Food Habits and Distribution of Cattle on a Forest and Pasture Range in Northern Idaho

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Abstract

The food habits and distribution of a cow-calf herd on a northern Idaho summer range was studied for 2 years. The forest-pasture range consisted of comparable areas of seeded grassland (pasture), tall brush, and forest communities. The entire area was classified as Douglas-fir *(Pseudotsuga menziesii)*/ninebark *(Physocarpus malvaceus)* habitat-type; however, ponderosa pine *(Pinus ponderosa)* dominated the forested communities. By early July, up to one-half of the cattle diet came from forest species, primarily browse. Ninebark comprised the major browse diet component. Browse species were selected more frequently in 1978, a wet year, than in the drought year of 1977, primarily because the livestock spent more time in the pasture during 1977. This occurred even though pasture production was much greater in 1978. Range managers in the northern Rockies should consider the forage value of tall shrubs when planning grazing programs.

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Summer ranges in the foothills and mountains of eastern Washington, northeastern Oregon, and adjacent Idaho have provided forage to cattle for more than a century (Cotton 1904). In early years the concepts of multiple-use and intensive resource management were unknown. Water quality and forest practices acts did not exist. Presently, however, such considerations greatly influence natural resource management in the northern Rockies, as well as other locations, requiring increasingly efficient and sophisticated approaches to achieve attendant management objectives.

A better understanding of livestock habits will provide information important in the management of forested rangelands during the 1980's. Numerous studies concerning livestock use of forest-range ecosystems have been conducted, but little of this work has taken place in the northern Rocky Mountains. More specifically, information pertaining to the feeding habits and distribution of cattle in the Douglas-fir *(Pseudotsuga menziesii)* zone (Daubenmire and Daubenmire 1968) of northern Idaho and adjacent Washington is scarce. Much of the Douglas-fir zone is characterized by understories dominated by tall and medium shrubs.

The value for browse of tall and medium shrubs in Douglas-fir forests has been reported as variable, depending upon species. Pengelly (1963) proposed a relationship which echoes the opinion of most managers of forested rangeland in the Northwest: Shrub species preferred by domestic livestock and big game mostly occur on open sites following logging or fire, while shrub species most prevalent as a stand approaches climax are unpalatable and seldom utilized as forage. Among the former are redstem ceanothus *(Ceanothus sanguineus)* elderberry (*Sambucus* spp.), serviceberry *(Amelanchier alnifolia),* willow *(Salix scouleriana),* and chokecherry (*Prunus* spp.). The latter include ocean spray *(Holodiscus discolor),* ninebark *(Physocarpus malvaceus),* snowberry (*Symphoricarpos* spp.), and spirea *(Spiraea betulifolia).* Support for such a hypothesis may be found in Idaho Soil Conservation Service woodland grazing guides, which list the species associated with seral communities as having high or medium forage value, while those associated with climax understories are given a low forage value rating. The Forest Service Northern Region omits any mention of forest-shrub communities in their Range Analysis Handbook (Forest Service Handbook 2209.21 R-1), leaving the connotation that shrub species have no significant forage value.

A few researchers have reported some use of these supposedly poor browse species. For example, Thilenius and Hungerford (1967) found ninebark and snowberry to be utilized by both cattle and white-tailed deer in a Douglas-fir/ninebark habitat type near Princeton, Ida.; however, their work dealt mostly with competition between deer and livestock, and did not emphasize the dietary aspects of the data. In a well-conducted three-year study in the Blue Mountains of Oregon, Holechek et al. (1982) measured overall browse intake by cattle at 23% of their diet, primarily from snowberry. They also demonstrated that cattle can significantly change their diet both within and between grazing seasons in response to vegetal and climatic factors.

Studies on cattle distribution and behavior have taken place in such places as Arizona (Clary et al. 1978), Utah (Cook 1966), Oklahoma (Dwyer 1962), and Oregon (Roath and Krueger 1982). No comparable research has been conducted in conifer/tall shrub ecosystems such as are commonly found in northern Idaho. This research, then, was designed to (1) describe cattle distribution on an area comprised of both a seeded pasture and a mixed-conifer/tall shrub forest, and to (2) determine the species composition and trend of cattle diets throughout the grazing season, given such free-choice conditions.

Study Area Description

The Rock Creek study area is approximately 6 km south of Potlatch, Ida., near Moscow Mountain on the north slope of the Palouse Range. The privately owned area, situated at an average elevation of 950 m, has a climate typified by warm, dry summers and cool, wet winters. Precipitation varies around 640 mm, two-thirds of which falls, mostly as snow, between late fall and early spring. The study site has deep, moderately well-drained loessal soils, primarily classified as frigid Boralfic Argixerolls (Soil Survey Staff 1975) with slopes between 4 and 25%.

