invasion by non-palatable, weedy species (eg. knapweed, hound's-tongue). This in turn leads to decreased carrying capacity. This is not a recent scenario. Overuse of rough fescue by elk was documented in the early 1950's on the Elko Deer Sanctuary (Sugden 1953). Sugden (1953) concluded that increasing numbers of deer and elk are exerting excessive demands on the range forage plants and that significant mortality can be expected with a more-than-average severe winter.

Site suitability as winter range may be a function of forage availability. Several authors (McCorquodale 1991, Hudson and Neitfield 1985), working on elk foraging behavior in summertime, report that elk require some critical forage biomass >600 kg/ha to maintain minimum intake rates.

Cattle too may experience reduced forage intake and diet quality as a function of decreased forage availability. Several authors (Senft et al 1985, Pinchak et al 1991, Smith et al

1992) report greater selection by cattle of areas with higher quantities of forage. Handl and Rittenhouse (1972), working with steers on crested wheatgrass pasture in eastern Oregon, found dry matter intake was not limited when herbage availability met or exceeded 135 kg/ha.

Desired plant community objectives are more difficult to achieve if key species receive heavy use while less palatable species receive little or no use.

Recommendations

Winter wildlife forage requirements are based primarily on the quantity of the standing crop. The specific species and forage quality are important but secondary. Wildlife winter/spring range should be managed for forage abundance - with regard to preferred forage species, forage quality, and other habitat requirements.

Spring wildlife forage allocation requirements should be related to diet preferences (eg. elk and rough fescue) and species abundance. Private land mitigation strategies are important for this time period. Fall wildlife foraging is disturbed somewhat by human activity - this likely affects deer and elk diets indirectly, as they are apt to spend more time in secure areas (forested). Cattle grazing can also disturb wildlife patterns. Forage allocation on Crown lands is less critical during this time. However, under the security of darkness, hayfields and preferred areas of Crown lands are still used. Private land mitigation strategies are also important in fall. Cattle should not be turned-out in early May on critical wildlife winter/spring ranges. If turn-out follows spring wildlife use too closely, 1) a lower SSC will be available for cattle, 2) cattle may over-use the forage in that grazing period if stocking is not adjusted, 3) negative impacts on the vigour of key forage species will occur as a result of repeated defoliation. Spring cattle turn-out dates should be based on plant phenology stages (eg. the number of leaves vs. plant height). For example, in a dry spring, Kentucky bluegrass may be in the head stage before the plants have reached the range readiness criteria if these criteria are based on plant height. Conversely, applying range readiness criteria based on height to bunchgrasses may time grazing for a vulnerable stage. If cattle are grazed after plant dormancy in summer or fall and there is little precipitation following the grazing period, this may result in little or no fall regrowth and less use by wildlife in fall. However, due to the lesser amounts of standing litter accumulation, these pastures are used more by wildlife in the following spring. Seasonal use should be calculated when monitoring wildlife and cattle use on critical winter/spring ranges. Although total use was consistent during this three year study, there is some variation in use patterns among years and periods. Forage removal objectives should be based on the SSC and TSC on these sites. Further investigation is warranted regarding the quantity of forage carryover which must remain for winter wildlife use. Sites with the highest available SSC received more use in this study. When SSC was about 350 - 400 kg/ha in fall or winter, sites received less wildlife use.

Some of the difference between fall carryover and winter SSC may be due to weathering losses. Determine the amount of standing crop lost to weathering by including a control cage solely for monitoring winter wildlife use.

Further research may be required to determine the amount of litter required to protect the site from erosion and allocate that amount first. This may be tied to utilization levels on key species. For example, Skovlin et al. (1976) recommended moderate use of 30 - 40% on bunchgrass species to prevent degradation.

The creation of spring livestock turn-out pastures composed of domestic species would reduce the impact of combined spring use on native rangelands. These pastures could then be

deferred so that the forage could be allocated to wintering wildlife or if feasible, late-fall grazing for livestock. Either option, or a combination of both, would allow for more flexibility in livestock rotations, maintain AUM's, and provide more management options for improving range condition.

5.4 Range Condition

Overview

Herbaceous Vegetation

Some sites (eg. Premier Ridge and Pickering Hills) are in lower seral states (poor to fair condition) and recovery potential is limited because "increaser" species such as bitterbrush, hold a disproportionate amount of the resources. In contrast, low amounts of the "decreaser" species such as bluebunch wheatgrass, Idaho fescue, and rough fescue are present. At sites such as Premier Ridge where diet similarity between grazing periods is more common, use is not excessive in most individual grazing periods. However, the site is subjected to sequential use by different grazers. If cattle are turned-out on these pastures in May, these pastures will have been grazed during the dormant period and from green-up to mid-June. Also, if cattle grazing is scheduled for late-fall, these areas may be grazed sequentially from then until the following May.

