1973

Evaluation of Cattle Use of A Deer Winter Range in the Black Hills

David C. Hamm

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By

DAVID C. HAMM

A thesis submitted
in partial fulfillment of the requirements for the
degree Master of Science, Major in
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This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree, but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

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EVALUATION OF CATTLE USE OF A DEER WINTER RANGE IN THE BLACK HILLS

Abstract

DAVID C. HAMM

Cattle use of a deer winter range in the Black Hills was investigated during the summer grazing seasons of 1971 and 1972. A U. S. Forest Service grazing allotment situated between Mystic and Redfern, South Dakota, was used as the study area. The allotment was divided into five grazing units or pastures managed collectively under a "rest-rotation" system of grazing. Three study sites were selected in each unit of the allotment, and 75 exclosures were erected on each site; a paired-plot method was used to collect data. Indices to use of sites by deer and cattle were obtained by counts of deer pellet groups and cow chips on belt transects.

Bottom, upland meadow, and prairie study sites were dominated by Kentucky bluegrass (Poa pratensis) and a variety of forbs. Western snowberry (Symphoricarpos occidentalis) was the prevalent browse species on these sites. Vegetation on the open slope and open forest sites was comprised of a large variety of grasses, forbs, and browse, with timber oatgrass (Danthonia intermedia), goldenrod (Solidago spp.), and rose (Rosa spp.) as abundant species.

Bottom, upland meadow, and prairie sites received the heaviest grazing use by cattle both years, with Kentucky bluegrass comprising

the highest percentage of the total forage consumed. Most forage species were grazed inadvertently with Kentucky bluegrass, but preference by cattle was observed for white clover (Trifolium repens), white heath aster (Aster ericoides), and mountain-dandelion (Agoseris glauca). Grazing of browse was not considered severe on any site throughout the grazing seasons. Grazing by cattle was negligible on open slope and open forest sites.

Use by cattle, measured by counts of cow chips per day of grazing, was highest on bottom, upland meadow, and prairie sites, and lowest on open slope and open forest sites. Counts of deer pellet groups were negligible on all sites throughout the grazing season both years. Use by deer in winter, however, as measured by counts of pellet groups, was high on all sites except the prairie site.

Results of this study indicate that the winter carrying capacity of the study area for deer was not significantly affected by cattle grazing in summer.

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INTRODUCTION

The condition of the winter range commonly determines the carrying capacity of an area for big game (Stoddart and Rasmussen 1945a:252). Personnel of the South Dakota Department of Game, Fish and Parks and the U. S. Forest Service have privately expressed concern that the carrying capacity of deer winter ranges in the Black Hills may be seriously reduced when they are grazed by cattle. The seasonal food habits of deer in the Black Hills have been described (Hill 1946, Schneeweis 1969, Schenck 1971); however, little is known about the effect of summer and fall grazing by cattle on the supply of winter deer foods in areas of high winter deer populations.

Accordingly, a study involving range analysis was conducted during the summer and fall of 1971 and 1972 on a public area known for its high winter deer populations that is also grazed by cattle in summer and fall. The objective of the study was to determine whether deer and cattle were in competition for food plants relied upon by deer in winter.

STUDY AREA

The study area was the Slate Prairie Grazing Allotment located between Redfern and Mystic in Pennington County, South Dakota, on Forest Service road 231. This allotment, administered by the Harney District, Black Hills National Forest for grazing and timber production, consists of five pastures or grazing units (Fig. 1).

The Slate Prairie Allotment is located within the 21,000-acre McVey Burn, a site that burned in 1939 (Fig. 2). Since the burn, much of the allotment has been replanted to ponderosa pine (Pinus ponderosa), but sparsely forested areas remain for grazing by deer and cattle.

Topography of the allotment is characterized by steep, rocky slopes which form narrow valleys and draws. Part of the allotment is native prairie occupying steep, rolling hills. Elevations vary from approximately 5,200 to 6,200 feet above sea level. The soil association of the region is classified as rough mountainous, pre-Cambrian (Westin and Bannister 1971).