Vegetation in the area is dominated by the Douglas-fir/ninebark habitat type (Daubenmire and Daubenmire 1968). On the most mesic north-facing steeper slopes, the grand fir/mountain-lover *(Abies grandis/ Pachistima myrsinites)* habitat type is found.

At the time of this research approximately 25% of the 65-ha study site was in seeded pasture, 20% was in 3 shrub fields, 20% was open forest (±40% crown cover), and the remaining 35% constituted a closed-canopy forest (70%+ crown cover) (Fig. 1).

The pasture, which was logged in the early 1900's, had been grazed, cultivated, and hayed at different times through the years. It was fertilized with ammonium nitrate at a rate of 70 kg ha^{-1} N in the early spring during both years of this study, 1977 and 1978. The pasture was stratified into a north and south pasture for vegetation sampling purposes because of obvious differences in primary production and utilization that could be observed. Dominant perennial species were smooth brome *(Bromus inermis)* and a mixture of bluegrasses (*Poa* spp.).

The open forest community was characterized by an overstory of ponderosa pine *(Pinus ponderosa)* with an understory of invading Douglas-fir seedlings and saplings. The densely forested community was dominated by Douglas-fir in the overstory, with ponderosa pine, western larch *(Larix occidentalis),* and a few grand fir interspersed.

Methods

The study site was grazed by cows with calves during the summers of 1977 and 1978. Stocking levels were set by the lessee at 44 and 58 animal units, respectively. Most of the cows had grazed there previously. The first year was quite dry (409 mm) while precipitation during 1978 exceeded normal (759 mm), hence sufficient herbage was available in the pasture to accommodate the increased stocking rate. Livestock were permitted free access to the

Table 1. Percent composition (±80% CI) by weight and estimated net production ((±80% CI) of major forage species in the north and south areas of a pasture, Douglas-fir zone, northern Idaho.

	North area[1]		South area	
Category/species	1977[2]	1978	1977[3]	1978
Grasses/Grasslike				
Agrostis interrupta	10 ± 5	2 ± 3		3 ± 3
Bromus inermis	44 ± 10	35 ± 5		25 ± 8
Bromus mollis	5 ± 2	11 ± 4		7 ± 2
Festuca arundinacea	—	3 ± 2		1 ± 1
Phleum pratense	17 ± 8	18 ± 7		1 ± 2
Poa spp.	14 ± 3	31 ± 6		54 ± 8
Forbs				
Achillea millefolium	—	—		2 ± 4
Cirsium spp.	—	—		2 ± 1
Rumex acetosella	2 ± 3	—		1 ± 1
Sanguisorba occidentalis	3 ± 3	—		—
Other forbs	5 ± 3	—		5 ± 2
Net Primary Production (Kg ha^{-1} yr^{-1})	2205 ± 394	5143 ± 690		2052 ± 251

[1]The north area had been grazed lightly to moderately (~50-55%) while utilization in south area averaged 75%. This differential grazing pressure had occurred for at least a decade.
[2]In 1977, precipitation was only 410 mm, while in 1978 it reached 760 mm. Average for this site is 640 mm.
[3]Data not available.

