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THE EFFECT OF RANGE CONDITION AND INTENSITY OF GRAZING UPON
THE DAILY INTAKE AND NUTRITIVE VALUE OF THE DIET OF
SHEEP ON SUMMER RANGES OF NORTHERN UTAH

by

Merwyn Mortimer Kothmann

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Range Management

Approved:

UTAH STATE UNIVERSITY
Logan, Utah

1963

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INTRODUCTION

The mountainous ranges of the West are commonly used during the summer and have been used in this manner since the settlement of white men over a century ago. Many of these ranges have been mis-managed and are in poor condition. The productivity of these ranges greatly affects the economy of the nation; thus, if ranges in poor condition have a nutritive value lower than ranges in good condition, it results in an economic loss. Little work has been done to determine the nutritive value of mountainous summer ranges in good condition compared to similar ranges in poor condition.

This study was conducted to make the following comparisons between good and poor condition ranges grazed at two intensities:

1. The current year's production of forage,
2. The botanical composition of the diet of sheep,
3. The chemical content of the diets,
4. The digestibility of the ingested forage, and
5. The total daily forage consumption and nutritive intake of sheep.

REVIEW OF LITERATURE

Considerable research has been done to classify ranges into condition classes, but little work has been done to determine the nutritive content and digestibility of forage consumed on ranges in different conditions, or the effect of grazing intensity upon the nutritive content and digestibility of the forage.

Cook et al. (1953, 1962) and Piper et al. (1959) found that the nutrient content of herbage on desert ranges in good condition compared to ranges in poor condition depended upon the species composition. With a similar degree of utilization, the nutrients in herbage on poor range were as highly digested as the nutrients in herbage on good range. More intensive grazing decreased the daily intake of forage and the content of the more desirable nutrients in the forage. Digestibility of the nutrients in the forage consumed also decreased with more intensive grazing. Cook et al. (1962) found that where the same amount of forage was allowed per animal unit on good and poor range, the overall use was never as high on poor ranges as on good ranges.

Cook and Harris (1950a), Gobel and Cook (1960), and Humphrey (1949) reported that ranges in supposedly good condition produce at or near their maximum potential, whereas poor ranges produce less than their potential. Obvious changes which occur when ranges deteriorate from good to poor condition are changes in species composition and plant density (Klenmedson, 1956; Short and Woolfolk, 1956; Stewart et al., 1940; Parker, 1954; Reid and Pickford, 1946).

Renner and Johnson (1942) and Hutchings (1954) stated that poor

ranges had a greater number of plants low in nutritive value than good ranges, however, Gobel and Cook (1960) found that many species that were abundant on poor ranges were as nutritious as the species found on good ranges and in some cases were higher in nutritive content.

On the mountainous summer range of northern Utah, Cook and Harris (1950b) found that lignin increased with plant maturity and that phosphorus decreased. Forbes and Garrigus (1950) found that digestible organic matter was closely associated with lignin content of the forage and as the lignin increased, digestible organic matter decreased.

Cook et al. (1961), working with wet and dry ewes, reported that the digestibility of the forage on the summer range in northern Utah decreased somewhat from July 10 to September 21. The nutrient content of the diet varied widely from one study area to another. On all study areas forbs produced more forage than grasses but somewhat less than browse, and were intermediate in percent of the diet. On some areas grass made up the major portion of the diet and on other areas browse made up most of the diet.

DESCRIPTION OF THE AREA

The region is typical mountainous summer range grazed by cattle and sheep. Overgrazing and grazing too early in the spring has resulted in changes in the species composition of some areas compared to adjoining protected areas. Less palatable, undesirable species are more predominant on the unprotected ranges than on the protected ranges.

The average annual precipitation for the areas is about 30 inches with about one-fourth of it coming during the growing season. The majority of the precipitation is in the form of snow during the winter months. Maximum temperatures of 80 to 90 F are reached during the summer. Frost occurs frequently during June and during the latter part of August and September. All of the study areas except area 1 were at approximately 7,000 feet elevation. Area 1 was located at 6,000 feet elevation.

There were many species of grasses, forbs, and browse on the study areas. On the sagebrush-grass areas the primary grass species were Poa secunda,¹ Poa fendleriana, Festuca idahoensis, Agropyron smithii, Agropyron inerme, Stipa lettermani, Hesperochloa kingii, Agropyron trachycaulum, and Koeleria cristata. The major forbs present were Microseris nutans, Allium acuminatum, Phlox gracilis, Achillea lanulosa, Lupinus laxiflorus, Eriogonum heracleoides, Aster chilensis, subsp. adscendens, Arenaria congesta, Senecio integerrimus, Astragalus miser var. decumbens, and Cordylanthus ramosus. The major browse species were Artemisia cana,

¹ Common names are listed in appendix.

Artemisia arbuscula, Artemisia tridentata, Artemisia nova, Chrysothamnus viscidiflorus, Tetradymia canescens, Purshia tridentata, and Symphoricarpos vaccinioides.

On the aspen areas the major species of grasses were Bromus carinatus, Poa pratensis, and Agropyron subsecundum. The major forbs were Cynoglossum officinale, Thalictrum fendleri, Sidalcea neomexicana, Lupinus laxiflorus, Achillea lanulosa, Wyethia amplexicaulis, Taraxacum officinale, Vicia americana, and Viola vallicola. The major browse species was Symphoricarpos vaccinioides.

METHODS AND PROCEDURES

Seven study areas were selected on the Cache National Forest and adjoining private ranges where the ranges on opposite sides of existing fences were in distinctly different conditions. Areas 1, 2, 4, 6, and 7 were in the sagebrush-grass type and areas 3 and 5 were in the aspen type. Ranges on the protected side were classified as good condition range and those on the deteriorated side were classified as poor condition range. Areas 1, 2, and 3 were classified according to the method used by the U. S. Forest Service (1962) and areas 4, 5, 6, and 7 were classified according to the two-phase method currently being used by the Bureau of Land Management (1957). The study was conducted through the summer grazing seasons of 1961 and 1962, from mid-June to early September.

A 10-day digestion trial was run on each of the areas. The areas were fenced with equal volumes of herbage on each side, allowing enough so that the first five days would represent light use and the second five days would represent moderate to heavy use. Since the degree of utilization varied with each trial, the two intensities of utilization will be referred to as period one and period two. The individual areas ranged in size from $2\frac{1}{2}$ to 5 acres.

Herbage production was calculated by the method used by Edlefsen et al. (1960). Plots 5 feet square were located along transects throughout the area, and the average cover per plot determined for all species present. The air dry weight per one-fourth square foot of cover was determined by clipping from 30 to 50 such units of each

species. Production per plot was determined by multiplying the average cover per plot by the average weight per unit of cover. Pounds per acre were determined by multiplying the grams of forage per plot by 3.84.

Utilization of each species was determined by ocular estimate at the end of each five-day period. Diets were calculated for each of the periods within the trials by the method outlined by Edlefsen et al. (1960).

The sheep were grazed for an initial six-day adjustment period on similar adjacent range before the first trial each summer. Three days separated the final fecal collections of a trial from the initial fecal collections of the following trial. A longer adjustment period did not precede each successive trial because the vegetation was a complex mixture with many species in common on all areas.

Fourteen paired wether sheep were randomly assigned, seven to each side, and were used for fecal collections. The number of sheep used in each trial varied from five to seven with seven being used on most areas. In addition, eight sheep equipped with esophageal-fistula cannulae were assigned, four to each side. The sheep used for fecal collections were weighed with a 12-hour shrink before and after each trial. Salt and water were available at all times during the trials.

Each evening one-half of the cannulated sheep were penned and early the next morning they were equipped with collection bags and turned out with the rest of the sheep to collect forage samples. At the end of the morning grazing period the other half of the cannulated sheep were penned. When the evening grazing period began they were equipped with collection bags and turned out to graze. Only about 30 minutes to 1 hour was required to collect a forage sample.

The samples were drained of excess saliva, moistened with 95 percent ethyl alcohol, and stored in jars. The forage samples were composited for each sheep at the end of each five-day period, dried at 60 C, and ground through a Wiley mill to pass through a 1 millimeter screen. The samples were analyzed for total protein (nitrogen X 6.25), ether extract, lignin, cellulose, ash, other carbohydrates (by difference), gross energy, and phosphorus. Nitrogen was determined by the Gunning method as outlined by the A.O.A.C. (1945) except that ammonia was collected in boric acid as outlined by Scales and Harrison (1920). Ether extract was determined with a Goldfish extraction apparatus using an extraction period of 8 hours. Lignin was determined by the method suggested by Ellis et al. (1946), cellulose by the method of Matrone et al. (1946), ash by the A.O.A.C. method (1945), phosphorus by the method of Koenig et al. (1942) and gross energy by a Parr oxygen bomb adiabatic calorimeter.

The chemical analyses of the forage samples collected by the cannulated sheep were corrected for ash and phosphorus content of the saliva. The saliva content of the samples was determined by feeding masticated samples containing different amounts of moisture and determining the amount of saliva retained in each sample. A formula was derived to correct for saliva contamination of the forage samples which was dependent upon the moisture content of herbage in the diet.

Fecal collections were begun 24 hours after the first forage collections, and were terminated 24 hours after the last forage collections for each period. Sheep equipped with harnesses and bags were used to make total collections of feces. Fecal collection bags were emptied twice daily. Collections from each sheep were kept in

individual containers, and sprinkled once a day with a mixture of 98 percent ethyl alcohol and 2 percent concentrated hydrochloric acid to prevent mold. At the end of each five-day period the feces were weighed and then mixed on a sheet of canvas and a representative sample was taken. The samples were stored in air-tight plastic bags until they could be weighed and dried at 60 C. Fecal samples were processed and analyzed in the same manner described for forage samples.

The total daily intake and digestibility coefficients were determined by the lignin-ratio technique as given by Harris et al. (1959). The percent total digestible nutrients, percent digestible protein, and kilocalories of digestible energy in the forage consumed were calculated. Also the total daily intake in pounds of total digestible nutrients and digestible protein and megacalories of digestible energy were calculated.

The data were analyzed statistically using mean values for each trial instead of individual animals. The cost of analyzing the data with unequal subsample numbers was prohibitive. The use of mean values is a valid method and does not affect the experimental error used to test significance of the main effects or interactions involved.

RESULTS AND DISCUSSION

Production

On the sagebrush-grass areas, browse produced more herbage than forbs or grasses on all areas except the good condition range on area 2 (Table 1). On that range the production of all three classes of forage was nearly equal (Tables 13 and 14). Good sagebrush-grass range produced slightly more grass and less forbs and browse than poor range. On the aspen areas, good ranges produced more browse and poor ranges produced more grass and forbs.

There was less total production on good range than on poor range, but good range had a greater quantity of desirable species.¹

Table 1. Average pounds per acre of grasses, forbs, and browse on good and poor condition summer range for the years 1961 and 1962.

	<u>Grasses</u>		<u>Forbs</u>		<u>Browse</u>	
	<u>Good</u>	<u>Poor</u>	<u>Good</u>	<u>Poor</u>	<u>Good</u>	<u>Poor</u>
Sagebrush-grass	168.11	110.15	163.82	177.08	542.29	707.15
Aspen	226.80	240.19	337.08	377.61	438.54	405.11
		<u>Sagebrush-grass</u>			<u>Aspen</u>	
		<u>Good</u>	<u>Poor</u>		<u>Good</u>	<u>Poor</u>
Total production		874.22	994.38		1022.42	1022.91

¹ Data is found in Appendix.

Utilization

The degree of utilization was variable between areas and years. Since utilization on the aspen and sagebrush-grass areas was somewhat different, they will be discussed separately. The utilization of the desirable species varied from about 15 to 30 percent at the end of the first period and from 30 to 70 percent at the end of the second period. On sagebrush-grass range at the end of the first period, which was considered light use, the average utilization was 5.96 percent for good condition range and 4.81 percent for poor condition range. The percentage of utilization on grasses and forbs was heavier on poor condition range and utilization of browse was heavier on good condition range (Table 2).

Table 2. Average percentage utilization of grasses, forbs, and browse for two intensities of grazing on good and poor condition summer range from mid-June to early September, 1961 and 1962.