Browse

Browse use by cattle and wildlife on measured Saskatoon and bitterbrush shrubs commonly ranged from >10% to nearly 70% during their respective grazing periods. The Range Management Guidebook for the Forest Practices Code series recommends 10% combined use.

Bitterbrush is not a preferred species by wildlife in the east Kootenay to the degree it is in other jurisdictions. Other shrubs (eg. Saskatoon, buckbrush, low Oregon grape) are more prominent in the diets of deer, elk, and cattle and less frequent on range. The exception is winter use of bitterbrush by deer. Browsing tree species is also important. For example, Douglas-fir is more commonly used by both deer and elk than most shrubs. Aspen and ponderosa pine are browsed, but are less prominent in ungulate diets than Douglas-fir. The foliage from Douglas-fir trees of 40 - 48 cm dbh is browsed more rapidly than that of trees <30 cm dbh. Foliage from seedlings <6 cm are virtually unbrowsed (Dawson et al. 1990).

In ranges of the East Kootenay, bitterbrush acts as an "increaser" species under continued disturbance by grazing. However, the bitterbrush increaser theory is not supported by literature or popular view. Additionally, literature or popular view does not support bitterbrush as a non-preferred species. Literature from other jurisdictions classifies bitterbrush as a critical winter browse species. Bitterbrush was not consumed relative to its abundance in this study.

Range condition is influenced by 1) stocking levels and 2) the season and intensity of defoliation on key species. Improvements in range condition, will result in decreased wildlife use on favoured areas and on private land.

Brink (cited in Agriculture Canada 1972) in summarizing the findings of the Grassroots Report stated, "Man, his logging, and his fires, have produced vegetation which made more forage available to native and domestic ungulates and their numbers have increased. A further point must be quickly added viz. forest fires set by man are now few and although it is a slow process, in most areas of the East Kootenay regeneration of the forest is occurring. As the

forest regenerates, the range forage is declining, at probably logarithmic rates". He also noted that "the rangelands of the East Kootenay are a product of human activity and human activity will be needed to maintain them. Livestock and wildlife may be in conflict but the conflict is surely secondary".

Implications

Continued high levels of forage removal on sites such as Premier Ridge and Pickering Hills may contribute to maintaining these sites in a lower condition steady state. Without management inputs, altering the grazing management plan may have little impact in changing the composition of these plant communities.

Weeds such as knapweed appear in winter deer diets, and also occasionally in elk and cattle diets. Additionally, hound's-tongue and other weeds, which spread by seed transmission of burred seeds, are on the increase. The spread of these weeds is influenced by both human and animal activity.

Recommendations

Resource managers must set plant community objectives on a site specific basis based on obtainable ecological, production and social goals. Desired plant communities should represent realistic targets; these may or may not be to climax ecological potential.

Desired levels for utilization for key forage species should be built into range use plans. These targets should be established for use in different seasons.

Avoid livestock turn-out, on critical winter/spring range (eg. pastures on Premier Ridge and Pickering Hills) in May as the forage (esp. preferred species) has no rest period following winter and spring wildlife use. Repeated defoliation leads to decline in vigour of plants, followed by decline in range condition, weed invasion etc. To improve range condition on key winter/spring ranges;

1. introduce rest into cattle rotations, where they are not currently used, on a site specific basis,
2. simultaneously conduct range enhancements (eg. lure crops, mitigation logging) to improve wildlife distribution.
3. where feasible, create turn-out pastures for livestock by using domestic forages which are ready to graze before the native species on traditional turn-out areas.

Wildlife will use rested pastures in the following winter, but are less likely to use them in spring due to accumulations of standing litter which impede access to forage. Similarly, cattle are less likely to uniformly graze pastures with high amounts of standing litter in spring. Some authors (Pinchak et al 1991, Ganskopp et al 1992) report cattle are very selective up until the late-boot or anthesis stage, but cattle are less selective when grasses are in the dormant stage. Following rest, a pasture may receive more uniform cattle use if grazing is deferred until late-July or August.

When site productivity is evaluated the impact of wildlife on soils should be considered. Wet soils cannot support weight of elk and thus are subject to compaction, and damage to roots and crowns of forage plants. This information should be incorporated in a site rating, particularly if wildlife spring use should lead to sufficient soil erosion so as to make production on the site unsustainable.

Livestock can be used as a "tool" to improve wildlife habitat in some cases. For example, using cattle to pre-condition forage for fall and winter elk use is an objective in some

CRMP's. On most ranges in the East Kootenay, however, there is not sufficient uniformity in the pasture to obtain uniform cattle distribution. Additionally, herd size is often insufficient to obtain even livestock distribution, and riders and salt are not used to hold cattle in specific areas. The distribution of water sources is a problem on many range units. Moreover, one pasture often contains more than one range type. These problems must be addressed to facilitate forage conditioning.