Ponderosa pine, quaking aspen (Populus tremuloides), and white spruce (Picea glauca) are the dominant tree species. Ponderosa pine and aspen are the most abundant and cosmopolitan, while white spruce is limited to moist bottoms. Ground cover is varied. Slopes are partially forested and covered with grasses, forbs, and shrubs, including timber oatgrass (Danthonia intermedia), goldenrod (Solidago spp.), and rose (Rosa spp.). Bottoms are also partially forested, but are

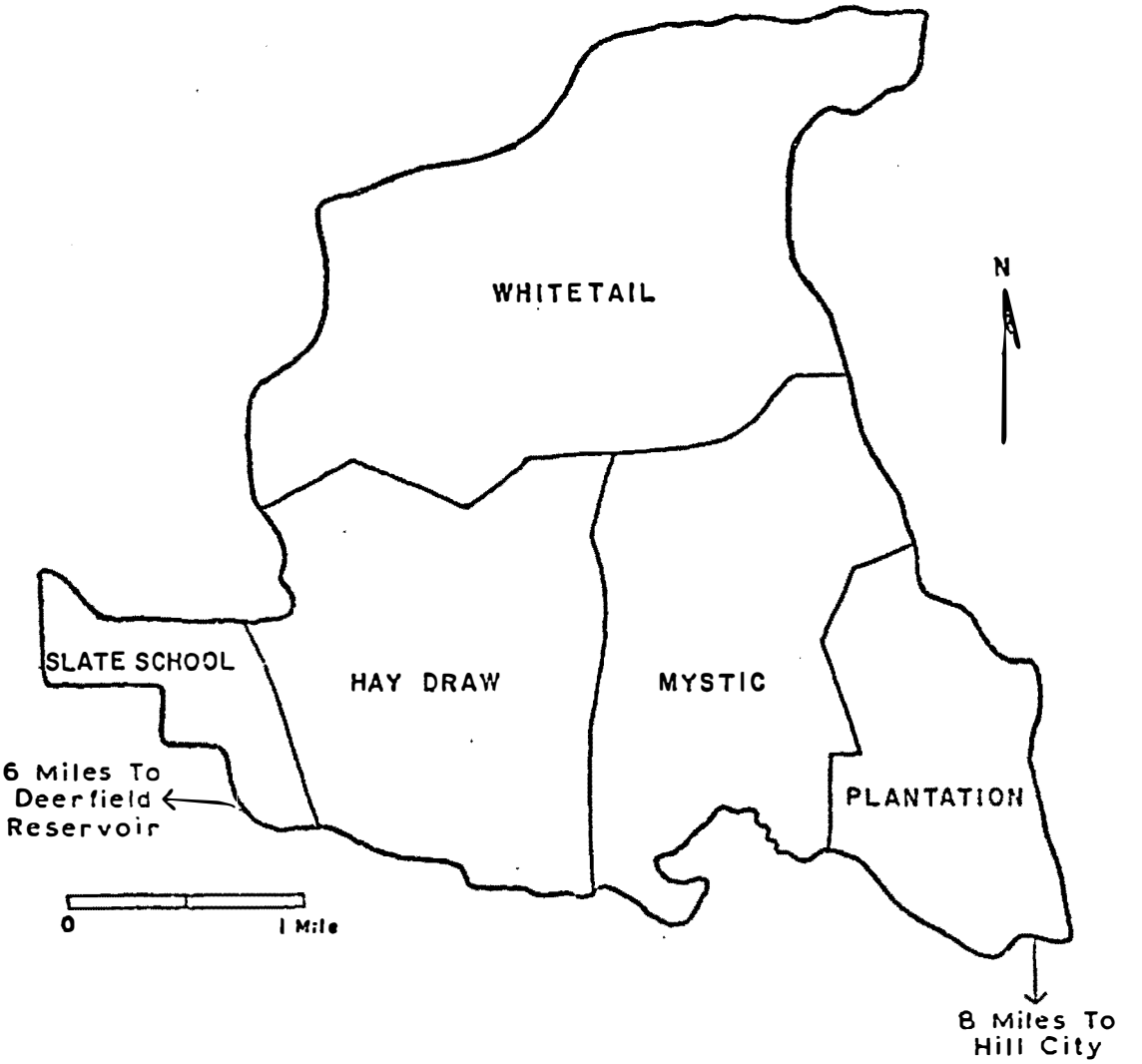

Fig. 1. Grazing units of the Slate Prairie Grazing Allotment.

dominated by Kentucky bluegrass (Poa pratensis), white clover (Trifolium repens), and western snowberry (Symphoricarpos occidentalis). Native prairie vegetation in the Slate School unit is composed of a variety of grasses and forbs with occasional clumps of shrubs and a few trees.

Whitetail deer (Odocoileus virginianus) and mule deer (O. hemionus) are found on the allotment; whitetail deer are the most common, especially during winter months.

At Deerfield, 6 miles west of the study area, the mean annual monthly air temperature is 37 F and the annual precipitation is 20.5 inches (U. S. Dept. Commerce 1971, 1972). Mean annual snowfall is 9.2 feet, but seldom accumulates to that depth.

The allotment is divided by cattle-proof barbed wire fences into five grazing units of varying acreages. Each unit has approximately the same quantity of forage available for grazing by cattle.

Spring-fed ponds, creeks, and stock dams are the principal reliable water sources. Small stock dams which hold water only during early spring and in wet summers are also located throughout the allotment.

Cattle grazing on the Slate Prairie Allotment is managed under a "rest-rotation" system. Four of the units were each successively grazed by 180 head of cattle for about 30 days during the grazing season from June 1 to October 20. The fifth grazing unit was not grazed by cattle (rested) until the following year.

MATERIALS AND METHODS

Study Site Selection