	Grasses		Forbs		Browse	
	Light	Heavy	Light	Heavy	Light	Heavy
Sagebrush-grass						
Good	10.8	26.7	8.0	24.8	2.9	6.9
Poor	14.7	38.4	10.5	30.0	2.2	5.8
Aspen						
Good	19.5	42.7	22.2	44.7	3.9	11.9
Poor	19.7	46.2	17.0	38.0	3.5	7.1

At the end of the second period, on good condition sagebrush-grass areas the average utilization of all species was 14.51 percent, and on poor condition range the average use was 12.71 percent. As was the case

during the first grazing period, grasses and forbs were utilized more heavily on poor range and browse was utilized more heavily on good range.

The average utilization was considerably heavier on aspen areas than on sagebrush-grass areas. On aspen areas at the end of the first period, the average utilization was 14.70 percent on good condition range and 12.22 percent on poor ranges. Grasses were utilized approximately the same on good and poor ranges, but forbs and browse were utilized heavier on good range.

At the end of the second period on aspen areas the average utilization of total herbage was 31.65 percent on good condition range and 26.81 percent on poor condition range. Grasses were utilized heavier on poor range at the end of the second period but forbs and browse were utilized heavier on good range.

In all cases, grass was utilized heavier on poor range, and browse was utilized heavier on good range. On aspen areas forbs were utilized heavier on good range, whereas on sagebrush-grass areas forbs were utilized heavier on poor range. On both aspen and sagebrush-grass areas and under both intensities of grazing, the average utilization of total herbage was greater on good range than on poor range.

Diets

The average percentage of grass, forbs, and browse in the diets was about the same on both good and poor ranges. Intensity of grazing did not appear to influence the average percentage of grasses, forbs, and browse in the diet on either good or poor ranges (Table 3). However, there was considerable difference among the forage classes in the diets

on aspen areas compared to sagebrush-grass areas. On sagebrush-grass areas the diet contained an average of 39.0 percent grasses, 33.6 percent forbs, and 27.3 percent browse. On the aspen areas the diet contained an average of 37.8 percent grasses, 47.3 percent forbs, and 14.5 percent browse.

Table 3. Average percentage of grasses, forbs, and browse in the diet of sheep on good and poor condition summer range for two intensities of grazing from mid-June to early September, 1961 and 1962.

	Grasses		Forbs		Browse	
	Light	Heavy	Light	Heavy	Light	Heavy
Sagebrush-grass						
Good	38.97	40.96	30.88	33.60	30.15	25.44
Average	39.96		32.24		27.79	
Poor	40.09	36.11	34.36	35.74	25.55	28.15
Average	38.10		35.05		26.85	
Average	39.53	38.53	32.62	34.67	27.85	26.79
Aspen						
Good	38.36	35.28	48.88	44.35	12.76	20.37
Average	36.82		46.61		16.56	
Poor	37.51	40.10	47.93	48.21	14.56	11.69
Average	38.80		48.07		13.12	
Average	37.93	37.69	48.40	46.28	13.66	16.03

Diets on the same areas differed greatly in species composition between years (Tables 9 and 10). In 1961, at the time trials began, Purshia tridentata had initiated new growth. It was readily eaten and comprised the majority of the diet. In 1962, when the first trial began, Purshia tridentata had not produced any new growth and as a result none was eaten.

Sheep exhibited a preference for some species when they were in certain growth stages. Lupinus laxiflorus was not grazed until its pods were mature and then it was utilized heavily. Symphoricarpos vaccinioides was grazed lightly until its fruit matured and then it was utilized heavily.

Nutrient Content of Diet

The percentage of ether extract in the diet was not influenced by range condition or by intensity of grazing. There was a significant difference between years but there was no significant difference among areas (Tables 4 and 5).

During both years there was a highly significant decrease in the percentage of total protein in the diet with increased intensity of utilization on both good and poor ranges. This was probably due to increased consumption of coarser portions of the plant. Total protein was slightly higher on poor range than good range during both years but the difference was not statistically significant (Tables 4 and 5). There was a highly significant difference between years in the percentage of total protein in the diet. In 1962 there was more moisture during the spring and rains in mid-July kept the forage green longer than in 1961, which may explain the difference between years. A decline in the total protein content as the forage matured was believed to be largely responsible for the significant differences among areas.

There was a highly significant increase in the ash content of the forage consumed with heavier utilization. This may be due to the parts of the plant consumed and to more dirt on the lower portion of the plants. The ash content of the diet on poor range was significantly

Table 4. Average nutrient content of the diet of sheep equipped with esophageal-fistula cannulae on good and poor condition summer range grazed at two intensities from mid-June to early September, 1961 and 1962.

		Ether extract	Total protein	Ash	Lignin	Cell- ulose	Other carbohy- drates	Phos- phorus	Gross energy
		%	%	%	%	%	%	%	kcal/lb
1961									
Good	Period 1	4.4	11.2	9.3	15.2	22.1	37.9	.25	1983
	Period 2	4.4	10.2	10.3	15.0	21.7	38.5	.26	1970
	Average	4.4	10.7	9.8	15.1	21.9	38.2	.26	1976
Poor	Period 1	4.2	12.0	10.2	13.9	21.8	38.7	.26	1967
	Period 2	4.0	10.3	10.8	16.1	21.3	37.3	.26	1967
	Average	4.1	11.2	10.5	15.0	21.6	38.0	.26	1967
	Period 1 average	4.3	11.6	9.7	14.5	21.9	38.3	.25	1975
	Period 2 average	4.2	10.2	10.5	15.5	21.5	37.9	.26	1968
1962									
Good	Period 1	3.7	12.2	11.7	14.5	20.0	37.9	.32	1958
	Period 2	3.7	11.9	11.8	15.6	20.6	36.4	.33	1953
	Average	3.7	12.0	11.8	15.0	20.3	37.2	.32	1955
Poor	Period 1	3.4	13.1	11.8	14.4	18.2	39.3	.34	1955
	Period 2	3.4	12.2	12.5	15.3	19.4	37.3	.33	1949
	Average	3.4	12.6	12.1	14.8	18.8	38.3	.33	1951
	Period 1 average	3.5	12.6	11.7	14.4	19.1	38.6	.33	1956
	Period 2 average	3.5	12.0	12.2	15.4	20.0	36.8	.33	1950

Table 5. Analysis of variance of the nutrient content of the diet of sheep equipped with esophageal-fistula cannulae on good and poor condition summer range for two years on seven areas and two intensities of grazing.

Source of variation	Degrees of freedom	Mean square							
		Ether extract	Total protein	Ash	Lignin	Cellulose	Other carbohydrates	Phosphorus	Gross energy
Year (Y)	1	7.143*	28.71**	43.75**	0.06	67.54**	2.88	.07214**	4554.
Area (A)	6	3.398	20.43*	2.76	69.67*	22.83*	18.56	.03203**	3548.
Y X A error (a)	6	1.393	3.24	3.10	13.43	3.80	20.06	.00277	2863.
Condition (C)	1	0.686	4.07	4.51 ^a	0.27	11.07	1.89	.00112	611.
Y X C	1	0.071	0.08	0.30	0.04	4.63	4.07	.00002	100.
Pooled error (b)	12	0.290	2.54	1.27	1.97	7.12	3.89	.00080	540.
Intensity (I)	1	0.058	14.30**	4.86**	13.90**	1.11	14.91 ^a	.00021	534.
C X I	1	0.035	1.61	0.00	4.29	0.30	6.24	.00079	90.
Y X I	1	0.046	1.90	0.62	0.02	5.98	6.11	.00000	1.
Y X C X I	1	0.000	0.04	0.95	5.34 ^a	0.43	1.97	.00015	212.
Pooled error (c)	24	0.209	1.18	0.48	1.68	3.27	3.69	.00038	938.

^a Significant at the .10 level of probability

* Significant at the .05 level of probability

** Significant at the .01 level of probability

higher at the .10 level of probability than the ash content of the diet on good range. Heavier use on the more palatable species was probably responsible for this difference.

Lignin in the forage showed a significant increase as the plants matured. The lignin content of the forage was about 10 percent on the areas grazed early in the season and increased to about 17 percent on the areas grazed later in the season. The percentage of lignin in the diet was about the same under both intensities of grazing on good range in 1961 but in all other cases lignin increased with increased intensity of grazing. Increased consumption of coarser parts of the plants could account for increased lignin under heavier utilization. Range condition had no effect on the average percentage of lignin in the diet.

Neither range condition nor intensity of grazing affected the percentage of cellulose in the diet. The percentage of cellulose in the diet was significantly different among areas. Cellulose in the diet was lower on areas where more grass and less forbs and browse were consumed. There was a highly significant difference between years. In 1961 the percentage of cellulose in the diet was about 2 percent higher than in 1962. This may be a result of the more favorable weather conditions in 1962 which prevented the forage from maturing as quickly as it did in 1961.

"Other carbohydrates" showed no significant differences between years, areas, or conditions. There was a slight decrease in the content of "other carbohydrates" in the diet with increased utilization.

The phosphorus content of the diet in 1962 was significantly higher than in 1961. More moisture and greener forage in 1962 were the probable causes of the higher phosphorus content of the diet in 1962.

Both years the phosphorus content of the forage decreased as the vegetation matured. Range condition and intensity of grazing had no significant effect upon the phosphorus content of the diet.

The gross energy in the diet was not affected by condition, intensity of grazing, years, or areas. The variation found appeared to be completely random.

Digestibility and Nutritive Intake

The digestibility of protein did not differ significantly between years but was significantly different among areas (Tables 6 and 7). The digestibility of protein was highest at the beginning of the summer and decreased as the forage matured. The digestibility coefficient for protein was significantly higher ($P < .10$) on poor range than on good range. A highly significant interaction between range condition and intensity of use was found. On good range the digestibility of protein increased the second period and on poor range the digestibility of protein decreased during the second period.

The percentage of digestible protein differed significantly ($P < .01$) among areas. The content was highest early in the summer and decreased rather consistently as the forage matured. Poor range produced a significantly greater amount of digestible protein than good range. The interaction of condition and intensity of grazing was statistically significant. The percentage of digestible protein in the diet was higher the first period on poor range, but was higher the second period on good range.

The pounds of digestible protein consumed on poor range was significantly higher ($P < .10$) than the pounds consumed on good range.

Table 6. Average daily intake, percent digestible nutrients in the forage, and nutrient intake of sheep on good and poor condition summer range with two intensities of grazing from mid-June to early September, 1961 and 1962.

		Percent digestibility										
		Daily intake	Total protein	Cellulose	Other carbohydrates	Gross energy	Total digestible nutrients	Digestible protein	Digestible energy	Total digestible nutrients	Digestible protein	Digestible energy
		lb/day					%	%	kcal/lb	lb/day	lb/day	megacal/day
1961												
Good	Period 1	1.63	16.1	33.0	55.7	21.7	30.7	1.94	432.	0.52	.035	0.739
	Period 2	1.73	19.4	33.6	54.0	24.4	30.8	2.16	477.	0.55	.044	0.973
	Average	1.68	17.7	33.3	54.8	23.0	30.7	2.05	454.	0.53	.039	0.856
Poor	Period 1	1.78	29.1	38.9	61.8	29.4	36.6	3.95	578.	0.68	.075	1.091
	Period 2	1.58	19.1	28.5	50.3	21.3	27.7	2.14	419.	0.47	.038	0.724
	Average	1.68	24.1	33.7	56.0	25.3	32.1	3.04	498.	0.57	.056	0.907
	Period 1 average	1.70	22.6	35.9	58.7	25.5	33.6	2.94	505.	0.60	.055	0.915
	Period 2 average	1.65	19.2	31.0	52.1	22.8	29.2	2.15	448.	0.51	.041	0.848
1962												
Good	Period 1	2.05	18.1	35.9	64.3	30.7	34.4	2.32	598.	0.70	.049	1.228
	Period 2	2.06	20.1	31.0	59.4	26.7	31.3	2.58	520.	0.67	.056	1.142
	Average	2.05	19.1	33.4	61.8	28.7	32.8	2.45	559.	0.68	.052	1.185
Poor	Period 1	2.02	23.5	33.4	67.7	31.5	36.3	3.42	616.	0.75	.072	1.312
	Period 2	1.87	19.9	27.7	57.4	24.6	29.2	2.67	479.	0.58	.055	0.940
	Average	1.94	21.7	30.5	62.5	28.0	32.7	3.04	547.	0.66	.063	1.126
	Period 1 average	2.03	20.8	34.6	66.0	31.0	35.3	2.87	607.	0.72	.060	1.270
	Period 2 average	1.96	20.0	29.3	58.4	25.6	30.2	2.62	499.	0.62	.055	1.041

Table 7. Analysis of variance of the average daily intake, percent digestibility of nutrients in the forage, and nutritive intake of sheep on good and poor condition summer range for two years on seven areas and two intensities of grazing.