The most important objective is land management, in particular soil, herbaceous forage species, and browse species. Instead of independent management of all ungulates the landscape unit should be managed as a whole with livestock and wildlife as components of the system. Just as cattle stocking levels should correspond with available forage and known distribution patterns, population objectives for wildlife species must be linked to an estimate of carrying capacity. Managers should de-emphasize using livestock as a "tool" to improve wildlife habitat as the only justification for grazing livestock on Crown range. Instead, use livestock grazing and other management inputs such as, burning, fertilizing, restoration logging, etc. to improve wildlife habitat where it is an obtainable objective with that input or combination of inputs. Unmanaged wildlife numbers and distribution may negate any benefits gained from livestock management.

Turn-out dates should be based on plant development stages rather than height measurements or calendar dates.

Winter/spring range management has different implications for deer or elk ranges. Mule deer make the most use of the bitterbrush sites, while white-tailed deer and elk use only small amounts of bitterbrush in the winter.

To promote the capability of winter/spring ranges for elk, desired plant communities should have increased amounts of rough fescue, Idaho fescue, and bluebunch wheatgrass. Numerous authors have reported the preference of elk for bunchgrass species in winter, if available (Kufeld 1973 - review of elk diet studies). Bitterbrush is not a preferred elk browse species. Bitterbrush and other shrubs are used when grasses are less available, although some claim elk have substituted browse for grass due to higher protein content in the browse. Ward (1971) reported bitterbrush digestibility averaged 26.5% between cattle and elk. In contrast, grass digestibility averaged 43.3% between cattle and elk in the same study.

To reduce use on the herbaceous component especially "decreaser" species, management inputs, in conjunction with grazing management, may be required to achieve desired plant communities. Management activities with fire, chemical, or mechanical inputs may be required to shift bitterbrush-dominated communities across the threshold from their current lower seral steady state to a higher state community which has less bitterbrush and more desirable shrubs (eg. Saskatoon, low Oregon grape, buckbrush).

5.5 Forage Allocation

Overview

Forage allocation is not simply dividing the biomass available on a site among the principal ungulates. Rather, it is the process of providing a sustainable environment which meets specific land management objectives. Obviously, these objectives may change over time. In general, forage is not wasted if it is not eaten by large ungulates. Litter is required for soil processes such as protection from erosion, building soil organic matter, maintaining soil structure, and water infiltration.

The allocation of "**forage**" must consider the following questions:

1. Does sufficient plant cover and litter remain following grazing to protect soils from erosion, contribute to nutrient cycling, reduce evaporation, and promote positive hydrological activities on the site?
2. How do current grazing patterns (and other disturbances) affect plant vigour?
3. Is the succession status of the community defined? Is it suitable for meeting the objectives of the plan for the site? Does the current species composition of the range need to be altered? How much more (or less) grazing pressure is necessary to alter the existing plant community to its desired state if a change is required? Are management inputs (fire, fertilizer, seeding, chemical or mechanical) required to alter the existing plant community?
4. Is adequate forage available for other herbivores occupying the site?
5. Is habitat structure suitable for other animal species?
6. Is sufficient plant cover available and animal management sufficient to impede weed encroachment?
7. Are other human activities (recreation, transportation, settlement patterns) influencing the composition of the plant community?

These questions must be addressed in the context of a highly variable forage resource which can fluctuate dramatically among years. Moreover, all of these factors may not be addressed in any one plan and the relative weight that each of these require will depend on the site specific objectives. Therefore, forage allocation decisions must be flexible and vegetation should be monitored to determine if the objectives of the plan are being met. Any forage allocation decision should;

1) consider the composition of an AUM for deer, elk, or cattle, 2) consider the value of an AUM in different seasons, 3) consider the "cost" to the plant community of producing that AUM, and 4) determine diet requirements and what plant species comprise a deer, elk, or cattle AUM. A sample forage allocation calculation is located in Table 168.

Implications

The lack of a forage allocation process will exacerbate existing negative trends in range condition. Irwin et al. (1994) concluded that forage allocation among livestock and big-game is important particularly in altered vegetation-herbivore systems. They recommended that managers consider grazing systems and the economic carrying capacity to determine if the current vegetation-herbivore system is sustainable. Currently we have only general estimates of carrying capacity. The forage species used by three different ungulates, on four sites, and in all seasons have been established. However, within each planning unit the effective foraging area (which is the actual area used) must be determined.

Limited knowledge exists documenting the effect on the plant community and on individual plants of removing an AUM in different grazing periods.

Recommendations

Base yearly forage allocations on Annual Standing Crop (ASC), the more conservative estimate of production. On non-critical areas an estimate of annual forage production and use may be sufficient. On areas where seasonal use is required calculate the SSC and TSC.

Forage allocation must be done by a definable land management unit (landscape unit, range unit, drainage, elk winter/spring range, etc.) - in order to apply specific knowledge of diet, ungulate distribution patterns etc., where they exist, to the allocation process.