Three study sites were selected within each of the five grazing units after a subjective survey (Table 1). Each site was selected on the basis of apparent heavy use by deer and/or cattle indicated by the abundance of old droppings from deer and cattle. Sites were also selected for proximity to roads to facilitate movement of equipment from one grazing unit to another.

Study sites selected were classified into five categories: bottom, open slope, open forest, upland meadow, and prairie (Figs. 3 to 7).

The bottom sites were sparsely forested bottom lands. Open slope sites were steep slopes partially covered with saplings and a few larger trees, and with a variety of grasses, forbs, and shrubs in the open areas. Open forest sites were similar to the open slopes except that trees were more dense and more mature. The upland meadow site was an old abandoned field vegetated with grasses, forbs, and shrubs. The prairie site was representative of native prairie, with steep, rolling hills covered by a variety of grasses and forbs.

Forage Production and Utilization

A paired-plot method, similar to that described by Klingman et al. (1943), was used to determine forage production and forage utilization by cattle. Annual forage production of each plant species was

Table 1. Grazing units and study sites on the Slate Prairie Allotment, 1971-72.

Grazing Unit	Study Sites	Period Grazed		Days Grazed		Sample Size[a]	
		1971	1972	1971	1972	1971	1972
Hay Draw	Bottom	6/1-7/6	9/16-10/14	36	28	39	75
	Open slope					68	75
	Upland meadow					63	75
Whitetail	Bottom	7/6-8/17	6/1-7/8	42	38	73	67
	Open slope					69	74
	Open forest					69	75
Slate School	Bottom	8/17-9/17	7/8-8/19	31	42	60[b]	75
	Open slope					70	74
	Prairie					75	75
Mystic	Bottom	9/17-10/20	Rested[c]	33	0	77	
	Open slope					73	
	Open forest					64	
Plantation	Bottom	Rested	8/19-9/16	0	38		75
	Open slope						75
	Open forest						75

[a]Seventy-five exclosures were set up on each site; however, usable data could only be collected from the number indicated.