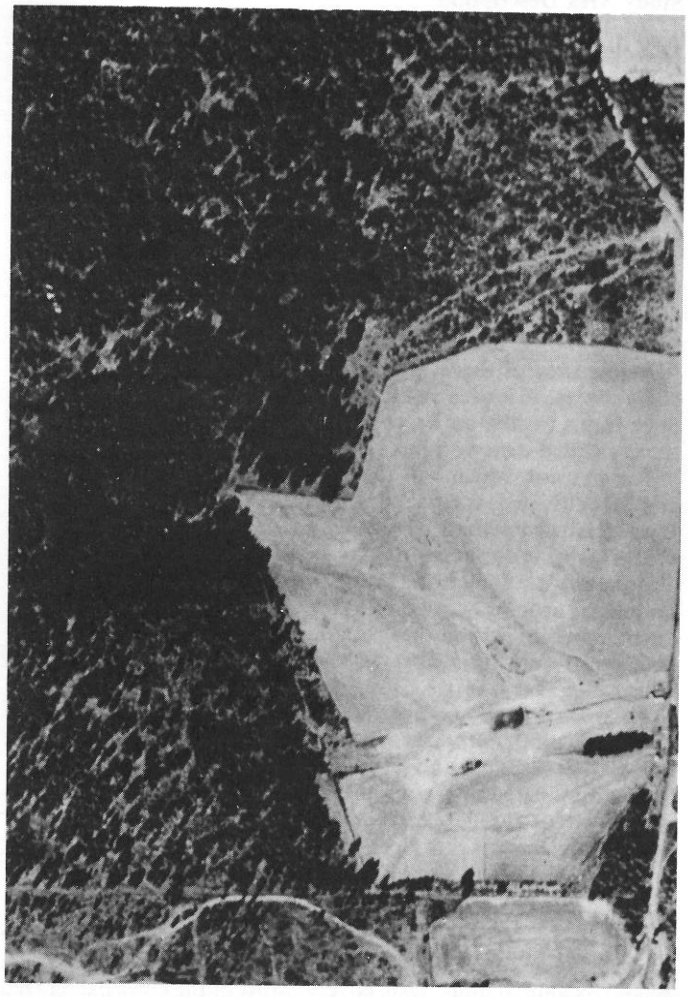

Fig. 1. *Aerial view of 65-ha forest-pasture study site, Latah County, northern Idaho.*

entire forest-pasture range throughout both grazing seasons. Salt was placed in the forested community, and water was generally only available from a development and a creek in the pasture.

Percent composition and estimated net primary production (NPP) of the pasture species were obtained by collecting air-dry biomass data during mid-June, -July, and -August. Twenty 0.1-m^2 circular plots were randomly located in both the north and south areas of the pasture; only the north area of the pasture was sampled in 1977. NPP estimates were based on summation of species peak biomass (Kelly et al. 1974).

Production estimates could not be made for the shrub fields and forest communities because exclosures were unavailable. However, percent composition by air-dry weight and total available biomass were estimated during June, July, and August 1978, using 10 0.1-m^2 circular plots within each of the 3 shrub fields and 10 0.5-m^2 plots in the forest community types.

Line transects were used to estimate the percent cover of tall shrubs (Canfield 1941). Preliminary sampling had indicated that estimating tall shrub biomass at the same level of precision as herbaceous species would be overly time-consuming. Since available shrub biomass far exceeded forage requirements, its relative abundance by species was determined on the basis of cover.

Fecal analysis was used to determine the composition of cattle diets. The procedures for this technique are outlined by Sparks and Malechek (1968). Ten fresh fecal grab samples, each representing a different individual, were collected at biweekly intervals from early June through the first of September in both 1977 and 1978. Two slides were made per fecal sample and 10 fields were read per slide. Fragments were categorized by genus and species when possible. Unidentifiable plants were grouped by life form category. Both the numbers of slides and observations per slide were probably inadequate for obtaining precise estimates of diet composition for each animal (Holechek and Vavra 1981). The small sample size reflected a desire to eliminate between-animal variation while achieving an accurate estimate for the herd as a whole, given the limited laboratory time available for the microhistological technique; i.e., the number of observations per grab sample was reduced in order to obtain a larger number of grab samples. The sample size was judged sufficient to distinguish differences in the diet by life form and major species.

A total of 49 different forage plants were identified in the diet by fecal analysis. Those plants making up at least 3% of the diet for any one sampling period were used in the data analysis. Eleven forage plants were so selected in 1977, while 17 satisfied this criterion in 1978. Collectively, they represented approximately 75% of the cattle's diet.

Multivariate analysis of variance was used to compare the various components of the diets. This statistical method takes into account the interrelationships of plants in the diet; thus, life forms and diets as a whole can be compared (Morrison 1976). Spearman's rank order correlation (RHO) was also used to evaluate cattle diets (Conover 1971).

The densities of cattle droppings for the pasture, shrub, and forest communities were estimated in 1978, using selectively located 25-m^2 circular plots, in order to monitor cattle distribution on the study site throughout both grazing seasons. A conversion factor of 12 droppings per animal unit day was assumed (Forest Service Handbook 2209.21).

Visual observations of cattle distribution and feeding habits were also recorded. They not only provided information on cattle distribution and activities, but also served as a check on the fecal analysis.

The overall study, of which this research comprised a part, was designed to evaluate cattle as a non-point pollution source on a watershed within the study area (Fortier et al. 1980, Jawson et al. 1982).

Results

The major perennial species present in the pasture were smooth brome, bluegrass *(Poa pratensis* and *P. compressa),* and, to a lesser extent, timothy *(Phleum pratense)* (Table 1). As a group, they comprised about 70% of the pasture composition by weight. Annual grasses dominated the remaining pasture production; they included interrupted apera *(Agrostis interrupta),* soft chess *(Bromus mollis),* and rat-tail fescue *(Festuca myuros).* Production on good-condition sites ranged from 2,000 kg ha^{-1} yr^{-1} in 1977, the dry year, to 5,000 kg $ha^{-1}yr^{-1}$ in 1978, the wet year. On poorer sites, about one quarter of the pasture, production was less than half this rate.