Table 168. Sample forage allocation calculation based on elk diet and forage use at Premier Ridge in spring 1992.

Elk Effective spring AUM = % in Diet X main species X production
 Assume: 225 Kg Cow Elk X 2.5% bodyweight

SSC in May

Elk Use: 25% X 400kg/ha = 100 kg/ha
 Stocking Rate: = 1.7 ha/AUM (5.1 for 3 months)
 (if elk only ate herbaceous forage)

Cover Vegetation

Plant Community (Table 140)	% (X 1.63) ¹	kg/ha (X 1.49) ²
Grass	34.3	56.2
Forbs	6.9	10.9
Tree/shrub	20.3	33
Total	61.5	100.1
		400

¹ 1.63 converts vegetative cover to 100%

² 1.49 converts vegetative cover to standing crop production

Spring Elk Diet (March, April, May) (factored to = 100)

(From Table 20)	Diet %	Cover	Selection ¹ Index
Grasses (10 species)			
bentgrass	2		
bluebunch wheatgrass	8	0.4	20
smooth brome	6		
pinegrass	1		
orchardgrass	2		
Idaho fescue	8	0.1	80
rough fescue	11		

Table 168. (continued)
Spring Elk Diet (March, April, May) (continued)

(From Table 20)	Diet %	Cover	Selection ¹ Index
Grasses (10 species) (continued)			
junegrass	3	1.5	2
bluegrass	24	21.6	1.1
needlegrass	6	10	0.6
Total Grasses	71		
Forbs (4 species)			
compound fleabane	1	0.9	1.1
sulphur buckwheat	1		
locoweed	2	0.4	5
s. penstemon	10	0.2	50
other forbs	1		
Total Forbs	15		
Trees/Shrubs (4 species)			
Saskatoon	4	2.6	1.5
trembling aspen	1		
soopolallie	2	0.3	7
ponderosa pine	1		
moss	1		
Total Trees/Shrubs	9		
Total	95		

¹ Selection Index = % cover of plant in diet / % cover of plant on range

$$\begin{aligned}
 \text{Elk AUM} &= 170 \text{ kg/month} \times 71\% \times 100/95 = 127 \text{ kg/month grass} \\
 &\quad \times 15\% \times 100/95 = 27 \text{ kg/month forbs} \\
 &\quad \times 9\% \times 100/95 = 16 \text{ kg/month trees/shrubs} \\
 &= 170 \text{ kg/month total}
 \end{aligned}$$

Table 168. (continued)

(grass + forbs) 154 kg/month herbaceous/100 kg/ha eaten = 1.54 ha/AUM
(trees and shrubs) 16 kg/month

Of that 127 kg/month grass:

bluebunch wheatgrass	8%	X	170	=	3.6 kg/month
Idaho fescue	11%	X	170	=	18.7 kg/month
rough fescue	8%	X	170	=	13.6 kg/month
bluegrasses	24%	X	170	=	40.8 kg/month
needlegrasses	6%	X	170	=	10.2 kg/month
Total				=	96.9 kg/month

The grazed area at Premier Ridge in May, 1992 supplied:

bluebunch wheatgrass	0.7%	X	400 kg/ha	=	2.8 kg/ha
Idaho fescue	0.2%	X	400 kg/ha	=	0.8 kg/ha
bluegrasses	32.5%	X	400 kg/ha	=	130.0 kg/ha
needlegrasses	16.0%	X	400 kg/ha	=	65.0 kg/ha
prairie junegrass	2.5%	X	400 kg/ha	=	10.0 kg/ha
Total				=	208.7 kg/ha

Therefore the effective elk carrying capacity for March, April, May is:

1.54 hectares/AUM X 3 months = 4.62 ha/cow elk for the spring grazing season (based on 25% use - actual in spring 1992)

0.77 hectares/AUM X 3 months = 2.31 ha/cow elk for the spring grazing season (based on 50% use - maximum for safe use)

Forage allocation must focus on land management goals - not animal production. Forage allocation should comprise a major portion of each Coordinated Resource Management Plan (CRMP). All activity on a Land Management unit should be considered together for the effect on other activities. For example, the effect the Buck Lake seeding (see EKTAW Committee Final Report) would have on wildlife and cattle distribution on the Gold Creek/Plumbob Range Unit was not included on the planning for that unit.

Sustainability of the soil and vegetation resource is more critical than ungulate management. It is more difficult and expensive to alter habitat than it is to influence ungulate distribution.

Forage allocation, in addition to considering all factors above in a qualitative sense, must consider:

1. the effective AUM for each ungulate and each grazing period,
2. the effective stocking rate, which is the combination of the effective AUM and the number of hectares required to produce that diet.

Elk must have a larger range than calculated above to produce this diet, especially the bunchgrasses. In the sample calculation (Table 168) the Selection Index for favoured species bluebunch wheatgrass, Idaho fescue, and small-flowered penstemon range between 20 and 80. So the effective range is actually larger, and the effective carrying capacity is lower.