Source of variation	Degrees of freedom	Mean squares										
		Percent digestibility										
		Daily intake lb/day	Total protein	Cellulose	Other carbohydrates	Gross energy	Total digestible nutrients %	Digestible protein %	Digestible energy kcal/lb	Total digestible nutrients lb/day	Digestible protein lb/day	Digestible energy megacal / day
Year (Y)	1	1.405**	3.91	30.61	634.50*	244.45	26.06	0.55	83006.	.2138	.0014	1.260
Area (A)	6	.567 ^a	1623.52*	1355.13*	179.17	623.18	404.76 ^a	29.22**	232718.	.3530 ^a	.0142**	1.617
Y X A error (a)	6	.157	244.79	296.62	111.17	261.38	122.62	3.04	102139.	.1039	.0016	.634
Condition (C)	1	.041	279.91 ^a	21.63	12.54	9.61	6.05	8.87*	3681.	.0018	.0027 ^a	.007
Y X C	1	.038	49.03	39.78	1.00	30.61	7.87	0.55	10920.	.0114	.0001	.094
Pooled error (b)	12	.094	92.31	124.35	87.81	74.07	35.89	1.63	27844.	.0396	.0006	.200
Intensity (I)	1	.050	60.49	362.10*	712.14**	232.07**	319.69**	3.76 ^a	95618.**	.1207*	.0013	.425*
C X I	1	.182 ^a	310.20**	121.84	199.51*	168.71*	150.49**	8.17*	60720.*	.1302*	.0045**	.532*
Y X I	1	.002	22.89	0.64	3.55	24.98	1.93	1.07	9002.	.0005	.0003	.042
Y X C X I	1	.017	50.16	89.01	16.83	54.81	23.14	0.93	18288.	.0098	.0004	.039
Pooled error (c)	24	.043	34.60	75.26	33.30	28.14	18.92	1.24	9903.	.0195	.0005	.083

^a Significant at the .10 level of probability

* Significant at the .05 level of probability

** Significant at the .01 level of probability

The interaction between condition of range and intensity of use was highly significant. On good range there was more digestible protein consumed the second period than during the first period; whereas, on poor range there was more digestible protein consumed the first period.

The digestibility of cellulose decreased significantly with heavier utilization, but was not affected by range condition (Tables 6 and 7).

The digestibility of "other carbohydrates" was significantly higher in 1962 than in 1961. There was a highly significant difference in the digestibility of "other carbohydrates" between the two intensities of grazing, and the interaction of conditions and intensities was significant. On poor range the digestibility of "other carbohydrates" was about 10 percent higher the first period than it was the second period. On good range the digestibility the first period was about 3 percent greater than it was the second period.

Year, area, and condition had no significant effect upon the digestibility of gross energy, but intensity of grazing had a highly significant effect. The interaction of condition and intensity was statistically significant. The digestibility of gross energy was considerably lower the second period on poor range. On good range the digestibility was only slightly higher the first period.

The kilocalories of digestible energy per pound of forage consumed was higher in 1962 than in 1961, but the difference was not statistically significant. Range condition did not affect the content of digestible energy in the forage consumed, but the intensity of grazing had a highly significant effect. The interaction of condition and intensity was also significant. On poor range the kilocalories of digestible energy in the forage was consistently less the second period

than the first, but on good range there was no consistent trend. This same relation was observed with the digestibility of gross energy, and the daily intake in megacalories of digestible energy.

There was no significant difference between the percentage of total digestible nutrients in the forage consumed on good range compared to poor range. Intensity of grazing and the interaction of condition and intensity were highly significant. On poor range the percentage of total digestible nutrients in the diet the first period was almost 10 percent higher than it was in the second period. On good range the percentage of total digestible nutrients the first period was about 2 percent higher than it was the second period (Table 6).

Years and range condition had no significant effect upon the daily intake of total digestible nutrients. Animals consumed more total digestible nutrients early in the summer than they did late in the summer. There was a significant decrease in the intake of total digestible nutrients during the second grazing period compared to the first period on poor range, but there was no difference between periods on good range.

Daily Intake

A highly significant difference was observed between the average daily intake in 1961 and 1962. The average daily intake was .31 pounds per day higher in 1962. The forage in 1962 remained green longer and the sheep used in the trials in 1962 weighed 14 pounds per head less than the ones used in 1961 (Table 8). The difference between the forage and age and condition of the sheep probably accounts for the difference between years. There was a significant difference ($P < .10$) between the

Table 8. Sheep weights on and off trials for the summers of 1961 and 1962.

Area	Time	1961		1962	
		Good average weight	Poor average weight	Good average weight	Poor average weight
		lbs.	lbs.	lbs.	lbs.
1	on	153	152	138	139
	off	156	151	141	141
Gain		3	-1	3	2
2	on	146	156	142	137
	off	150	163	148	141
Gain		4	7	6	4
3	on	153	166	145	144
	off	154	164	143	149
Gain		1	-2	-2	5
4	on	155	156	148	147
	off	160	152	153	151
Gain		4	-4	5	4
5	on	158	153	152	150
	off	154	154	152	150
Gain		-4	1	0	0
6	on	154	154	146	151
	off	153	155	150	152
Gain		-1	1	4	1
7	on	158	151	149	153
	off	159	148	151	160
Gain		1	-3	2	7
Total gain		8	-1	18	23

average daily intake on the different areas. There seemed to be a close association between the intake of forage and the digestibility of cellulose. On the areas where cellulose digestibility was high, intake was high, and where cellulose digestibility was low, intake was also low. There was no significant effect of range condition or intensity of grazing on daily intake, but the interaction between range condition and intensity of grazing was significant at the .10 level of probability. There was a slight increase in the daily intake of forage with heavier utilization on good range, but on poor range there was a marked decrease in the daily intake with heavier utilization.

SUMMARY AND CONCLUSIONS

During the summers of 1961 and 1962 a study was conducted on the mountainous summer range of northern Utah to determine the effect of range condition and intensity of grazing upon the daily intake, nutritive content and digestibility of the grazing sheep's diet.

Seven areas displaying fence-line contrasts of good and poor range were selected and fenced so that each side included equal amounts of herbage for the same number of experimental animals. Seven wethers equipped with fecal collecting bags and four sheep equipped with esophageal-fistula cannulae were grazed on each side of the fence. Each paddock was grazed for two five-day periods, the first represented light use, and the second represented heavy use. Daily intake and digestibility were determined by the lignin-ratio method.

Ranges in poor condition produced slightly more total herbage than similar ranges in good condition but good ranges had a greater quantity of palatable plants.

Although the same quantity of herbage was allowed on both good and poor ranges, the average utilization was heavier on good ranges. Grasses received more use and browse received less use on poor range.

The diets of the sheep fluctuated greatly from one area to another, but the average percentage of grasses, forbs, and browse contained in the diets was about the same on good range as on poor range and did not change materially with increased intensity of use.

The nutrient content of the diet on good and poor range did not differ significantly ($P < .05$). With increased use on both good and

poor ranges the content of total protein and "other carbohydrates" in the diet decreased and ash and lignin increased. These differences were more pronounced on poor range than on good range.

The average digestibility of cellulose, "other carbohydrates", and gross energy for both good and poor range condition decreased with heavier utilization. On good range, however, the digestibility of total protein increased with increased utilization, but on poor range it decreased. On good condition range the digestibility of "other carbohydrates" and gross energy decreased slightly; whereas, on poor range there was a substantial decrease with increased utilization.

Total digestible nutrients in the forage decreased on both good and poor ranges with increased use, but the decrease was much less on good range. On poor range the digestible protein decreased with increased use, but on good range it increased. Digestible energy was lower the second period on both good and poor range than the first period, but this difference was more pronounced on poor range.

Daily intake increased slightly during the second grazing period on good range but decreased markedly during the second period on poor range.

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APPENDIX

Table 9. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 1, June 14-23, 1961.

Species	lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Poa secunda</u>	48.15	17.08	7.70	35.77	4.10
<u>Stipa lettermani</u>	13.17	18.89	2.33	60.00	2.47
<u>Sitanion hystrix</u>	9.79	0.00	0.00	6.36	0.28
<u>Melica bulbosa</u>	3.65	0.00	0.00	5.00	0.08
<u>Koeleria cristata</u>	24.31	9.37	2.12	41.25	3.53
<u>Agropyron trachycaulum</u>	25.77	2.50	0.61	50.00	5.58
<u>Carex spp.</u>	2.46	45.00	1.03	80.00	0.39
Grasses	127.30	11.59	13.79	39.90	16.43
<u>Lomatium grayi</u>	7.49	5.00	0.34	51.25	1.58
<u>Microseris nutans</u>	15.36	1.25	0.18	32.50	2.19
<u>Delphinium nelsonii</u>	1.15	6.67	0.07	63.33	0.29
<u>Wyethia amplexicaulis</u>	45.62	20.00	8.54	66.67	9.71
<u>Viola vallicola</u>	1.00	0.00	0.00	65.00	0.30
<u>Astragalus argophyllus</u>	1.08	0.00	0.00	0.00	0.00
<u>Achillea lanulosa</u>	26.50	4.17	1.03	44.00	4.74
<u>Aster chilensis</u> subsp. <u>adscendens</u>	28.30	15.00	3.97	57.50	5.49
<u>Allium acuminatum</u>	9.45	17.69	1.57	59.23	1.79
<u>Phlox gracilis</u>	8.60	0.00	0.00	0.00	0.00
Forbs	144.54	11.61	15.70	51.19	26.09
<u>Artemisia arbuscula</u>	672.84	0.00	0.00	1.93	5.92
<u>Purshia tridentata</u>	226.18	33.33	70.51	83.33	51.56
<u>Artemisia tridentata</u>	107.71	0.00	0.00	0.00	0.00
Browse	1006.73	7.49	70.51	20.02	57.48
Totals and averages	1278.57	8.36	100.00	25.51	100.00

Table 10. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 1, June 9-18, 1962.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Poa secunda</u>	103.14	14.00	21.59	42.50	23.75
<u>Sitanion hystrix</u>	29.33	8.33	3.66	34.16	6.13
<u>Koeleria cristata</u>	17.98	15.00	4.04	62.50	6.90
<u>Poa pratensis</u>	1.89	15.00	0.42	90.00	1.14
<u>Agropyron trachycaulum</u>	23.90	25.00	8.93	50.00	4.83
<u>Danthonia intermedia</u>	2.99	70.00	3.13	70.00	0.00
<u>Melica bulbosa</u>	0.65	3.33	0.02	45.00	0.21
Grasses	179.88	15.54	41.79	45.10	42.96
<u>Delphinium nelsonii</u>	18.86	4.00	1.13	55.00	7.77
<u>Viola vallicola</u>	7.68	0.00	0.00	0.00	0.00
<u>Microseris nutans</u>	14.32	13.12	2.80	56.25	4.99
<u>Allium acuminatum</u>	24.50	33.18	12.15	75.00	8.28
<u>Phlox gracilis</u>	37.06	0.00	0.00	0.00	0.00
<u>Achillea lanulosa</u>	18.62	14.17	3.95	39.00	3.74
<u>Collomia tenella</u>	1.69	0.00	0.00	17.50	0.24
<u>Senecio integerrimus</u>	1.03	0.00	0.00	0.00	0.00
<u>Camassia quamash</u>	20.16	23.33	7.04	66.67	7.06
<u>Lomatium grayi</u>	14.25	6.67	1.41	71.67	7.49
<u>Aster chilensis</u> subsp. <u>adscendens</u>	8.48	12.50	1.59	38.75	1.80
<u>Eriogonum heracleoides</u>	0.89	0.00	0.00	80.00	0.57
<u>Wyethia amplexicaulis</u>	30.14	55.00	24.79	90.00	8.52
Forbs	197.68	18.55	54.86	50.15	50.46
<u>Artemisia arbuscula</u>	498.97	0.45	3.35	1.36	3.67
<u>Purshia tridentata</u>	11.97	0.00	0.00	30.00	2.91
<u>Artemisia tridentata</u>	18.51	0.00	0.00	0.00	0.00
Browse	529.45	0.42	3.35	1.96	6.58
Totals and averages	907.01	7.37	100.00	21.02	100.00