[b]Only 60 exclosures were set up.

[c]Was not grazed by cattle.

Fig. 2. View of McVey Burn from Slate Prairie.

Fig. 3. Bottom site in Whitetail Unit.

Fig. 4. Open slope site in Hay Draw Unit.

Fig. 5. Open forest site in Whitetail Unit.

Fig. 6. Upland meadow site in Hay Draw Unit.

Fig. 7. Prairie site in Slate School Unit.

determined for each study site at the end of the grazing period for each grazing unit. These determinations were made by an ocular estimate of the wet weight of current annual growth of each forage species as it appeared in about 75, 2-square-foot ungrazed plots (Table 1). Each plot was located at the center of about 75 separate 12-square-foot plots protected from grazing by a welded-wire fence exclosure 4 feet in diameter and 6 feet high. The design of the exclosures was a modification of that described by Smith and Sheets (1960). Exclosures were placed on each study site in a grazing unit before that unit was grazed by cattle. Exclosures were held in place by 5-foot steel posts. Exclosures were moved from one pasture to another ahead of the cattle.

Distribution of exclosures on each study site was subjective in order to obtain an even distribution over the entire site and to exclude the possible sampling of areas without vegetation. The shape of the site determined the pattern of distribution that was used. A zig-zag pattern was followed throughout the length of the narrow bottom sites. Twenty-five exclosures were placed along each of three parallel rows spaced approximately 20 yards apart on the rectangular-shaped open slope and open forest sites. A spiral pattern was used on the circular-shaped upland meadow site. A zig-zag row of 25 exclosures was placed on a ridge top, a slope, and a bottom of the prairie site. The location

of each exclosure was marked by a surveying flag placed 20 paces (approximately 15 yards) apart.

At the same time the location for an exclosure was determined, a similar paired plot outside of the exclosure was visually selected and marked with a small colored stake. The plot was located not less than 5 feet from the exclosure because grazing was observed to be unusually heavy within the immediate proximity of the exclosures on heavily grazed sites. Exclosures were arbitrarily relocated to a more suitable nearby site when the plot could not be adequately paired or occurred on bare ground. At the end of the grazing period, ocular estimates were made of the wet weight of each forage species remaining in these plots. Estimates of the percentage utilization of plant species on a wet-weight basis were obtained by an ocular comparison of the grazed plot with the paired ungrazed plot. Accuracy of estimates of percentage utilization were not determined; however, percentages were comparable within this study.

The paired-plot method was not used in the first two units grazed during 1971. In the first unit, three 2-square-foot grazed plots were randomly selected equidistant from each other and the center of the ungrazed plot. These plots were selected after the cattle had been moved to the second pasture in the rotation. All other methods were the same as those with paired plots. Methods used for the second unit grazed were the same as the first except that only two grazed plots opposite

each other and equidistant from the center were randomly selected for each ungrazed plot. The paired-plot method was used for the last two units grazed in 1971 and for all units grazed in 1972.

Error-Correction Terms

Error-correction terms for forage wet-weight estimates were determined by randomly selecting one of every ten pairs of plots for clipping and weighing by plant species and were calculated according to Blair (1968). Clippings were oven dried at 85 F for 24 hours before weighing. Forage species on each study site were combined into six classes according to growth form. An error-correction term was calculated for each growth form. Separate correction terms for grazed and ungrazed plots were calculated for the bottom, upland meadow, and prairie study sites. Data from grazed and ungrazed plots were combined on open forest and open slope sites because both of these sites were only lightly grazed. Error-correction terms were applied to the total estimated wet weights of the appropriate forage growth forms on their respective study sites.

The three study sites on the rested grazing unit were sampled only at the end of each grazing season to determine current annual forage production of each plant species. Ocular wet-weight estimates were made on a total of 75, 2-square-foot plots spaced 20 paces apart. Plots were not clipped for use in calculating error-correction terms because of time and labor limitations. Instead, error-correction terms from other units previously grazed were applied to the wet-weight estimates.