The process to determine the effective carrying capacity for elk requires the following steps:

1. determine size of winter/spring range for a particular herd - estimated number of animals wintering in a landscape unit (or other definable physical area),
2. map location of winter range and winter/spring range,
3. delineate habitat - area of range types - amount and type of forage produced in each range type,
4. include open and edge habitats but exclude most of dense forest,
5. forage carryover - determine the appropriate amount for each type for site and habitat requirements,
6. set carrying capacity based on the final estimate of lands suitable X production of key species.

This process meshes with "range condition" and DPC objectives, as well as current range inventory initiatives. Diet information has provided the means to determine which plant species deer, elk, and cattle are consuming at the different sites during the different grazing periods - thus the "effective AUM". Forage production and use data have confirmed the relative temporal forage demands of cattle and wildlife. Plant community data describe the species present on each site. A forage allocation program and desired plant communities for all sites can be derived with the information from these three programs.

5.6 Vegetation Monitoring Procedures

Overview

This represents the end of a phase in monitoring. Potential exists for a second phase incorporating the most important techniques from phase one, but with a less detailed program for each site. This type of monitoring would be suitable for determining PNC's, DPC's,

describing existing plant communities, evaluation of forage production and use, vegetation trends, and adaptive management requirements.

Implications

If monitoring is not continued:

1. the potential exists to return to subjective/polarized management decisions,
2. loss in infrastructure and investment from existing sites,
3. loss of continuity of information,
4. loss in ability to quantitatively assess changes in range condition, which seriously limits the ability for adaptive management.

Recommendations

At Skookumchuck Prairie, Premier Ridge, Peckhams Lake, and Pickering Hills:

1. no need to continue monitoring diet or standing crop,
2. monitor cover/freq - every 3-5 years- grazed vs. ungrazed- min 100 plots/site
3. measure forage use - grazed vs. ungrazed - annually - smaller sample size
4. maintain present exclosures as range reference areas.

Identify other sites of management importance in the East Kootenay region where livestock and wildlife are presumed to be in competition. At these sites measure:

1. cover and frequency,
2. standing crop,
3. forage use - modified from current system,
4. establish range reference areas.

Sample Size

Vegetation monitoring procedures should collect sufficient numbers of samples to provide for statistical analysis. Unless information is collected at the reconnaissance level of intensity, or there is a written agreement not to dispute the data, a minimum of twenty grazed and twenty ungrazed plots should be installed to determine forage standing crop production and forage use. Sample size calculations should be based on known levels of variability when possible.

Forage Production

If monitoring is to follow specific periods of use (eg. spring wildlife, summer cattle), the Seasonal Standing Crop (SSC) should be used as the measure of production. Total Standing Crop can be calculated for these situations by summing the SSC for each period (less the carryover from the previous period). If monitoring is for seasonal use only (eg. combined seasonal wildlife/cattle use), the Annual Standing Crop (ASC) should be used as the measure of production. This would be suitable for less critical areas where both cattle and wildlife use the area for part of the year, but where there is no perceived conflict. On critical winter/spring ranges SSC and TSC should be used. Forage use should be calculated for each grazing period. Total Standing Crop (TSC) is only significantly different from ASC if there is sufficient moisture for regrowth - the use of the ASC is a more conservative estimate of production. TSC is more time-consuming to collect if the SSC is not required for each grazing period.

Winter Wildlife Use

Grazed plots must have an ungrazed control which is only used to compare with the winter wildlife plot in order to account for weathering.

Browse

Temporary exclosures should be used to monitor shrubs for annual or seasonal use calculations. Protection from browsing can result in vegetation stagnation (Tueller and Tower 1979).

5.7 Forest Practices Code

Recommendations

Range use plans are being developed to FPC standards for Skookumchuck Prairie, Premier Ridge, Peckhams Lake, and Pickering Hills. Data from the vegetation monitoring project would be suitable for descriptions of the Existing Plant Communities (EPC), current forage production and use, and to assist in determining DPC's.

Range Unit Plans should also include wildlife numbers, the time they spend on the winter range, distribution, and projected levels of use. This information is required to properly manage land and vegetation as per the FPC.

When determining "Desired Plant Communities" realistic strategies need to be developed that recognize the forage preferences for ungulates using the site and the effect this can have on the sites recovery prospects. For example, elk have a preference for rough fescue, particularly in spring. Repeated defoliation of bunchgrass species such as rough fescue in the spring reduces vigour, forage production, seed production etc. If these species are important components of DPC's then it will be difficult to meet plant community objectives.

DPC's in low-elevation plant communities should also include objectives for forest types:

1. tree species,
2. spacing (# stems/ha.), and
3. desired Average Weighted Crown Closure (AWCC) or basal area/ha.

Clary (1975), working in the ponderosa pine zone in Arizona, found that reductions in the timber overstory, whether done primarily to improve the yields of water, timber, or herbage will virtually always result in an increase in herbage.