Table 11. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 1, June 14-23, 1961.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Poa secunda</u>	9.60	30.00	3.91	56.67	3.80
<u>Agropyron smithii</u>	2.19	3.33	0.10	36.67	1.07
<u>Bromus tectorum</u>	0.73	0.00	0.00	0.00	0.00
<u>Poa fendleriana</u>	9.33	30.00	3.91	82.00	7.18
<u>Melica bulbosa</u>	4.80	0.00	0.00	10.00	0.72
<u>Sitanion hystrix</u>	31.80	0.00	0.00	52.50	24.71
<u>Agropyron trachycaulum</u>	1.77	7.50	0.18	20.00	0.33
<u>Stipa lettermani</u>	14.44	31.67	6.39	79.17	10.15
<u>Koeleria cristata</u>	1.00	0.00	0.00	85.00	1.27
Grasses	75.66	13.72	14.49	57.68	49.23
<u>Viola vallicola</u>	1.42	0.00	0.00	77.00	1.62
<u>Microseris nutans</u>	14.28	4.50	0.91	57.00	11.11
<u>Achillea lanulosa</u>	23.81	9.17	3.05	41.67	11.47
<u>Aster chilensis</u> subsp. <u>adscendens</u>	3.11	20.00	0.87	83.33	2.93
<u>Phlox gracilis</u>	4.50	0.00	0.00	0.00	0.00
<u>Lomatium grayi</u>	1.65	0.00	0.00	3.33	0.09
<u>Allium acuminatum</u>	14.98	45.00	9.44	81.82	8.19
<u>Astragalus argophyllus</u>	2.27	0.00	0.00	0.00	0.00
Forbs	66.02	15.44	14.27	51.63	35.41
<u>Chrysothamnus viscidiflorus</u>	0.88	50.00	0.62	70.00	0.26
<u>Purshia tridentata</u>	67.89	70.00	66.42	80.00	10.06
<u>Artemisia tridentata</u>	148.49	0.00	0.00	0.00	0.00
<u>Artemisia arbuscula</u>	1171.05	0.13	2.12	0.40	4.67
<u>Amelanchier alnifolia</u>	2.49	60.00	2.08	70.00	0.37
Browse	1390.80	3.67	71.24	4.41	15.36
Totals and averages	1532.48	4.67	100.00	9.07	100.00

Table 12. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 1, June 9-18, 1962.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Poa fendleriana</u>	50.27	3.13	8.29	32.22	23.28
<u>Sitanion hystrix</u>	10.94	2.14	1.23	13.57	1.99
<u>Stipa lettermani</u>	11.48	19.17	11.54	45.00	4.72
<u>Koeleria cristata</u>	9.48	0.00	0.00	60.00	9.06
<u>Poa secunda</u>	26.84	14.00	19.75	44.00	12.81
<u>Melica bulbosa</u>	0.42	0.00	0.00	6.67	0.05
Grasses	109.43	7.10	40.81	36.90	51.91
<u>Viola vallicola</u>	9.29	5.00	2.48	6.25	0.19
<u>Phlox gracilis</u>	39.09	0.00	0.00	0.00	0.00
<u>Microseris nutans</u>	32.26	12.92	21.92	40.83	14.31
<u>Delphinium nelsonii</u>	25.73	3.89	5.27	17.78	5.68
<u>Allium acuminatum</u>	26.76	14.09	19.83	46.78	13.92
<u>Achillea lanulosa</u>	18.05	5.00	4.73	20.00	4.32
<u>Collomia tenella</u>	1.46	5.00	0.39	12.50	0.16
<u>Sidalcea neomexicana</u>	0.38	0.00	0.00	0.00	0.00
<u>Lomatium grayi</u>	6.72	7.00	2.48	39.00	3.43
Forbs	159.74	6.80	57.10	23.32	42.01
<u>Artemisia arbuscula</u>	589.82	0.00	0.00	0.14	1.32
<u>Purshia tridentata</u>	11.98	3.33	2.09	28.33	4.76
<u>Artemisia tridentata</u>	23.77	0.00	0.00	0.00	0.00
Browse	625.57	0.06	2.09	0.67	6.08
Totals and averages	894.74	2.13	100.00	9.14	100.00

Table 13. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 2, June 29- July 8, 1961.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Stipa lettermani</u>	48.31	6.56	16.59	12.06	12.39
<u>Festuca idahoensis</u>	147.80	2.00	15.51	11.67	48.82
<u>Koeleria cristata</u>	15.13	2.50	2.01	5.38	1.51
<u>Agropyron smithii</u>	26.61	6.00	8.33	6.37	0.35
<u>Poa secunda</u>	19.32	1.67	1.70	2.00	0.20
<u>Sitanion hystrix</u>	5.91	0.00	0.00	0.00	0.00
Grasses	263.08	3.21	44.14	10.24	63.27
<u>Achillea lanulosa</u>	116.51	2.84	17.28	4.62	7.10
<u>Taraxacum officinale</u>	6.60	0.00	0.00	37.50	8.46
<u>Senecio integerrimus</u>	12.83	0.00	0.00	0.00	0.00
<u>Arenaria congesta</u>	34.52	9.67	17.44	12.33	3.13
<u>Microseris nutans</u>	18.74	1.25	1.24	2.44	0.76
<u>Aster chilensis</u> subsp. <u>adscendens</u>	13.59	14.00	9.95	26.00	5.59
<u>Phlox gracilis</u>	1.08	0.00	0.00	0.00	0.00
<u>Allium acuminatum</u>	1.77	0.00	0.00	0.00	0.00
<u>Lupinus laxiflorus</u>	48.50	0.00	0.00	0.00	0.00
<u>Collomia tenella</u>	1.34	0.00	0.00	0.00	0.00
<u>Epilobium paniculatum</u>	0.19	0.00	0.00	0.00	0.00
<u>Eriogonum heracleoides</u>	21.00	9.00	9.95	25.00	11.54
Forbs	276.75	3.86	55.86	7.74	36.73
<u>Chrysothamnus viscidiflorus</u>	94.58	0.00	0.00	0.00	0.00
<u>Artemisia tridentata</u>	149.76	0.00	0.00	0.00	0.00
<u>Artemisia cana</u>	22.50	0.00	0.00	0.00	0.00
Browse	266.84	0.00	0.00	0.00	0.00
Totals and averages	806.67	2.37	100.00	6.00	100.00

Table 14. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 2, June 22- July 1, 1962.

Species	lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Koeleria cristata</u>	20.47	3.00	2.29	5.50	1.22
<u>Poa secunda</u>	38.17	1.67	2.35	5.00	2.99
<u>Agropyron smithii</u>	31.65	9.38	10.96	22.50	9.81
<u>Festuca idahoensis</u>	155.44	2.50	14.39	5.83	12.22
<u>Stipa lettermani</u>	12.48	18.88	8.72	40.55	6.37
<u>Sitanion hystrix</u>	6.99	6.24	1.64	7.14	0.14
<u>Melica bulbosa</u>	12.28	0.00	0.00	0.00	0.00
<u>Agropyron trachycaulum</u>	13.86	0.00	0.00	0.00	0.00
Grasses	291.34	3.75	40.35	8.50	32.75
<u>Achillea lanulosa</u>	72.27	0.83	2.24	8.33	12.80
<u>Aster chilensis</u> subsp. <u>adscendens</u>	4.01	17.14	2.56	50.62	3.16
<u>Microseris nutans</u>	39.74	7.78	11.45	9.44	1.57
<u>Phlox gracilis</u>	13.36	0.00	0.00	0.00	0.00
<u>Arenaria congesta</u>	77.26	12.08	34.51	33.33	38.73
<u>Senecio integerrimus</u>	27.46	3.33	3.38	3.33	0.00
<u>Allium acuminatum</u>	1.46	16.25	0.87	65.00	1.67
<u>Lupinus laxiflorus</u>	37.09	0.00	0.00	0.00	0.00
<u>Taraxacum officinale</u>	6.87	8.33	2.13	30.00	3.51
<u>Eriogonum heracleoides</u>	8.83	7.50	2.45	35.00	5.74
<u>Zigadenus paniculatis</u>	4.41	0.00	0.00	0.00	0.00
<u>Collomia tenella</u>	0.62	2.50	0.06	7.50	0.07
Forbs	293.38	5.50	59.65	15.21	67.25
<u>Chrysothamus viscidiflorus</u>	67.43	0.00	0.00	0.00	0.00
<u>Artemisia tridentata</u>	120.23	0.00	0.00	0.00	0.00
Browse	187.66	0.00	0.00	0.00	0.00
Totals and averages	772.38	3.50	100.00	8.98	100.00

Table 15. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 2, June 29- July 8, 1961.

Species	lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Stipa lettermani</u>	60.06	13.33	28.91	37.50	12.97
<u>Festuca idahoensis</u>	47.08	0.00	0.00	24.00	10.10
<u>Poa secunda</u>	14.48	25.00	13.11	34.00	1.17
<u>Agropyron smithii</u>	1.57	3.33	0.21	36.67	0.47
<u>Poa pratensis</u>	0.77	15.00	0.42	40.00	0.17
<u>Koeleria cristata</u>	8.68	0.00	0.00	16.00	1.25
<u>Sitanion hystrix</u>	11.25	8.75	3.57	32.50	2.39
<u>Agropyron trachycaulum</u>	26.30	10.00	9.53	30.00	4.71
<u>Stipa columbiana</u>	2.65	0.00	0.00	20.00	0.48
Grasses	172.84	8.93	55.75	30.72	33.71
<u>Achillea lanulosa</u>	27.65	2.00	2.02	25.00	5.68
<u>Senecio integerrimus</u>	80.72	0.00	0.00	1.43	1.03
<u>Aster chilensis</u> subsp. <u>adscendens</u>	101.84	8.33	30.62	42.50	31.12
<u>Taraxacum officinale</u>	24.38	9.00	7.93	18.00	1.96
<u>Phlox gracilis</u>	142.77	0.00	0.00	0.00	0.00
<u>Lepidium montanum</u>	0.19	15.00	0.11	67.50	0.09
<u>Capsella bursa-pasturus</u>	0.31	15.00	0.16	47.50	0.09
<u>Microseris nutans</u>	12.52	7.50	3.41	42.50	3.92
<u>Chenopodium leptophyllum</u>	26.50	0.00	0.00	58.00	13.75
<u>Epilobium paniculatum</u>	0.46	0.00	0.00	5.00	0.03
<u>Collomia tenella</u>	2.84	0.00	0.00	50.00	1.28
<u>Madia glomerata</u>	6.22	0.00	0.00	28.33	1.59
<u>Lupinus laxiflorus</u>	10.79	0.00	0.00	47.50	4.59
<u>Arenaria congesta</u>	3.87	3.33	0.00	66.67	1.16
<u>Zigadenus paniculatis</u>	1.03	0.00	0.00	0.00	0.00
Forbs	442.09	2.77	44.25	19.56	66.29
<u>Chrysothamnus viscidiflorus</u>	771.99	0.00	0.00	0.00	0.00
<u>Artemisia cana</u>	196.02	0.00	0.00	0.00	0.00
<u>Artemisia tridentata</u>	146.76	0.00	0.00	0.00	0.00
Browse	1114.77	0.00	0.00	0.00	0.00
Totals and averages	1729.70	1.60	100.00	8.07	100.00