Understory vegetation in the 2 forest communities and shrub fields did not vary greatly in species composition, reflecting a greater speed of succession in the understory than in the overstory (Table 2). Pinegrass *(Calamagrostis rubescens)* and elk sedge *(Carex geyeri)* were the most important graminoids. Common forbs included heartleaf arnica *(Arnica cordifolia),* elk weed *(Frasera fastigiata),* lomatium *(Lomatium triternatum),* and cinquefoil *(Potentilla gracilis).* Shrub species, however, provided most of the understory biomass available as forage. While forb and graminoid production accumulated to approximately 200 kg $ha^{-1}yr^{-1}$ on open sites, shrubs provided in the order of 10 to 20 times more usable forage.

Tall shrubs ranged in canopy cover from 5 to 70% on the forest and shrub communities, with average values of approximately 35 and 60%, respectively (Table 3). Ocean spray and ninebark were the dominant species, constituting between 75 and 100% of tall

Table 2. Percent composition (±80% CI) by weight and total biomass (±80% CI) of grasses, forbs, and low shrubs in the shrub fields and forest communities, Douglas-fir zone, northern Idaho. Data obtained during June, July, and August 1978.

Category/species	Percent composition		
	June	July	August
Grasses/Grasslike			
Agropyron spicatum	1 ± 1	1 ± 2	1 ± 1
Bromus vulgaris	1 ± 1	2 ± 1	2 ± 1
Carex geyeri	6 ± 2	11 ± 3	27 ± 6
Calamagrostis rubescens	23 ± 5	25 ± 10	17 ± 8
Poa spp.	2 ± 1	2 ± 2	5 ± 3
Other Grasses	3 ± 2	2 ± 1	4 ± 2
Forbs			
Achillea millefolium	1 ± 2	1 ± 1	1 ± 1
Arnica cordifolia	8 ± 7	4 ± 2	—
Besseya rubra	2 ± 2	1 ± 2	—
Fragaria vesca	2 ± 4	2 ± 4	3 ± 3
Frasera fastigiata	1 ± 1	1 ± 2	10 ± 8
Lathyrus bijugatus	4 ± 5	3 ± 3	—
Lomatium triternatum	3 ± 1	4 ± 2	2 ± 1
Potentilla gracilis	5 ± 4	10 ± 6	1 ± 1
Senecio integerrimus	2 ± 1	1 ± 1	—
Viola adunca	2 ± 3	1 ± 2	—
Other Forbs	7 ± 5	6 ± 3	4 ± 3
Low Shrubs			
Pteridium aquilinum	—	2 ± 3	1 ± 2
Rosa gymnocarpa	5 ± 3	8 ± 5	10 ± 4
Spiraea betulifolia	4 ± 2	4 ± 2	2 ± 2
Symphoricarpos albus	17 ± 4	9 ± 3	9 ± 4
Other Low Shrubs	1 ± 1	—	1 ± 2
Total Biomass (kg ha^{-1})	617 ± 163	468 ± 99	226 ± 60

shrub cover. Medium shrubs, represented for the most part by snowberry and wild rose *(Rosa gymnocarpa),* were less prevalent, averaging less than one-half the cover of tall shrubs (Rodgers 1980).

Grass and browse species were the major components of cattle diets in both 1977 and 1978 (Fig. 2). The first year, grass was the principal diet constituent for all except the last sampling period, when the shrub category surpassed it. The following year, however, browse species apparently made up the greatest percentage of the diet in 4 of the 7 biweekly sample periods. Annual means for the dietary components were 60, 7, and 33% for grasses, forbs, and shrubs, respectively, in 1977, and 52, 9, and 39% in 1978.

Generally, diets as a whole were significantly different among sampling dates for each year. Grass, forb, and browse diet components were evaluated individually. In general, the 2 major dietary components, grass and browse, remained fairly consistent during midsummer in both grazing season, but changed significantly dur-

Table 3. Average percent cover (±80% CI) of tall shrubs in the shrub fields and forested communities, Rock Creek research site, northern Idaho.