While these objectives are ultimately the responsibility of silviculture, range and fish and wildlife managers, resource users can have important input in determining these objectives.

DPC's should also evaluate the shrub layer and determine the desired species and strategies to manage them.

In describing the herbaceous layer of the plant community terms such as "decreaser" and "increaser" should be retained. While these terms traditionally pertain only to grazing effects, the SRM Task Group (1995) has redefined these terms to include plants which increase or decrease "as a result of a specific biotic/abiotic influence or management practises".

The effect of a particular enhancement activity must be considered in the whole range unit. For example, the Buck Lake seeding in the Gold Creek/Plumbob Range Unit was designed as a "lure crop" area. There was limited planning to integrate its use and required management into the range unit plan. A similar situation occurred with the restoration logging at Rat Lakes (see EKTAW Committee Final Report).

5.8 Monitoring Procedures For Wildlife

Overview

Elk should be radio-collared and monitored in each herd wintering area. Distribution and length of time on the winter/spring range is more critical for integrated management than absolute numbers, which will change year by year. Wildlife distribution is a function of:

1. aspect, slope, edge cover, topography,
2. forage (abundance/plant species/plant community type),
3. security (maybe most important).

Plot the area of winter/spring range by range unit management unit or some other distinct area. This would aid the allocation of forage by describing the areas where wildlife are most likely to congregate, given the severity of the winter. Known quantities of forage could then be reserved in these areas. I believe this approach would be more effective than providing general grazing opportunities for wildlife in areas where they may or may not winter.

Recommendations

Better monitoring of wildlife populations is needed so their distribution, the size of the summer and winter/spring range, and their numbers can be incorporated into land management planning. Monitor the lure crop area at Buck Lake. The objective was to enhance habitat on Crown range to draw wildlife off;

1. private land,
2. preferred areas on Crown range, especially in spring (most critical time to defoliate key forage species).

Although the Buck Lake seeding has been successful in attracting wildlife, it is uncertain whether this has resulted in less use on the neighbouring hayfields or the adjacent Buck Lake ridges. Involve user groups more in monitoring of numbers, habitat selection, and distribution. For example, the observations of interested stake-holders and resource users such as ranchers, antler-hunters, and wildlife clubs should be incorporated in wildlife monitoring procedures.

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Appendix 1. List of scientific and common animal names.

Scientific Name	Common Name
<i>Bos taurus</i>	Cattle
<i>Cerphus elaphus</i>	Elk
<i>Odocoileus hemionus</i>	Mule Deer
<i>Odocoileus virginianus</i>	Whitetail Deer
<i>Ovis canadensis canadensis</i>	Rocky Mountain Bighorn Sheep

Appendix 2. List of common and scientific plant names.

Common Name	Scientific Name
Alfalfa	<i>Medicago sativa</i>
Alsike Clover	<i>Trifolium hybridum</i>
Balsamroot	<i>Balsamorhiza sagittata</i>
Bastard Toadflax	<i>Commandra umbellata</i>
Bearberry	<i>Arctostaphylos uva-ursi</i>
Bentgrass	<i>Agrostis alba</i>
Birdsfoot Trefoil	<i>Lotus corniculatus</i>
Bitterbrush	<i>Purshia tridentata</i>
Bitterroot	<i>Lewisia rediviva</i>
Black Medic	<i>Medicago lupulina</i>
Blue-eyed Grass	<i>Sisyrinchium angustifolium</i>
Bluebunch Wheatgrass	<i>Agropyron spicatum</i>
Bluegrass	<i>Poa spp.</i>
Brown-eyed Susan	<i>Gaillardia aristata</i>
Buckbrush	<i>Ceanothus velutinus</i>
Canada Bluegrass	<i>Poa compressa</i>
Cheatgrass	<i>Bromus tectorum</i>
Chickweed	<i>Cerastium arvense</i>
Chokecherry	<i>Prunus virginiana</i>
Clover	<i>Trifolium spp.</i>
Columbia Needlegrass	<i>Stipa columbiana</i>
Common Mullein	<i>Verbascum thapsis</i>
Common Peppergrass	<i>Lepidium densiflorum</i>
Common Yarrow	<i>Achillea millefolium</i>
Compound Fleabane	<i>Erigeron compositus</i>
Crested Wheatgrass	<i>Agropyron cristatum</i>
Currant	<i>Ribes spp.</i>
Dandelion	<i>Taraxacum officinale</i>
Death Camas	<i>Zygadenus venenosus</i>
Diffuse Knapweed	<i>Centaurea diffusa</i>
Douglas-fir	<i>Pseudotsuga menziesii</i>
Douglas' Sedge	<i>Carex douglasii</i>
Dune Goldenrod	<i>Solidago spathulata</i>
Early Blue Violet	<i>Viola adunca</i>
Fairy Candelabra	<i>Androsace septentrionalis</i>
Field Chickweed	<i>Cerastium arvense</i>
Goatsbeard	<i>Tragopogon pratense</i>
Hairy Goldaster	<i>Chrysopsis villosa</i>
Holboell's Rockcress	<i>Arabis holboellii</i>
Houndstongue	<i>Cynoglossum officianale</i>