Table 16. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 2, June 22- July 1, 1962.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Koeleria cristata</u>	5.00	6.67	1.28	10.00	0.32
<u>Festuca idahoensis</u>	53.18	3.00	6.01	15.00	12.54
<u>Sitanion hystrix</u>	5.49	8.33	1.73	17.50	0.98
<u>Poa secunda</u>	29.81	13.00	14.30	40.00	15.47
<u>Agropyron smithii</u>	1.39	3.33	0.17	28.33	0.70
<u>Melica bulbosa</u>	9.48	0.00	0.00	0.00	0.00
<u>Poa fendleriana</u>	8.14	0.00	0.00	15.00	2.40
<u>Stipa columbiana</u>	14.36	13.00	7.06	24.00	3.10
<u>Stipa lettermani</u>	13.74	11.87	6.17	38.12	7.10
<u>Poa pratensis</u>	8.76	6.67	2.23	43.33	6.32
Grasses	148.72	6.95	38.95	23.70	48.93
<u>Wyethia amplexicaulis</u>	1.77	30.00	2.00	50.00	0.69
<u>Collomia tenella</u>	0.91	7.72	0.22	13.33	0.12
<u>Arenaria congesta</u>	8.98	6.25	2.12	21.25	2.64
<u>Microseris nutans</u>	16.59	9.17	3.73	15.83	2.17
<u>Achillea lanulosa</u>	38.21	2.86	4.12	10.71	5.88
<u>Phlox gracilis</u>	82.33	0.00	0.00	0.83	1.33
<u>Lupinus laxiflorus</u>	18.82	0.00	0.00	0.00	0.00
<u>Eriogonum heracleoides</u>	1.70	0.00	0.00	0.00	0.00
<u>Aster chilensis</u>					
subsp. <u>adscendens</u>	26.96	25.63	26.10	61.87	19.18
<u>Senecio integerrimus</u>	152.91	2.22	12.80	4.00	5.36
<u>Zigadenus paniculatis</u>	10.29	0.00	0.00	0.00	0.00
<u>Taraxacum officinale</u>	14.10	15.00	7.96	15.62	0.17
<u>Allium acuminatum</u>	13.52	0.00	0.00	47.50	12.63
<u>Viola vallicola</u>	1.00	0.00	0.00	45.00	0.90
Forbs	388.09	4.17	61.05	10.07	51.07
<u>Chrysothamnus viscidiflorus</u>	374.21	0.00	0.00	0.00	0.00
<u>Artemisia tridentata</u>	107.37	0.00	0.00	0.00	0.00
<u>Artemisia cana</u>	62.25	0.00	0.00	0.00	0.00
Browse	543.83	0.00	0.00	0.00	0.00
Totals and averages	1080.64	2.45	100.00	7.16	100.00

Table 17. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 3, July 12-21, 1961.

Species	lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Agropyron subsecundum</u>	82.64	7.86	4.31	20.00	5.66
<u>Poa fendleriana</u>	3.11	0.00	0.00	50.00	0.88
<u>Agropyron trachycaulum</u>	26.42	22.50	3.94	25.00	0.37
<u>Bromus carinatus</u>	96.31	18.33	11.69	19.00	0.37
<u>Festuca idahoensis</u>	7.68	15.00	0.76	70.00	2.38
<u>Stipa lettermani</u>	5.68	12.50	0.47	35.00	0.72
<u>Koeleria cristata</u>	9.72	10.00	0.64	22.50	0.68
Grasses	231.56	14.22	21.81	22.70	11.06
<u>Arabis holboellii</u>	0.61	0.00	0.00	0.00	0.00
<u>Lupinus laxiflorus</u>	134.52	1.67	1.48	8.33	5.05
<u>Erigeron speciosus</u>	12.63	30.00	2.52	75.00	3.22
<u>Geranium fremontii</u>	30.68	10.00	2.03	10.00	0.00
<u>Achillea lanulosa</u>	124.45	4.00	3.30	11.00	4.91
<u>Thalictrum fendleri</u>	25.65	60.00	10.20	60.00	0.00
<u>Viola canadensis</u>	9.06	0.00	0.00	0.00	0.00
<u>Taraxacum officinale</u>	19.55	58.33	7.57	58.33	0.00
<u>Cynoglossum officinale</u>	171.38	25.00	28.37	78.00	51.18
<u>Viola vallicola</u>	19.81	30.00	3.93	50.00	2.23
<u>Potentilla pectinisecta</u>	20.08	16.67	2.22	53.33	4.16
<u>Vicia americana</u>	32.79	70.00	15.21	80.00	1.85
<u>Tragapogon porrifolius</u>	1.50	25.00	0.25	90.00	0.56
<u>Collomia tenella</u>	1.96	0.00	0.00	0.00	0.00
Forbs	604.67	19.06	77.08	40.31	73.16
<u>Chrysothamnus viscidiflorus</u>	6.41	0.00	0.00	0.00	0.00
<u>Populus tremuloides</u>	10.71	0.00	0.00	90.00	5.45
<u>Artemisia cana</u>	34.83	0.00	0.00	0.00	0.00
<u>Symphoricarpos vaccinioides</u>	416.26	0.40	1.11	4.80	10.33
Browse	468.21	0.33	1.11	5.83	15.78
Totals and averages	1304.44	11.18	100.00	24.31	100.00

Table 18. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 3, July 4-13, 1962.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Bromus carinatus</u>	109.48	18.75	11.77	51.25	14.91
<u>Agropyron subsecundum</u>	29.52	18.33	3.11	56.11	4.67
<u>Festuca idahoensis</u>	3.38	22.50	0.44	72.50	0.71
Grasses	142.38	18.75	15.32	52.76	20.39
<u>Wyethia amplexicaulis</u>	49.73	40.00	11.41	80.00	8.33
<u>Thalictrum fendleri</u>	20.97	33.33	4.01	78.33	3.95
<u>Polemonium albiflorum</u>	18.53	25.00	2.66	85.00	4.66
<u>Cynoglossum officinale</u>	107.98	40.00	24.77	87.56	21.49
<u>Taraxacum officinale</u>	26.19	38.33	5.76	71.67	3.66
<u>Potentilla pectinisecta</u>	13.67	50.00	3.92	80.00	1.72
<u>Potentilla gracilis</u>	34.95	15.00	3.01	42.50	4.03
<u>Viola vallicola</u>	44.89	4.38	1.12	33.75	5.52
<u>Sidalcea neomexicana</u>	18.24	32.00	3.34	73.00	3.13
<u>Hydrophyllum capitatum</u>	19.35	0.00	0.00	10.00	0.81
<u>Achillea lanulosa</u>	77.34	4.44	1.97	26.11	7.02
<u>Vicia americana</u>	25.07	37.50	5.40	82.50	4.73
<u>Geranium fremontii</u>	7.68	30.00	1.33	47.50	0.56
<u>Phlox gracilis</u>	18.67	0.00	0.00	0.00	0.00
<u>Collomia tenella</u>	4.57	7.50	0.19	47.50	0.77
<u>Lupinus laxiflorus</u>	25.42	0.00	0.00	0.00	0.00
<u>Agastache urticifolia</u>	15.01	0.00	0.00	20.00	1.26
<u>Senecio serra</u>	25.69	60.00	8.84	85.00	2.69
Forbs	553.99	24.47	77.73	56.49	74.33
<u>Artemisia cana</u>	13.43	0.00	0.00	0.00	0.00
<u>Symphoricarpos vaccinioides</u>	225.75	2.88	3.73	3.88	0.95
<u>Rosa woodsii</u>	13.09	20.00	1.51	80.00	3.29
<u>Amelanchier alnifolia</u>	6.10	20.00	0.70	65.00	1.14
<u>Populus tremuloides</u>	8.76	20.00	1.01	20.00	0.00
Browse	267.13	4.53	6.95	9.34	5.38
Totals and averages	963.50	18.10	100.00	42.87	100.00

Table 19. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 3, July 12-21, 1961.

Species	lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Festuca idahoensis</u>	17.51	0.00	0.00	0.00	0.00
<u>Agropyron trachycaulum</u>	104.18	0.00	0.00	5.00	3.62
<u>Koeleria cristata</u>	4.88	0.00	0.00	7.50	0.26
<u>Stipa lettermani</u>	91.85	30.00	20.99	35.00	3.19
<u>Poa pratensis</u>	103.30	25.83	20.32	54.17	20.36
<u>Bromus carinatus</u>	55.41	4.00	1.68	20.00	6.18
<u>Bromus tectorum</u>	6.14	0.00	0.00	0.00	0.00
<u>Agropyron subsecundum</u>	23.00	0.00	0.00	27.50	4.40
<u>Poa fendleriana</u>	1.27	5.00	0.04	25.00	0.17
Grasses	407.54	13.86	43.03	27.32	38.18
<u>Sidalcea neomexicana</u>	10.41	27.50	2.19	46.67	1.40
<u>Achillea lanulosa</u>	59.56	0.00	0.00	3.75	1.56
<u>Collomia tenella</u>	12.06	3.75	0.35	3.75	0.00
<u>Wyethia amplexicaulis</u>	42.20	5.50	1.78	11.25	1.69
<u>Epilobium paniculatum</u>	2.92	5.00	0.11	18.33	0.27
<u>Aster chilensis</u> subsp. <u>adscendens</u>	65.51	17.50	8.74	62.50	20.52
<u>Potentilla pectinisecta</u>	50.53	11.25	4.34	50.00	13.62
<u>Taraxacum officinale</u>	10.41	2.50	0.20	100.00	7.08
<u>Viola vallicola</u>	6.34	0.00	0.00	15.00	0.67
<u>Geranium fremontii</u>	102.22	20.00	15.57	25.00	3.56
<u>Lupinus laxiflorus</u>	58.91	0.00	0.00	0.00	0.00
<u>Cynoglossum officinale</u>	25.23	70.00	13.47	90.00	3.52
<u>Potentilla gracilis</u>	5.76	0.00	0.00	80.00	3.21
<u>Eriogonum heracleoides</u>	35.33	15.00	4.04	20.00	1.23
Forbs	487.39	13.67	50.79	30.86	58.33
<u>Rosa woodsii</u>	22.56	15.00	3.45	25.00	2.55
<u>Symphoricarpos vaccinioides</u>	314.23	1.14	2.73	1.57	0.94
<u>Artemisia cana</u>	131.33	0.00	0.00	0.00	0.00
Browse	468.12	1.70	6.18	2.76	3.49
Totals and averages	1363.05	9.57	100.00	20.06	100.00

Table 20. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 3, July 4-13, 1962.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Koeleria cristata</u>	37.44	5.00	1.17	57.50	8.81
<u>Melica bulbosa</u>	4.50	0.00	0.00	60.00	1.21
<u>Poa pratensis</u>	150.61	24.00	22.56	68.00	29.71
<u>Bromus carinatus</u>	18.43	1.67	0.19	46.67	3.72
<u>Agropyron trachycaulum</u>	19.89	21.00	2.60	35.00	1.25
<u>Festuca idahoensis</u>	24.65	25.00	3.85	75.00	5.53
Grasses	255.52	19.04	30.37	62.86	50.23
<u>Cynoglossum officinale</u>	23.77	2.50	0.37	95.00	9.85
<u>Polemonium albiflorum</u>	3.83	0.00	0.00	0.00	0.00
<u>Thalictrum fendleri</u>	19.35	50.00	6.04	75.00	2.17
<u>Collomia tenella</u>	20.01	0.00	0.00	0.00	0.00
<u>Wyethia amplexicaulis</u>	236.31	5.00	7.37	10.00	5.30
<u>Achillea lanulosa</u>	29.80	0.00	0.00	23.00	3.07
<u>Aster chilensis</u> subsp. <u>adscendens</u>	20.42	10.00	1.28	90.00	7.32
<u>Phlox gracilis</u>	71.27	0.00	0.00	0.00	0.00
<u>Sidalcea neomexicana</u>	24.96	70.00	10.91	85.00	1.68
<u>Geranium fremontii</u>	40.32	30.00	7.55	56.25	4.75
<u>Viola vallicola</u>	23.65	15.00	2.22	53.75	4.11
<u>Taraxacum officinale</u>	21.16	13.33	1.75	65.00	4.90
<u>Potentilla pectinisecta</u>	29.42	0.00	0.00	5.00	0.66
<u>Lupinus laxiflorus</u>	5.57	0.00	0.00	5.00	0.13
<u>Potentilla gracilis</u>	6.69	0.00	0.00	3.33	0.11
<u>Vicia americana</u>	53.22	82.50	27.40	92.50	2.39
Forbs	630.05	16.50	64.89	32.94	46.44
<u>Artemisia cana</u>	168.00	0.00	0.00	0.00	0.00
<u>Symphoricarpos vaccinioides</u>	135.36	5.33	4.50	10.67	3.24
<u>Populus tremuloides</u>	0.96	40.00	0.24	60.00	0.09
Browse	304.32	2.50	4.74	4.93	3.33
Totals and averages	1189.89	13.46	100.00	32.21	100.00