Species/category	Shrub fields	Forested communities
Amelanchier alnifolia	1	1
Ceanothus sanguineus	12	1
Holodiscus discolor	19	18
Physocarpus malvaceous	27	10
Prunus emarginata	—	1
Salix scouleriana	2	1
Total Cover	61 ± 14	32 ± 13

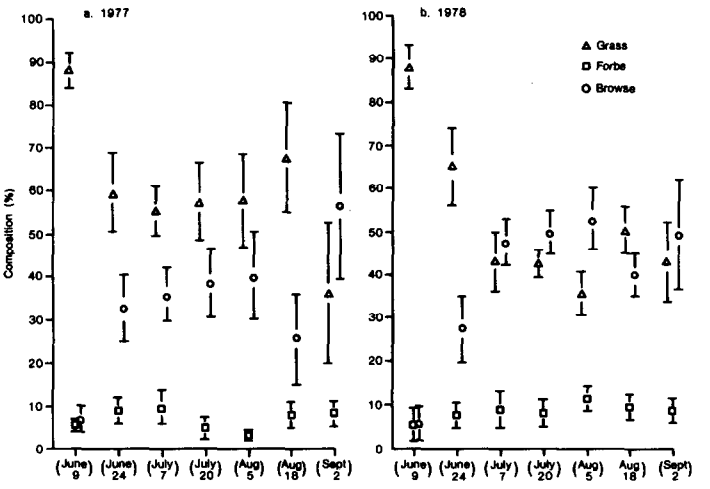

Fig. 2. *Percent composition (±95% CI) of grasses, forbs, and browse in the diet of cattle grazing a forest-pasture range in northern Idaho during (a) 1977 and (b) 1978.*

ing spring and fall (Fig. 2). The significant differences found between dates during midsummer for grass reflected a shifting among species, and not a change in the percentage of total grass consumption.

Spearman's rank correlation coefficient had relatively high values (.53 ≤ RHO ≤ .94) when comparing consecutive dates within years and the same dates between years (Table 4). The median RHO values, when making all pairwise comparisons within years, were greater for 1977 (.80) than 1978 (.44). This suggests that the diets changed more through the season in the latter year.

Useful information can be obtained from the ranking of forage plants as to their importance in the diet (Vavra et al. 1978). Pasture species receiving the highest rankings were brome (both perennial

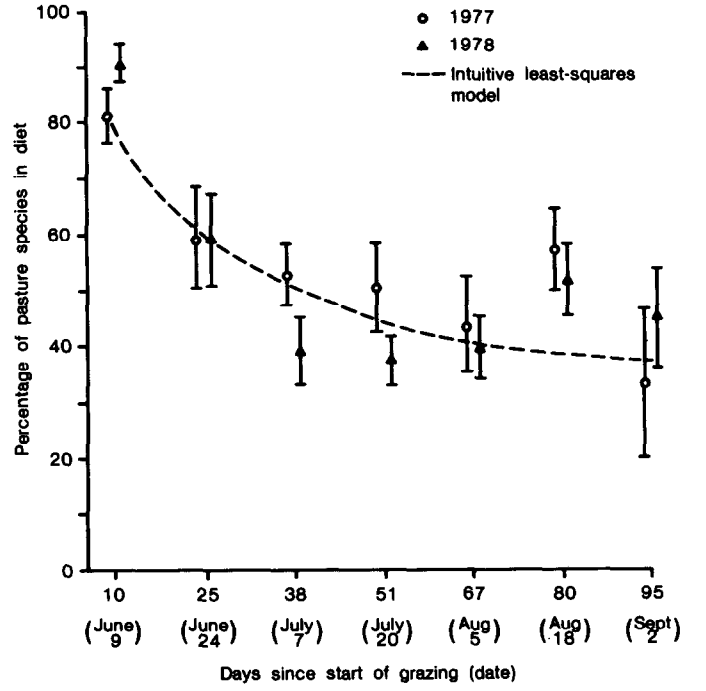

Fig. 3. *Percent composition of cattle diets comprised of pasture species on a forest-pasture range in the Douglas-fir zone, northern Idaho (±95% CI). Dotted line denotes predicted Y from intuitive model based on inverse of natural growth function.*

Table 4. Spearman's rank order correlation for (A) 1977/78 and (B) 1977 vs. 1978 diets of cattle grazing a forest-pasture range in the Douglas-fir zone, northern Idaho.