Idaho Fescue
Kentucky Bluegrass
Locoweed
Low Oregongrape
Low Pussytoes
Mockorange
Needle-and-thread
Needlegrass
Nineleaf Lomatium
Nodding Onion
Nuttall's Pussytoes
Old Man's Whiskers
Orchardgrass
Pacific Anemone
Perennial Ryegrass
Pinegrass
Ponderosa Pine
Prairie Crocus
Prairie Groundsel
Prairie Junegrass
Prickly Phlox
Rabbitbrush
Richardson's Needlegrass
Rose
Rosy Pussytoes
Rough Fescue
Roundleaf Alumroot
Rush
Sagebrush Mariposa
Sagebrush
Sandberg's Bluegrass
Saskatoon
Scotch Bellflower
Sedge
Shaggy Fleabane
Shiny-Leaf Spirea
Shooting Star
Slender Hawksbeard
Slender Wheatgrass
Small-flowered Blue-eyed Mary
Small-flowered Penstemon
Smooth brome
Snowberry
Soopolallie
Spiny Phlox
Spotted Knapweed

Festuca idahoensis
Poa pratensis
Oxytropis campestris
Berberis repens
Antennaria dimorpha
Philadelphus lewisii
Stipa comata
Stipa spp.
Lomatium triternatum
Allium cernuum
Antennaria parvifolia
Geum triflorum
Dactylis glomerata
Anemone multifida
Lolium perenne
Calamagrostis rubescens
Pinus ponderosa
Anemone patens
Senecio canus
Koeleria cristata
Leptodactylon pungens
Chrysothamnus nauseosus
Stipa richardsonii
Rosa spp.
Antennaria microphylla
Festuca scabrella
Heuchra cylindrica
Juncus spp.
Calochortus macrocarpum
Artemesia spp.
Poa sandbergii
Amelanchier alnifolia
Campanula rotundifolia
Carex spp.
Erigeron pumilis
Spirea betulifolia
Dodecatheon pauciflorum
Crepis atrabarba
Agropyron trachycaulum
Collinsia parviflora
Penstemon procerus
Bromus inermis
Symphoricarpus albus
Shepherdia canadensis
Phlox rigida
Centaurea maculosa

Spreading Dogbane
Stickseed
Stoneseed
Sulphur Buckwheat
Sulphur Cinquefoil
Thin-leaved Owlclover
Thistle
Thompson's Paintbrush
Three-spot Mariposa Lily
Timber Milkvetch
Timothy
Tiny Penstemon
Trembling Aspen
Upland Larkspur
Viper's Bugloss
Western Meadow Aster
Western Needlegrass
Western Wheatgrass
Wheatgrass
White Clover
Wild Strawberry
Woolly Cinquefoil
Wyeth Buckwheat
Yellow Owlclover

Apocynum androsaemifolium
Lappula echinata
Lithospermum ruderae
Eriogonum umbellatum
Potentilla recta
Orthocarpus tenuifolius
Cirsium spp.
Castilleja thompsonii
Calochortus apiculatus
Astragalus miser
Phleum pratense
Penstemon confertus
Populus tremuloides
Delphinium nuttallianum
Echium vulgare
Aster campestris
Stipa occidentalis
Agropyron smithii
Agropyron spp
Trifolium repens
Fragaria virginiana
Potentilla hippiana
Eriogonum heracleoides
Orthocarpus luteus

Appendix 3. List of scientific and common plant names.