Table 21. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 4, July 25- August 3, 1961.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Agropyron smithii</u>	28.72	5.88	4.45	14.38	5.47
<u>Festuca idahoensis</u>	61.79	6.25	10.13	15.00	12.09
<u>Stipa lettermani</u>	9.52	8.33	2.09	16.67	1.78
<u>Koeleria cristata</u>	11.17	17.50	5.14	21.25	0.92
<u>Poa secunda</u>	10.48	30.00	8.23	30.00	0.00
<u>Poa ampla</u>	3.03	0.00	0.00	0.00	0.00
<u>Stipa columbiana</u>	5.07	0.00	0.00	0.00	0.00
Grasses	129.78	8.82	30.04	15.80	20.26
<u>Achillea lanulosa</u>	50.27	0.00	0.00	1.43	1.61
<u>Aster chilensis</u> subsp. <u>adscendens</u>	12.44	25.00	8.16	25.00	0.00
<u>Potentilla gracilis</u>	0.19	50.00	0.27	65.00	0.07
<u>Antennaria dimorpha</u>	3.30	0.00	0.00	0.00	0.00
<u>Eriogonum heracleoides</u>	23.19	0.00	0.00	10.00	5.20
<u>Epilobium paniculatum</u>	0.42	0.00	0.00	0.00	0.00
<u>Lupinus laxiflorus</u>	21.47	0.00	0.00	45.00	21.61
<u>Astragalus miser</u> var. <u>decumbens</u>	63.17	31.00	51.36	44.00	18.35
<u>Phlox gracilis</u>	10.02	0.00	0.00	0.00	0.00
<u>Geranium fremontii</u>	11.94	10.00	3.13	10.00	0.00
Forbs	196.41	12.21	62.92	22.88	46.84
<u>Chrysothamnus viscidiflorus</u>	119.96	0.00	0.00	0.00	0.00
<u>Artemisia tridentata</u>	342.84	0.00	0.00	0.00	0.00
<u>Symphoricarpos vaccinioides</u>	409.92	0.00	0.00	2.00	18.31
<u>Amelanchier alnifolia</u>	33.48	8.00	7.04	27.50	14.39
<u>Artemisia cana</u>	16.51	0.00	0.00	0.00	0.00
<u>Tetradymia canescens</u>	34.83	0.00	0.00	0.00	0.00
Browse	957.54	0.29	7.04	1.85	32.90
Totals and averages	1283.73	3.01	100.00	6.54	100.00

Table 22. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 4, July 16-25, 1962.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Agropyron smithii</u>	56.76	15.00	15.02	35.00	15.73
<u>Agropyron inerme</u>	39.31	8.75	6.06	20.00	6.14
<u>Poa secunda</u>	3.54	15.00	0.93	55.00	1.96
<u>Sitanion hystrix</u>	5.48	0.00	0.00	0.00	0.00
<u>Stipa lettermani</u>	20.61	40.00	14.53	55.00	4.29
<u>Koeleria cristata</u>	4.56	13.33	1.04	30.83	1.06
<u>Poa pratensis</u>	1.89	50.00	1.66	50.00	0.00
<u>Stipa columbiana</u>	3.18	0.00	0.00	20.00	0.88
<u>Festuca idahoensis</u>	43.93	0.00	0.00	15.00	0.13
Grasses	179.26	12.43	39.24	28.22	39.19
<u>Astragalus decumbens</u>	2.15	0.00	0.00	90.00	2.68
<u>Achillea lanulosa</u>	35.87	4.29	4.24	12.86	6.64
<u>Astragalus miser</u> var. <u>decumbens</u>	51.80	16.00	14.60	22.00	4.31
<u>Taraxacum officinale</u>	1.00	30.00	0.52	40.00	0.15
<u>Eriogonum heracleoides</u>	8.83	21.00	3.28	42.00	2.57
<u>Lupinus laxiflorus</u>	32.06	15.00	8.47	62.50	21.11
<u>Aster chilensis</u> subsp. <u>adscendens</u>	1.57	75.00	2.08	77.50	0.06
<u>Potentilla pectiniflora</u>	7.22	60.00	0.75	70.00	0.10
<u>Geranium fremontii</u>	1.92	0.00	0.00	75.00	2.00
Forbs	162.42	12.35	33.94	30.68	39.62
<u>Tetradymia canescens</u>	29.42	0.00	0.00	0.00	0.00
<u>Symphoricarpos vaccinioides</u>	66.24	15.00	17.52	23.33	7.64
<u>Chrysothamnus viscidiflorus</u>	103.49	0.22	0.39	5.56	7.66
<u>Artemisia tridentata</u>	351.74	0.00	0.00	0.00	0.00
<u>Amelanchier alnifolia</u>	12.13	41.67	8.91	76.67	5.89
Browse	563.02	2.70	26.82	5.42	21.19
Totals and averages	904.70	6.32	100.00	14.35	100.00

Table 23. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 4, July 25- August 3, 1961.

Species	lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Agropyron smithii</u>	15.20	0.83	1.00	9.17	2.42
<u>Festuca idahoensis</u>	3.49	0.00	0.00	15.00	1.01
<u>Poa secunda</u>	17.12	20.00	25.49	34.00	4.58
<u>Stipa lettermani</u>	27.26	8.75	17.80	22.50	7.14
<u>Koeleria cristata</u>	9.60	0.00	0.00	0.00	0.00
<u>Carex spp.</u>	14.98	0.00	0.00	7.50	2.14
Grasses	87.65	6.78	44.29	17.12	17.29
<u>Achillea lanulosa</u>	93.85	1.20	8.35	2.22	1.81
<u>Antennaria dimorpha</u>	0.96	0.00	0.00	0.00	0.00
<u>Eriogonum heracleoides</u>	36.10	8.00	21.54	35.00	18.57
<u>Cordylanthus ramosus</u>	0.84	0.00	0.00	45.00	0.73
<u>Lupinus laxiflorus</u>	76.54	0.00	0.00	11.67	18.52
<u>Phlox gracilis</u>	32.99	0.00	0.00	0.00	0.00
<u>Epilobium paniculatum</u>	0.51	0.00	0.00	1.67	0.03
<u>Astragalus decumbens</u>	5.40	15.00	6.04	80.00	6.69
Forbs	247.19	1.95	35.93	11.79	46.38
<u>Chrysothamnus viscidiflorus</u>	181.37	0.00	0.00	1.17	3.70
<u>Symphoricarpos vaccinioides</u>	218.19	0.00	0.00	3.67	15.26
<u>Purshia tridentata</u>	21.19	12.50	19.78	50.00	15.14
<u>Artemisia cana</u>	24.39	0.00	0.00	0.00	0.00
<u>Artemisia tridentata</u>	203.52	0.00	0.00	0.00	0.00
<u>Tetradymia canescens</u>	18.19	0.00	0.00	0.00	0.00
<u>Amelanchier alnifolia</u>	7.83	0.00	0.00	15.00	2.25
Browse	674.68	0.40	19.78	3.30	36.35
Totals and averages	1009.52	1.35	100.00	6.62	100.00

Table 24. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 4, July 16-25, 1962.

Species	lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Poa pratensis</u>	10.91	22.50	5.41	67.50	4.75
<u>Poa secunda</u>	7.91	15.00	2.60	48.33	2.55
<u>Agropyron smithii</u>	16.17	11.00	3.92	47.22	5.67
<u>Festuca idahoensis</u>	12.71	6.25	1.75	16.25	1.23
<u>Koeleria cristata</u>	12.44	11.25	3.08	35.00	2.85
<u>Stipa lettermani</u>	5.61	10.00	1.23	57.50	2.58
<u>Stipa columbiana</u>	6.11	0.00	0.00	45.00	2.66
<u>Melica bulbosa</u>	3.49	0.00	0.00	50.00	1.70
Grasses	75.35	10.86	17.99	43.77	23.99
<u>Collomia tenella</u>	0.35	0.00	0.00	0.00	0.00
<u>Taraxacum officinale</u>	4.53	0.00	0.00	35.00	1.53
<u>Achillea lanulosa</u>	64.32	4.50	6.35	10.50	3.74
<u>Aster chilensis</u> subsp. <u>adscendens</u>	11.29	42.50	10.57	60.00	1.91
<u>Lupinus laxiflorus</u>	15.48	15.83	5.38	65.83	7.49
<u>Microseris nutans</u>	3.15	0.00	0.00	0.00	0.00
<u>Geranium fremontii</u>	1.92	30.00	1.26	65.00	0.66
<u>Cirsium spp.</u>	3.92	0.00	0.00	50.00	1.90
<u>Eriogonum heracleoides</u>	2.19	25.00	1.20	72.50	1.00
<u>Cordylanthus ramosus</u>	5.22	65.00	7.46	80.00	0.75
<u>Astragalus miser</u> var. <u>decumbens</u>	14.36	12.50	3.96	25.00	1.74
<u>Astragalus decumbens</u>	2.88	15.00	0.94	47.50	0.90
Forbs	129.61	13.03	37.12	30.26	21.62
<u>Tetradymia canescens</u>	18.39	0.00	0.00	0.00	0.00
<u>Chrysothamnus viscidiflorus</u>	71.50	2.00	3.14	28.00	18.00
<u>Artemisia cana</u>	216.81	0.00	0.00	0.00	0.00
<u>Artemisia tridentata</u>	350.05	0.00	0.00	0.00	0.00
<u>Symphoricarpos vaccinioides</u>	55.80	3.00	3.70	35.00	17.28
<u>Rosa woodsii</u>	1.00	45.00	1.00	60.00	0.14
<u>Amelanchier alnifolia</u>	6.11	15.00	2.01	75.00	3.54
<u>Purshia tridentata</u>	39.86	40.00	35.04	80.00	15.43
Browse	759.52	2.69	44.89	10.09	54.39
Totals and averages	964.48	4.72	100.00	15.43	100.00

Table 25. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 5, August 7-16, 1961.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Festuca idahoensis</u>	19.20	22.50	6.72	40.00	3.10
<u>Bromus carinatus</u>	151.75	9.00	21.25	39.00	41.95
<u>Stipa columbiana</u>	44.69	12.50	8.69	33.75	8.75
<u>Carex spp.</u>	7.99	16.67	2.06	53.33	2.70
<u>Koeleria cristata</u>	3.88	11.25	0.69	11.25	0.00
<u>Stipa lettermani</u>	4.26	20.00	1.33	65.00	1.77
<u>Agropyron subsecundum</u>	34.37	10.00	5.34	20.00	3.17
<u>Poa fendleriana</u>	10.91	70.00	11.88	80.00	1.01
<u>Agropyron smithii</u>	4.76	0.00	0.00	0.00	0.00
Grasses	281.81	13.22	57.96	37.26	62.45
<u>Aster chilensis</u> subsp. <u>adscendens</u>	6.56	75.00	7.66	75.00	0.00
<u>Achillea lanulosa</u>	41.55	1.40	0.89	15.00	5.20
<u>Viola vallicola</u>	2.85	20.00	0.89	50.00	0.79
<u>Epilobium paniculatum</u>	0.88	0.00	0.00	0.00	0.00
<u>Lupinus laxiflorus</u>	4.11	0.00	0.00	90.00	3.41
<u>Tragopogon porrifolius</u>	3.06	35.00	1.67	77.50	1.20
<u>Geranium fremontii</u>	1.27	50.00	0.99	95.00	0.53
<u>Phlox gracilis</u>	4.88	0.00	0.00	0.00	0.00
<u>Eriogonum heracleoides</u>	9.02	0.00	0.00	30.00	2.50
Forbs	74.18	10.49	12.10	30.43	13.63
<u>Symphoricarpos vaccinioides</u>	676.95	2.83	29.80	5.33	15.61
<u>Artemisia cana</u>	26.76	0.00	0.00	0.00	0.00
<u>Populus tremuloides</u>	9.60	0.00	0.00	90.00	7.96
<u>Rosa woodsii</u>	4.72	2.00	0.14	10.00	0.35
<u>Chrysothamhus viscidiflorus</u>	63.76	0.00	0.00	0.00	0.00
Browse	781.79	2.46	29.94	5.87	23.92
Totals and averages	1137.78	5.65	100.00	15.19	100.00