Weekly Changes in Food Habits

Weekly changes in food habits of cattle were determined for each study site during the 1972 grazing season. The percentage wet-weight of each plant species grazed was estimated weekly on study sites of each unit while cattle were on the unit. These estimates were made by an ocular comparison of the grazed plot with its paired ungrazed plot inside the exclosure.

Deer and Cattle Use in Summer

The abundance of deer pellet groups and cow chips was used as an index to relative use of the study sites by deer and cattle during the grazing period for each grazing unit. Results of work done by Julander (1958) indicate that deer pellet group counts are a reliable index to the intensity of deer use.

Five, 200- x 6-feet belt transects were established on each study site. Placement of the transects was determined visually to obtain an even distribution. All deer pellet groups and old cow chips within these transects were marked with tree-marking paint before each grazing unit was grazed. Transects were rechecked at the end of the grazing period, and all fresh deer pellet groups and cow chips were counted and marked. Results were expressed as the number of pellet groups and cow chips per day of grazing by cattle.

Deer Use in Winter

Abundance of deer pellet groups was used as a relative index to use of the study sites by deer during the winter. The same transects used in summer on all study sites were used to enumerate pellet groups. Transects on the first and second grazing units grazed were rechecked at the end of the grazing season in 1971, and all pellet groups were marked. In addition, transects on the rested unit were checked and all pellet groups marked. A recheck of transects on the last two units grazed was not necessary because only a short time elapsed before the end of the grazing season and few new pellet groups would be expected. Transects on all study sites were run at the end of April, 1972, and all pellet groups were counted and marked.

Nomenclature

Names of mammals are from Burt and Grossenheider (1964). Scientific names of plants are from Van Bruggen (1972). Common names of plants are from Johnson and Nichols (1970), Van Bruggen (1971 and 1972), and U. S. Forest Service (1971?). The common names selected from these sources for use in this manuscript are those in use in the Black Hills region.

RESULTS AND DISCUSSION

Vegetation on Study Sites

Bottom, upland meadow, and prairie sites had the highest total oven-dried weight of vegetation per acre in both years (Tables 2 and 3). The largest portion of this production was represented by grasses and sedges. Open slope and open forest sites had the lowest total production per acre, being composed of a large variety of grasses, sedges, and forbs. Forbs comprised a larger portion of the total vegetation on the open slope and open forest sites than on the other study sites. Browse was most abundant on the open slope and open forest sites and least abundant on the bottom, upland meadow, and prairie sites. These estimates of forage production, however, may have been inflated since nonvegetated areas on the study sites were excluded from the samples.

Large variation in forage composition was noted between years on the study sites. This may have been due to the time of year that sites were sampled, since units sampled early in the growing season tended to have less grasses and sedges, but more forbs and browse than when sampled later in the growing season the following year. Variation in grasses and sedges was due in part to immaturity of the plants early in the growing season. The quantity of forbs on a site tended to decrease later in the season because many of the abundant spring forbs such as yarrow (Achillea millefolium) and mountain-dandelion (Agoseris glauca) withered and disappeared before sampling. Loss of leaves caused a

Table 2. Total vegetation available expressed in pounds per acre oven-dried weight, 1971.

Study Site/ Forage Class	Grazing Unit				
	Hay Draw	Whitetail	Slate School	Mystic	Plantation
Bottom					
Grasses and sedges	1,201	2,369	1,559	1,219	98
Forbs	354	759	168	221	165
Browse	176	41	70	24	23
Total	1,731	3,169	1,797	1,464	286
Open slope					
Grasses and sedges	345	232	474	81	115
Forbs	290	385	166	197	155
Browse	56	373	5	132	157
Total	691	990	645	410	427
Open forest					
Grasses and sedges		303		107	96
Forbs		150		272	236
Browse		262		33	53
Total		715		412	385
Upland meadow					
Grasses and sedges	712				
Forbs	673				
Browse	174				
Total	1,559				
Prairie					
Grasses and sedges			1,546		
Forbs			305		
Browse			2		
Total			1,853		

Table 3. Total vegetation available expressed in pounds per acre oven-dried weight, 1972.