Scientific Name	Common Name
<i>Achillea millefolium</i>	Common Yarrow
<i>Agropyron cristatum</i>	Crested Wheatgrass
<i>Agropyron smithii</i>	Western Wheatgrass
<i>Agropyron spicatum</i>	Bluebunch Wheatgrass
<i>Agropyron spp.</i>	Wheatgrass
<i>Agropyron trachycaulum</i>	Slender Wheatgrass
<i>Agrostis alba</i>	Bentgrass
<i>Allium cernuum</i>	Nodding Onion
<i>Amelanchier alnifolia</i>	Saskatoon
<i>Androsace septentrionalis</i>	Fairy Candelabra
<i>Anemone multifida</i>	Pacific Anemone
<i>Anemone patens</i>	Prairie Crocus
<i>Antennaria dimorpha</i>	Low Pussytoes
<i>Antennaria microphylla</i>	Rosy Pussytoes
<i>Antennaria parvifolia</i>	Nuttall's Pussytoes
<i>Apocynum androsaemifolium</i>	Spreading Dogbane
<i>Arabis holboellii</i>	Holboell's Rockcress
<i>Arctostaphylos uva-ursi</i>	Bearberry
<i>Artemesia spp.</i>	Sagebrush
<i>Aster campestris</i>	Western Meadow Aster
<i>Astragalus miser</i>	Timber Milkvetch
<i>Balsamorhiza sagittata</i>	Balsamroot
<i>Berberis repens</i>	Low Oregongrape
<i>Bromus inermis</i>	Smooth brome
<i>Bromus tectorum</i>	Cheatgrass
<i>Calamagrostis rubescens</i>	Pinegrass
<i>Calochortus apiculatus</i>	Three-spot Mariposa Lily
<i>Calochortus macrocarpum</i>	Sagebrush Mariposa
<i>Campanula rotundifolia</i>	Scotch Bellflower
<i>Carex douglasii</i>	Douglas' Sedge
<i>Carex spp.</i>	Sedge
<i>Castilleja thompsonii</i>	Thompson's Paintbrush
<i>Ceanothus velutinus</i>	Buckbrush
<i>Centaurea diffusa</i>	Diffuse Knapweed
<i>Centaurea maculosa</i>	Spotted Knapweed
<i>Centaurea spp.</i>	Knapweed
<i>Cerastium arvense</i>	Chickweed
<i>Chrysopsis villosa</i>	Hairy Goldaster
<i>Chrysothamnus nauseosus</i>	Rabbitbrush

Cirsium spp.
Collinsia parviflora
Commandra umbellata
Crepis atrabarba
Cynoglossum officianale
Dactylis glomerata
Delphinium nuttallianum
Dodecatheon pauciflorum
Echium vulgare
Erigeron compositus
Erigeron pumilis
Eriogonum heracleoides
Eriogonum umbellatum
Festuca idahoensis
Festuca scabrella
Filago arvensis
Fragaria virginiana
Gaillardia aristata
Geum triflorum
Heuchra cylindrica
Juncus spp.
Koeleria cristata
Lappula echinata
Lepidium densiflorum
Leptodactylon pungens
Lewisia rediviva
Lithospermum ruderae
Lolium perenne
Lomatium triternatum
Lotus corniculatus
Medicago lupulina
Medicago sativa.
Orthocarpus luteus
Orthocarpus tenuifolius
Oxytropis campestris
Penstemon confertus
Penstemon procerus
Philadelphus lewisii
Phleum pratense
Phlox rigida
Pinus ponderosa
Poa compressa
Poa pratensis
Poa sandbergii
Poa spp.
Populus tremuloides

Thistle
 Small-flowered Blue-eyed Mary
 Bastard Toadflax
 Slender Hawksbeard
 Houndstongue
 Orchardgrass
 Upland Larkspur
 Shooting Star
 Viper's Bugloss
 Compound Fleabane
 Shaggy Fleabane
 Wyeth Buckwheat
 Sulphur Buckwheat
 Idaho Fescue
 Rough Fescue
 Filago
 Wild Strawberry
 Brown-eyed Susan
 Old Man's Whiskers
 Roundleaf Alumroot
 Rush
 Prairie Junegrass
 Stickseed
 Common Peppergrass
 Prickly Phlox
 Bitterroot
 Stoneseed
 Perennial Ryegrass
 Nineleaf Lomatium
 Birdsfoot Trefoil
 Black Medic
 Alfalfa
 Yellow Owlclover
 Thin-leaved Owlclover
 Locoweed
 Tiny Penstemon
 Small-flowered Penstemon
 Mockorange
 Timothy
 Spiny Phlox
 Ponderosa Pine
 Canada Bluegrass
 Kentucky Bluegrass
 Sandberg's Bluegrass
 Bluegrass
 Trembling Aspen

Potentilla hippiana
Potentilla recta
Potentilla spp.
Prunus virginiana
Pseudotsuga menziesii
Purshia tridentata
Ribes spp.
Rosa spp.
Senecio canus
Shepherdia canadensis
Sisyrinchium angustifolium
Solidago spathulata
Spirea betulifolia
Stipa columbiana
Stipa comata
Stipa occidentalis
Stipa richardsonii
Stipa spp.
Symphoricarpus albus
Taraxacum officinale
Tragopogon pratense
Trifolium hybridum
Trifolium repens
Trifolium spp.
Verbascum thapsis
Viola adunca
Zygadenus venenosus

Woolly Cinquefoil
Sulphur Cinquefoil
Cinquefoil
Common Chokecherry
Douglas-fir
Bitterbrush
Currant
Rose
Prairie Groundsel
Soopolallie
Blue-eyed Grass
Dune Goldenrod
Shiny-Leaf Spirea
Columbia Needlegrass
Needle-and-thread
Western Needlegrass
Richardson's Needlegrass
Needlegrass
Snowberry
Dandelion
Goatsbeard
Alsike Clover
White Clover
Clover
Common Mullein
Early Blue Violet
Death Camas