Table 26. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 5, July 28- August 6, 1962.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Bromus carinatus</u>	114.74	12.85	10.23	45.00	29.99
<u>Poa pratensis</u>	86.71	65.00	39.08	75.00	7.05
<u>Agropyron subsecundum</u>	15.74	12.50	1.37	40.00	3.53
<u>Stipa columbiana</u>	11.06	0.00	0.00	45.00	4.05
<u>Agropyron smithii</u>	6.68	25.00	1.16	42.50	0.95
<u>Carex spp.</u>	1.31	21.67	0.19	63.33	0.44
<u>Festuca idahoensis</u>	15.21	60.00	6.33	70.00	1.23
Grasses	251.45	33.47	58.36	56.58	47.24
<u>Berberis vulgaris</u>	7.07	0.00	0.00	3.33	0.19
<u>Achillea lanulosa</u>	33.52	5.00	1.17	13.75	2.39
<u>Taraxacum officinale</u>	25.19	45.84	8.01	74.17	5.80
<u>Viola vallicola</u>	7.03	15.00	0.74	46.67	1.81
<u>Lupinus laxiflorus</u>	21.00	60.00	8.73	85.00	4.27
<u>Cynoglossum officinale</u>	3.61	90.00	2.26	95.00	0.14
<u>Sidalcea neomexicana</u>	4.80	55.00	1.83	85.00	1.18
<u>Thalictrum fendleri</u>	4.84	85.00	2.85	85.00	0.00
<u>Tragapogon porrifolius</u>	2.88	75.00	1.49	75.00	0.00
<u>Collomia tenella</u>	1.57	0.00	0.00	0.00	0.00
<u>Potentilla gracilis</u>	3.99	55.00	1.52	70.00	0.49
Forbs	115.50	35.71	28.60	53.04	16.27
<u>Artemisia tridentata</u>	53.49	0.00	0.00	0.00	0.00
<u>Rosa woodsii</u>	8.60	51.00	3.04	84.00	2.30
<u>Amelanchier alnifolia</u>	7.14	26.25	1.30	76.25	2.90
<u>Symphoricarpos vaccinioides</u>	165.31	7.44	8.53	30.56	31.08
<u>Populus tremuloides</u>	2.50	10.00	0.17	20.00	0.21
Browse	237.04	7.93	13.04	26.86	36.49
Totals and averages	603.98	23.88	100.00	44.24	100.00

Table 27. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 5, August 7-16, 1961.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
Carex spp.	13.98	2.50	0.53	35.50	4.86
<u>Poa pratensis</u>	41.47	43.75	27.27	53.75	4.36
<u>Stipa lettermani</u>	14.70	36.25	8.00	65.00	4.46
<u>Agropyron smithii</u>	3.18	1.67	0.09	11.67	0.34
<u>Agropyron subsecundum</u>	11.21	5.71	0.95	13.75	0.95
<u>Bromus carinatus</u>	14.60	8.75	1.93	30.00	3.26
<u>Koeleria cristata</u>	6.94	0.00	0.00	0.00	0.00
<u>Poa fendleriana</u>	7.25	0.00	0.00	32.50	2.48
Grasses	113.33	22.76	38.77	40.11	20.71
<u>Taraxacum officinale</u>	7.83	0.00	0.00	50.00	4.13
<u>Epilobium paniculatum</u>	2.42	0.00	0.00	1.67	0.05
<u>Lupinus laxiflorus</u>	68.70	25.00	25.83	77.50	41.60
<u>Collomia tenella</u>	3.38	0.00	0.00	0.00	0.00
<u>Achillea lanulosa</u>	113.16	1.00	1.71	4.55	4.22
<u>Phlox gracilis</u>	6.44	0.00	0.00	0.00	0.00
<u>Eriogonum heracleoides</u>	5.41	5.00	0.40	25.00	1.16
Forbs	207.34	8.62	27.94	32.39	51.16
<u>Symphoricarpos vaccinioides</u>	559.45	3.90	32.82	8.50	27.10
<u>Chrysothamhus viscidiflorus</u>	1.00	0.00	0.00	5.00	0.05
<u>Artemisia cana</u>	47.66	0.00	0.00	0.00	0.00
<u>Amelanchier alnifolia</u>	2.49	12.50	0.47	50.00	0.98
Browse	610.60	3.62	33.29	8.00	28.13
Totals and averages	931.27	7.14	100.00	17.34	100.00

Table 28. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 5, July 28- August 6, 1962.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Stipa columbiana</u>	19.35	5.00	0.86	42.50	6.31
<u>Agropyron smithii</u>	16.17	16.67	2.37	56.67	5.62
<u>Bromus carinatus</u>	20.28	13.33	2.37	35.00	3.82
<u>Koeleria cristata</u>	1.23	0.00	0.00	20.00	0.22
<u>Agropyron subsecundum</u>	37.40	5.00	1.65	50.00	14.63
<u>Poa pratensis</u>	40.28	50.00	17.73	65.00	5.26
<u>Stipa lettermani</u>	44.93	30.00	11.86	65.00	13.67
<u>Carex spp.</u>	4.76	25.00	1.05	57.50	1.76
Grasses	184.40	23.35	37.89	55.33	51.29
<u>Lupinus laxiflorus</u>	46.39	21.25	8.68	66.25	18.16
<u>Achillea lanulosa</u>	77.34	6.11	4.15	18.33	8.22
<u>Collomia tenella</u>	3.15	6.67	0.18	26.67	0.55
<u>Aster chilensis</u> subsp. <u>adscendens</u>	0.54	40.00	0.18	75.00	0.16
<u>Viola vallicola</u>	4.57	80.00	3.22	90.00	0.40
<u>Taraxacum officinale</u>	25.19	59.00	13.08	83.00	5.26
<u>Sidalcea neomexicana</u>	10.56	90.00	8.36	95.00	0.46
<u>Eriogonum heracleoides</u>	14.94	60.00	7.89	85.50	3.58
<u>Potentilla gracilis</u>	3.00	90.00	2.38	95.00	0.13
Forbs	185.68	29.45	48.12	52.32	36.92
<u>Artemisia cana</u>	26.88	0.00	0.00	0.00	0.00
<u>Chrysothamnus viscidiflorus</u>	20.43	10.00	1.80	20.00	3.56
<u>Amelanchier alnifolia</u>	8.83	56.66	4.40	85.00	2.18
<u>Rosa woodsii</u>	1.00	50.00	0.44	60.00	0.09
<u>Populus tremuloides</u>	5.30	10.00	0.47	20.00	0.46
<u>Symphoricarpos vaccinioides</u>	135.36	5.77	6.88	10.44	5.50
<u>Artemisia tridentata</u>	39.63	0.00	0.00	0.00	0.00
Browse	237.43	6.69	13.99	12.40	11.79
Totals and averages	607.51	18.70	100.00	37.63	100.00

Table 29. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 6, August 20-29, 1961.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Agropyron smithii</u>	21.96	9.38	7.15	20.63	4.33
<u>Poa fendleriana</u>	5.07	50.00	8.79	70.00	1.78
<u>Stipa lettermani</u>	34.59	40.00	47.93	65.00	15.13
<u>Hesperochloa kingii</u>	58.06	11.43	22.99	55.83	45.05
<u>Stipa columbiana</u>	0.50	0.00	0.00	30.00	0.26
Grasses	120.18	20.86	86.86	52.54	66.55
<u>Eriogonum heracleoides</u>	47.35	2.00	3.27	14.00	9.92
<u>Achillea lanulosa</u>	51.42	0.00	0.00	5.00	4.48
<u>Phlox gracilis</u>	11.01	8.33	3.18	8.33	0.00
<u>Cordylanthus ramosus</u>	6.84	0.00	0.00	0.00	0.00
<u>Lupinus laxiflorus</u>	17.12	0.00	0.00	50.00	14.98
<u>Cirsium</u> spp.	7.94	0.00	0.00	0.00	0.00
Forbs	141.68	1.31	6.45	13.18	29.38
<u>Artemisia tridentata</u>	328.86	0.00	0.00	0.00	0.00
<u>Purshia tridentata</u>	14.28	13.33	6.69	25.00	2.96
<u>Chrysothamnus viscidiflorus</u>	8.45	0.00	0.00	7.50	1.11
Browse	351.59	0.55	6.69	1.21	4.07
Totals and averages	613.49	4.70	100.00	14.03	100.00

Table 30. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 6, August 9-18, 1962.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Agropyron smithii</u>	9.20	1.43	0.18	12.86	0.96
<u>Koeleria cristata</u>	8.14	13.33	1.46	18.33	0.38
<u>Hesperochloa kingii</u>	103.30	11.67	16.68	28.33	15.68
<u>Stipa lettermani</u>	34.95	13.76	6.37	33.75	6.37
<u>Poa pratensis</u>	8.06	10.00	1.08	30.00	1.46
Grasses	163.65	11.53	25.17	28.19	24.85
<u>Astragalus decumbens</u>	1.69	0.00	0.00	20.00	0.31
<u>Circium spp.</u>	3.54	5.00	0.24	20.00	0.48
<u>Eriogonum heracleoides</u>	50.22	6.00	4.01	34.00	12.82
<u>Cordylanthus ramosus</u>	5.96	0.00	0.00	33.00	1.79
<u>Aster chilensis</u> subsp. <u>adscendens</u>	6.87	25.00	2.30	85.00	3.76
<u>Lupinus laxiflorus</u>	11.06	10.00	1.47	76.67	6.72
<u>Achillea lanulosa</u>	21.47	2.50	0.71	2.50	0.00
Forbs	100.81	6.49	8.73	34.66	25.88
<u>Chrysothamnus viscidiflorus</u>	19.20	12.50	3.20	22.50	1.74
<u>Symphoricarpos vaccinioides</u>	3.45	30.00	1.42	47.50	0.55
<u>Artemisia tridentata</u>	587.48	0.00	0.00	0.00	0.00
<u>Purshia tridentata</u>	162.77	28.33	61.48	60.00	46.98
Browse	772.90	6.41	66.10	9.99	49.27
Totals and averages	1037.36	7.23	100.00	17.81	100.00

Table 31. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 6, August 20-29, 1961.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Stipa lettermani</u>	95.66	23.13	38.35	55.00	35.08
<u>Agropyron smithii</u>	7.03	0.00	0.00	26.43	2.14
<u>Koeleria cristata</u>	2.15	0.00	0.00	0.00	0.00
<u>Hesperochloa kingii</u>	19.24	27.00	9.00	35.00	1.76
<u>Stipa columbiana</u>	36.36	0.00	0.00	8.75	3.67
<u>Poa fendleriana</u>	4.60	30.00	2.40	80.00	2.65
<u>Carex spp.</u>	3.34	5.00	0.28	45.00	1.54
Grasses	168.38	17.14	50.03	41.30	46.84
<u>Lupinus laxiflorus</u>	42.74	25.00	18.54	79.38	26.74
<u>Phlox gracilis</u>	12.90	25.00	5.60	25.00	0.00
<u>Astragalus miser</u> var. <u>decumbens</u>	0.81	50.00	0.72	80.00	0.29
<u>Eriogonum heracleoides</u>	34.52	5.00	2.99	10.00	1.99
<u>Aster chilensis</u> subsp. <u>adscendens</u>	14.89	36.67	9.46	71.67	6.00
<u>Sphaeralcea coccinea</u>	1.57	60.00	1.64	90.00	0.54
<u>Circium spp.</u>	1.41	0.00	0.00	10.00	0.17
Forbs	108.84	20.63	38.95	49.16	35.73
<u>Chrysothamnus viscidiflorus</u>	0.91	0.00	0.00	3.33	0.03
<u>Furshia tridentata</u>	22.19	26.67	10.25	76.67	12.78
<u>Symphoricarpos vaccinioides</u>	8.90	5.00	0.77	50.00	4.62
<u>Artemisia tridentata</u>	421.97	0.00	0.00	0.00	0.00
Browse	453.97	1.40	11.02	4.74	17.43
Totals and averages	731.19	7.89	100.00	19.77	100.00

Table 32. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 6, August 9-18, 1962.