A Within years

	June 24	July 7	July 20	August 5	August 18	Sept. 2
June 9	.62/.61	.56/.16	.53/-.02	.50/-.14	.65/.10	.29/.13
June 24		.88/.76	.81/.44	.79/.24	.79/.37	.64/.38
July 7			.89/71	.86/.55	.90/.44	.75/.44
July 20				.94/.73	.83/.55	.80/.48
August 5					.90/.58	.90/.65
August 18						.83/.53

B Between years

	1978						
	June 9	June 24	July 7	July 20	August 5	August 18	Sept. 2
1977							
June 9	.65	.58	.33	.15	.02	.18	.19
June 24		.64	.65	.56	.54	.65	.68
July 7			.67	.48	.33	.76	.71
July 20				.53	.47	.63	.62
August 5					.56	.70	.73
August 18						.73	.72
Sept. 2							.81

and annual), bluegrass, and timothy (Table 5). The 2 major browse species consumed were ninebark and ocean spray. In fact, ninebark ranked first in the diet approximately 70% of the time. The most important herbaceous species in the diet unique to the forest and shrub communities was pinegrass. Only one forb, western yarrow *(Achillea millefolium),* was consistently consumed by the cattle.

Diet data were used to determine whether cattle spent their time feeding in the pasture or forest/shrub communities (Fig. 3). Except for western yarrow, which was omitted from the analysis, species constituting at least 3% of the diet were unique to 1 of the 2 areas. Taken collectively, these data support a hypothesis that preference for pasture species decreases rapidly in the early summer and gradually in late summer when cattle have access to both areas. For unknown reasons, intake of pasture species was higher than expected during mid-August of both years (Fig. 3). In general, the relationship between forage source and season was consistent between years. The only notable significant differences occurred during early to mid-July, when cattle consumed a higher proportion of pasture species in 1977.

To quantify the relationship between pasture use and time, the inverse of a natural growth function was proposed as an intuitive model. Using the data supporting Figure 3 (except for those collected in mid-August, which were assumed to be outliers for the purpose of the model), the following least-squares model was obtained.

$$Y = 100 - 64\,(1 - e^{-.038X})$$

where Y is the proportion of pasture species in the diet, and X is the number of days since the start of the grazing season (Fig. 3). The

Table 5. Mean percentages of major forage species constituting the diet of cattle grazing a forest-pasture range in the Douglas-fir zone, northern Idaho, 1977-78. Included are species making up ≥3% of the diet for at least one sampling period.

	Sampling period													
	6-9		6-24		7-7		7-20		8-5		8-18		9-2	
Category/species	1977	1978	1977	1978	1977	1978	1977	1978	1977	1978	1977	1978	1977	1978
Grasses														
Brome (annual)	4	19	3	12	2	5	2	2	<1	3	0	<1	0	<1
Smooth brome	26	14	16	9	9	4	8	4	12	4	14	7	6	9
Pine grass	7	2	4	9	8	9	10	9	15	4	14	4	8	3
Timothy	7	7	8	6	9	1	5	2	4	1	7	5	4	5
Bluegrass	17	15	16	11	9	12	13	13	9	11	13	16	5	12
Total grasses	87	88	59	65	55	43	57	42	57	36	67	50	36	43
(±95% C.I.)	(4)	(5)	(9)	(9)	(6)	(7)	(9)	(3)	(11)	(7)	(13)	(6)	(16)	(9)
Browse														
Ninebark	2	3	16	18	15	30	17	22	19	22	11	13	24	22
Ocean spray	2	0	6	0	7	3	6		8	8	6	5	11	7
Redstem ceanothus	0	0	0	0	0	1	0	3	0	6	0	2	0	1
Serviceberry	0	0	0	1	0	3	0	4	0	2	0	2	0	1
Ponderosa pine needles	0	0	1	2	3	3	3	2	3	4	1	4	8	3
Total browse	7	6	33	27	35	48	38	50	40	53	25	40	56	49
(±95% C.I.)	(3)	(4)	(8)	(7)	(7)	(6)	(8)	(5)	(11)	(7)	(11)	(5)	(17)	(10)
Forb														
Western Yarrow	2	4	4	3	4	1	<1	2	<1	2	1	3	<1	3
Total forbs	6	6	8	8	10	9	5	8	3	11	8	10	8	8
(±95% C.I.)	(2)	(4)	(3)	(3)	(4)	(4)	(3)	(4)	(1)	(3)	(3)	(3)	(3)	(3)

model accounted for 95% of the variation in Y.

Cow chip densities were useful in estimating the relative time cattle spent in the forest, shrub, and pasture communities. Their preference, in descending order, was for shrub field, pasture, open forest, and dense forest during July 1978. In August, the order between shrub field and pasture was reversed. Estimates of time spent in the 2 principal areas, pasture and forest/shrub, was 30 and 70%, respectively, for July, and 45 and 55% for August.