Species	lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Stipa lettermani</u>	69.88	17.14	24.33	36.43	13.62
<u>Hesperochloa kingii</u>	39.31	8.57	6.80	49.29	16.18
<u>Agropyron smithii</u>	17.16	1.25	0.45	53.75	9.10
<u>Koeleria cristata</u>	6.49	27.50	3.61	35.83	0.55
<u>Poa ampla</u>	6.80	0.00	0.00	0.00	0.00
<u>Stipa columbiana</u>	7.94	8.00	1.29	19.00	0.88
Grasses	147.58	12.18	36.38	39.22	40.33
<u>Achillea lanulosa</u>	30.57	1.67	1.04	10.00	2.58
<u>Eriogonum heracleoides</u>	41.94	30.00	25.46	68.00	16.10
<u>Aster chilensis</u> subsp. <u>adscendens</u>	23.07	18.00	8.41	86.67	16.02
<u>Lupinus laxiflorus</u>	2.74	3.00	0.18	48.00	1.25
<u>Sphaeralcea coccinea</u>	0.96	35.00	0.69	90.00	0.54
Forbs	99.28	17.81	35.78	54.18	36.49
<u>Chrysothamnus viscidiflorus</u>	40.86	6.67	5.52	28.35	8.94
<u>Amelanchier alnifolia</u>	3.45	25.00	1.76	75.00	1.74
<u>Rosa woodsii</u>	3.23	10.00	0.66	70.00	1.95
<u>Artemisia tridentata</u>	653.72	0.00	0.00	0.00	0.00
<u>Purshia tridentata</u>	24.58	40.00	19.90	82.50	10.55
Browse	725.84	1.90	27.85	5.06	23.18
Totals and averages	972.70	5.08	100.00	15.25	100.00

Table 33. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 7, September 1-10, 1961.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Agropyron inerme</u>	86.16	16.25	56.69	27.50	73.41
<u>Poa fendleriana</u>	0.43	0.00	0.00	99.00	3.24
<u>Koeleria cristata</u>	4.14	0.00	0.00	20.00	6.26
<u>Agropyron smithii</u>	12.94	2.50	1.31	10.00	7.37
Grasses	103.67	13.81	58.00	25.30	90.28
<u>Cordylanthus ramosus</u>	5.38	0.00	0.00	0.00	0.00
<u>Aster chilensis</u> subsp. <u>adscendens</u>	18.62	0.00	0.00	0.00	0.00
<u>Cirsium</u> spp.	10.44	0.00	0.00	0.00	0.00
<u>Eriogonum heracleoides</u>	7.25	0.00	0.00	0.00	0.00
Forbs	41.69	0.00	0.00	0.00	0.00
<u>Purshia tridentata</u>	155.37	6.67	42.00	7.50	9.72
<u>Tetradymia canescens</u>	20.51	0.00	0.00	0.00	0.00
<u>Chrysothamnus viscidiflorus</u>	47.30	0.00	0.00	0.00	0.00
<u>Artemisia tridentata</u>	111.01	0.00	0.00	0.00	0.00
Browse	334.19	3.09	42.00	3.47	9.72
Totals and averages	479.55	5.14	100.00	7.88	100.00

Table 34. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on good condition range on area 7, August 21-30, 1962.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Agropyron inerme</u>	97.57	3.50	4.47	10.00	8.45
<u>Koeleria cristata</u>	7.49	0.00	0.00	10.00	1.00
<u>Hesperochloa kingii</u>	17.93	25.00	5.86	40.00	3.57
Grasses	122.99	6.43	10.33	14.37	13.02
<u>Cordylanthus ramosus</u>	61.33	8.33	6.67	23.33	12.26
<u>Cirium spp.</u>	13.36	0.00	0.00	0.00	0.00
<u>Astragalus decumbens</u>	3.06	50.00	2.00	62.50	0.51
<u>Aster chilensis</u> subsp. <u>adscendens</u>	5.08	30.00	1.98	45.00	1.02
Forbs	82.83	9.85	10.65	22.34	13.79
<u>Tetradymia canescens</u>	16.16	0.00	0.00	0.00	0.00
<u>Artemisia nova</u>	85.06	0.00	0.00	0.00	0.00
<u>Artemisia tridentata</u>	102.84	0.00	0.00	0.00	0.00
<u>Purshia tridentata</u>	187.78	30.00	73.59	53.75	59.40
<u>Symphoricarpos vaccinioides</u>	5.53	35.00	2.52	51.25	1.20
<u>Chrysothamnus viscidiflorus</u>	55.60	4.00	2.91	21.00	12.59
Browse	452.97	13.35	79.02	25.48	73.19
Totals and averages	658.79	11.62	100.00	23.01	100.00

Table 35. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 7, September 1-10, 1961.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Agropyron inerme</u>	44.74	48.33	76.71	78.75	38.64
<u>Sitanion hystrix</u>	12.64	30.00	11.52	41.25	4.02
<u>Bromus tectorum</u>	4.60	0.00	0.00	1.67	0.21
<u>Agropyron smithii</u>	7.61	31.67	7.31	32.50	0.17
Grasses	69.59	39.97	84.54	61.75	43.04
<u>Aster chilensis</u> subsp. <u>adscendens</u>	4.45	25.00	3.41	40.00	1.88
<u>Cordylanthus ramosus</u>	1.41	0.00	0.00	1.67	0.08
<u>Astragalus decumbens</u>	0.76	12.50	0.31	100.00	1.93
<u>Eriogonum heracleoides</u>	2.18	0.00	0.00	12.86	0.80
Forbs	8.80	13.88	3.72	32.61	4.69
<u>Artemisia nova</u>	122.95	0.00	0.00	0.00	0.00
<u>Purshia tridentata</u>	66.82	5.00	10.17	26.67	41.11
<u>Chrysothamhus viscidiflorus</u>	23.15	0.25	0.18	16.25	10.50
<u>Artemisia tridentata</u>	163.51	0.00	0.00	0.00	0.00
<u>Tetradymia canescens</u>	25.95	0.00	0.00	0.67	0.50
<u>Symphoricarpos vaccinioides</u>	0.57	80.00	1.39	90.00	0.16
Browse	402.95	0.96	11.74	5.53	52.27
Totals and averages	481.34	6.83	100.00	14.15	100.00

Table 36. Species composition, average production, utilization, and diet of sheep for two intensities of grazing on poor condition range on area 7, August 21-30, 1962.

Species	Lbs. per acre air dry	Light use		Heavy use	
		% use	% diet	% use	% diet
<u>Agropyron inerme</u>	39.12	28.13	17.69	36.88	5.66
<u>Sitanion hystrix</u>	3.69	0.00	0.00	3.75	0.22
<u>Koeleria cristata</u>	3.49	0.00	0.00	0.00	0.00
Grasses	46.30	23.76	17.69	31.43	5.88
<u>Cordylanthus ramosus</u>	92.24	7.22	10.71	17.22	15.28
<u>Cirsium spp.</u>	18.89	10.00	3.04	15.00	1.56
<u>Aster chilensis</u> subsp. <u>adscendens</u>	3.80	28.33	1.73	38.33	0.63
<u>Eriogonum heracleoides</u>	6.18	0.00	0.00	2.50	0.25
Forbs	121.11	7.95	15.48	16.79	17.72
<u>Artemisia nova</u>	122.57	0.00	0.00	0.00	0.00
<u>Tetradymia canescens</u>	39.17	0.00	0.00	0.00	0.00
<u>Artemisia tridentata</u>	109.56	0.00	0.00	2.50	4.52
<u>Chrysothamnus viscidiflorus</u>	18.39	26.67	7.90	76.67	15.23
<u>Symphoricarpos vaccinioides</u>	6.92	50.00	5.57	65.00	1.71
<u>Purshia tridentata</u>	82.94	40.00	53.36	80.00	54.93
Browse	379.53	10.94	66.83	23.09	76.39
Totals and averages	546.96	11.36	100.00	22.40	100.00

Table 37. Scientific and common names of plants discussed.

Scientific name	Common name
<u>Agropyron inerme</u>	Beardless Wheatgrass
<u>Agropyron smithii</u>	Bluestem
<u>Agropyron subsecundum</u>	Bearded Wheatgrass
<u>Agropyron trachycaulum</u>	Slender Wheatgrass
<u>Bromus carinatus</u>	Mountain Brome
<u>Bromus tectorum</u>	Cheat grass
<u>Carex spp.</u>	Sedge
<u>Festuca idahoensis</u>	Bluebunch Fescue
<u>Hesperochloa kingii</u>	Spike Fescue
<u>Koeleria cristata</u>	June Grass
<u>Melica bulbosa</u>	Oniongrass
<u>Poa ampla</u>	Big Bluegrass
<u>Poa fendleriana</u>	Mutton Grass
<u>Poa pratensis</u>	Kentucky Bluegrass
<u>Poa secunda</u>	Sandberg Bluegrass
<u>Sitanion hystrix</u>	Squirreltail
<u>Stipa columbiana</u>	Columbia Needlegrass
<u>Stipa lettermani</u>	Letterman Needlegrass
<u>Achillea lanulosa</u>	Yarrow
<u>Allium acuminatum</u>	Wild onion
<u>Antennaria dimorpha</u>	Everlasting
<u>Arabis holboellii</u>	Hornem Rockcress
<u>Arenaria congesta</u>	Sandwort
<u>Aster chilensis</u> subsp. <u>adscendens</u>	Aster
<u>Astragalus argophyllus</u>	Loco Weed
<u>Astragalus decumbens</u>	Loco Weed
<u>Astragalus miser</u> var. <u>decumbens</u>	Milkvetch
<u>Berberis vulgaris</u>	Common Barberry
<u>Camassia quamash</u>	Camas
<u>Capsella bursa-pasturus</u>	Shepherd's Purse
<u>Chenopodium leptophyllum</u>	Goosefoot
<u>Cirsium spp.</u>	Thistle
<u>Collomia tenella</u>	Collomia
<u>Cordylanthus ramosus</u>	Cordylanthus
<u>Cynoglossum officinale</u>	Hound's Tongue
<u>Delphinium nelsonii</u>	Low Larkspur
<u>Epilobium paniculatum</u>	Willow Weed
<u>Erigeron speciosus</u>	Fleabane
<u>Eriogonum heracleoides</u>	Eriogonum
<u>Galium boreale</u>	Bedstraw
<u>Geranium fremontii</u>	Geranium
<u>Hydrophyllum capitatum</u>	Water leaf
<u>Lepidium montanum</u>	Peppergrass
<u>Lomatium grayi</u>	Desert Parsley
<u>Lupinus laxiflorus</u>	Lupine
<u>Madia glomerata</u>	Madia
<u>Microseris nutans</u>	Microseris

Table 37 continued.

Scientific name	Common name
<u>Phlox gracilis</u>	Phlox
<u>Potentilla gracilis</u>	Cinquefoil
<u>Potentilla pectinisetia</u>	Cinquefoil
<u>Senecio integerrimus</u>	Senecio
<u>Senecio serra</u>	Senecio
<u>Sidalcea neomexicana</u>	Prairie Mallow
<u>Sphaeralcea coccinea</u>	Globe Mallow
<u>Thalictrum fendleri</u>	Meadow Rue
<u>Tragapogon porrifolius</u>	Oyster plant
<u>Taraxacum officinale</u>	Dandelion
<u>Vicia americana</u>	American Vetch
<u>Viola canadensis</u>	White Violet
<u>Viola vallicola</u>	Yellow Violet
<u>Wyethia amplexicaulis</u>	Mule Ears
<u>Zigadenus paniculatis</u>	Foothill Death Camas
<u>Amelanchier alnifolia</u>	Service Berry
<u>Artemisia arbuscula</u>	Low Sagebrush
<u>Artemisia cana</u>	Hoary Sagebrush
<u>Artemisia nova</u>	Black Sage
<u>Artemisia tridentata</u>	Sagebrush
<u>Chrysothamnus viscidiflorus</u>	Rabbitbrush
<u>Populus tremuloides</u>	Aspen
<u>Purshia tridentata</u>	Bitter Brush
<u>Rosa woodsii</u>	Wildrose
<u>Symphoricarpos vaccinioides</u>	Snowberry
<u>Tetradymia canescens</u>	Spineless Horsebrush