Visual observations substantiated the results obtained from fecal analysis and chip counts. They showed the relatively high use of forest/shrub communities in relation to diet information during July 1978 to ensue from occupation of these sites when not grazing.

Discussion

Prevalent concepts in range livestock behavior state that, when an abundance of grass exists, cattle generally select graminoids as their major forage source (Cook et al. 1967, Skovlin et al. 1976). As the quantity of herbage is reduced through the grazing season, browse often becomes a major diet constituent (Julander 1955, Connor et al. 1963). Browse also increases proportionally in cattle diets during late summer as some grass species cure, thereby reducing their level of crude protein below critical values (Holechek et al. 1981). This study, however, found a large proportion of the diet to consist of browse, even when the quantity and quality of herbaceous vegetation were not limiting. Excluding the first sampling period in both study years, at least 25% of the diet always consisted of shrub species.

Browse tended to increase in the diet throughout both grazing seasons, except for an unexplained decline in August. Although increases in the proportion of browse were not always significant, the overall trend remained obvious.

Visual observations noted that cattle were apparently more selective in the forest and shrub communities than they were in the pasture. This selectivity pertained to the parts of plants as well as species selection. For example, cattle were observed stripping leaves from shrub twigs, rather than cropping them off. Ocean spray flowers were relished, but there appeared to be no selection for inflorescences of other shrubs. In addition, cattle were observed riding down the branches of tall willow plants so they could consume the leaves that were out of reach.

Snowberry constituted a negligible proportion of the cattle diet in this study. Vavra and Holechek (1980) have recently demonstrated that snowberry shows considerable destruction during digestion, resulting in its underestimation as a diet constituent. However, preference for snowberry probably remained much lower than that shown in an Oregon study by Holechek et al. (1982). Sufficient dissimilarities existed between the 2 studies to account for the differences observed, but not to explain them. Nonetheless, Pengelly's (1963) conclusion concerning the uselessness of ninebark, ocean spray, and snowberry as forage species has been shown to be overly generalized, at least for cattle.

In the pasture, timothy was obviously a highly preferred species (Table 5). This was especially evident in 1978 when it made up an insignificant proportion of the pasture's composition, but was still measured as an important component in the cattle diet. Utilization of soft chess and other annual grasses after they became unpalatable resulted more from the cattle extirpating them as they grazed the green leaves of perennial grasses, rather than a selection for them per se.

Cattle spent a greater amount of time in the pasture during the drought year of 1977 than in 1978; thus, more forage was consumed from this community. Management practices were similar for both years, but cattle appeared to be more bothered by flies in 1977, and possibly were able to obtain a greater degree of relief from them in the pasture. Dwyer (1962) has observed that flies cause less trouble with cattle during the heat of the day if cattle are in the sun.

Observations indicated that daytime temperatures were an important factor affecting cattle distribution in 1978. It is known that animals seek relief from heat by shading; hence, grazing time is reduced by hot temperatures (Ehrenreich and Bjugstad 1966). The high temperatures recorded in July and early August 1978, coupled with a lessening of the fly problem, probably were overriding factors causing the cattle to make fairly steady use of the forest and shrub communities during this time.

This study reinforced the established precept that cattle utilize open-canopied forests much more heavily than densely forested areas (Pickford and Reid 1948). Communities having open conifer overstories on the study area were preferred by cattle, while sites having a closed overstory canopy were usually just travelled through and used for shade around their periphery. Some browsing was observed under dense canopy during the hottest part of the day in late summer. The open forest and shrub communities were used for shade as well as forage.

The only discrepancy between the fecal data versus visual appraisal and vegetation production estimates was the dietary importance of ponderosa pine (Table 5). Although cattle were occasionally observed browsing ponderosa pine and some pine needles were likely ingested inadvertently with other forage, it appears that the use of this species was overestimated. This could be accounted for by the morphological characteristics of pine needles, which would enable them to survive chemical digestion better than parts of other forage species (Anthony and Smith 1974).

Conclusion

Land managers of forested rangelands in the northern Rocky Mountains should consider tall and mid browse species as a forage source for cattle when determining carrying capacity. Parameters defining the degree of expected use will have to be somewhat site-specific. Cattle behavior and food habits on ranges containing both forest and pasture land are complex functions, responding interactively to food supply, climate, and perhaps other factors.

Literature Cited

Anthony, R.G., and N.S. Smith. 1974. Comparison of rumen and fecal analysis to describe deer diets. J. Wildlife Manage. 38:535-540.

Canfield, R. 1941. Application of the line interception method in range vegetation. J. Forest. 39:388-394.

Clary, W.P., P.F. Ffolliott, and F.R. Larson. 1978. Factors affecting forage consumption by cattle in Arizona ponderosa pine forests. J. Range Manage. 31:9-10.

Connor, J.M., V.R. Bohman, A.L. Lesperance, and F.E. Kinsinger. 1963. Nutritive evaluation of summer forage with cattle. J. Anim. Sci. 22:961-969.

Conover, W.J. 1971. Practical nonparametric statistics. John Wiley and Sons, Inc. New York, N.Y.

Cook, C.W. 1966. Factors affecting utilization of mountain slopes by cattle. J. Range Manage. 19:200-204.

Cook, C.W., L.E. Harris, and M.C. Young. 1967. Botanical and nutrient content of diets of cattle and sheep under single and common use on mountain range. J. Anim. Sci. 26:1169-1174.

Cotton, J.S. 1904. A report on the range condition of central Washington. Washington Agr. Exp. Sta. Bull. 60.

Daubenmire, R.F., and J.B. Daubenmire. 1968. Forest vegetation of eastern Washington and northern Idaho. Washington Agr. Exp. Sta. Tech. Bull. 60.

Dwyer, D.D. 1962. Activities and grazing preferences of cows with calves in northern Osage County, Oklahoma. Oklahoma Agr. Exp. Sta. Bull. B-588.

Ehrenreich, J.H., and A.J. Bjugstad. 1966. Cattle grazing time is related to temperature and humidity. J. Range Manage. 19:141-142.

Fortier, D.H., M. Molnau, and K.E. Saxton. 1980. Sediment from a small summer grazed watershed. p. 790-801. *In:* Symposium on watershed management 1980. Boise Ida., July 21-23, 1980. Vol. 2. Amer. Soc. Civil Eng., New York, N.Y.

Holechek, J.L., and M. Vavra. 1981. The effect of slide and frequency observation numbers on the precision of microhistological analysis. J. Range Manage. 34:337-338.

Holechek, J.L., M. Vavra, and J. Skovlin. 1981. Diet quality and performance of cattle on grassland and forest range. J. Anim. Sci. 53:291-298.

Holechek, J.L., M. Vavra, J. Skovlin, and W.C. Krueger. 1982. Cattle diets in the Blue Mountains of Oregon II. Forests. J. Range Manage. 35:239-242.

Jawson, M.D., L.F. Elliott, K.E. Saxton, and D.H. Fortier. 1982. The effect of cattle grazing on indicator bacteria in runoff from a Pacific Northwest watershed. J. Environ. Qual. 11:621-627.

Julander, O. 1955. Deer and Cattle relations in Utah. Forest Sci. 1:131-139.

Kelly, J.M., G.M. Van Dyne, and W.F. Harris. 1974. Comparison of three methods of assessing grassland productivity and biomass dynamics. Amer. Midland Natur. 92:357-369.

Morrison, D.F. 1976. Multivariate statistical methods. McGraw-Hill Book Co., New York, N.Y.

Pengelly, W.L. 1963. Timberlands and deer in the northern Rockies. J. Forest. 61:734-740.

Pickford, G.D., and E.H. Reid. 1948. Forage utilization on summer cattle ranges in eastern Oregon. USDA Cir. No. 769.

Roath, L.R., and W.C. Krueger. 1982. Cattle grazing and behavior on a forested range. J. Range Manage. 35:332-338.

Rodgers, R.T. 1980. Food habits and distribution of cattle on a forest-pasture range in northern Idaho. M.S. Thesis. Univ. of Idaho, Moscow.

Skovlin, J.M., R.W. Harris, G.S. Strickler, and G.A. Garrison. 1976. Effects of cattle grazing on a ponderosa pine-bunchgrass range in the Pacific Northwest. USDA-Forest Service Tech. Bull. PNW-1531. Pacific NW Forest and Range Exp. Sta. Portland, Ore.

Soil Survey Staff. 1975. Soil taxonomy. USDA-Soil Conservation Service Agr. Handbook No. 436.

Sparks, D.R., and J.C. Malechek. 1968. Estimating percentage dry weight in diets using a microscope technique. J. Range Manage. 21:264-265.

Thilenius, J.F., and K.E. Hungerford. 1967. Browse use by cattle and deer in northern Idaho. J. Wildlife Manage. 31:141-145.

Vavra, M., R.W. Rice, and R.M. Hansen. 1978. A comparison of esophageal fistula and fecal material to determine steer diets. J. Range Manage. 31:11-13.

Vavra, M., and J.L. Holechek. 1980. Factors influencing microhistological analysis of herbivore diets. J. Range Manage. 33:371-374.