Study Site/ Forage Class	Grazing Unit				
	Whitetail	Slate School	Plantation	Hay Draw	Mystic
Bottom					
Grasses and sedges	2,245	2,403	2,057	2,412	2,041
Forbs	691	409	578	292	401
Browse	232	305	46	128	66
Total	3,168	3,117	2,681	2,832	2,508
Open slope					
Grasses and sedges	534	1,243	560	809	242
Forbs	465	510	368	249	229
Browse	352	17	221	65	65
Total	1,351	1,770	1,149	1,123	536
Open forest					
Grasses and sedges	363		609		373
Forbs	277		490		244
Browse	257		120		15
Total	897		1,219		632
Upland meadow					
Grasses and sedges				1,217	
Forbs				506	
Browse				73	
Total				1,796	
Prairie					
Grasses and sedges		2,407			
Forbs		663			
Browse		22			
Total		3,092			

decrease in available browse late in the grazing season. Weather conditions also contributed to this variation.

Kentucky bluegrass was the most abundant grass species observed on bottom, upland meadow, and prairie sites (Tables 4 to 7). Open slope sites supported a greater variety of grasses and sedges, of which timber oatgrass, Kentucky bluegrass, sedges (Carex spp.), and little bluestem (Andropogon scoparius) were most abundant (Tables 8 and 9). Timber oatgrass and Kentucky bluegrass were also the most abundant grass species occurring on open forest sites (Table 10).

The forbs class had the highest number of species, and species composition varied among sites. However, most of the forage by weight was represented by relatively few species. Yarrow, cinquefoil (Potentilla spp.), Canada goldenrod (Solidago canadensis), other goldenrod, and white clover were the most abundant forbs observed on bottom sites (Tables 4 and 5). Goldenrod also comprised a large portion by weight of forage found on open slope, open forest, and upland meadow sites (Tables 6 and 8 to 10). Mountain-dandelion, western sagebrush (Artemisia campestris), and hairy goldaster (Heterotheca villosa) were also abundant on open slope sites (Tables 8 and 9). Spreading dogbane (Apocynum androsaemifolium) was abundant on open forest sites (Table 10). The prairie site was dominated by white heath aster (Aster ericoides) (Table 7).

Table 4. Percentage composition of forage available on bottom sites, based on oven-dried weight, 1971.

Plant Taxa	Grazing Unit				
	Hay Draw	Whitetail	Slate School	Mystic	Plantation
Grasses and sedges					
Agropyron smithii	--	--	--	--	0.1
Agropyron subsecundum	--	0.3	0.1	--	--
Bromus sp.	--	--	7.6	2.7	2.3
Carex spp.	4.3	2.6	31.5	16.9	2.8
Phleum pratense	--	1.6	2.9	1.1	--
Poa pratensis	64.7	64.2	41.4	56.6	28.4
Other taxa	0.4	6.0	3.2	5.9	0.8
Total grasses and sedges	69.4	74.7	86.6	83.2	34.3
Forbs					
Achillea millefolium	7.8	5.7	1.4	2.7	4.9
Artemisia frigida	2.3	3.5	0.7	2.0	0.8
Artemisia ludoviciana	--	--	--	0.1	4.7
Aster ericoides	--	1.3	2.0	0.6	5.1
Cerastium arvense	0.4	0.2	0.1	--	1.3
Linaria vulgaris	--	4.0	--	--	--
Potentilla spp.	1.2	1.5	2.4	1.4	6.1
Solidago canadensis	--	--	--	--	--
Solidago spp.	3.1	0.8	1.5	1.8	11.3
Trifolium repens	0.4	3.5	0.3	3.2	6.5
Other taxa	5.2	3.5	1.0	3.4	17.1
Total forbs	20.4	24.0	9.4	15.2	57.7

Table 4. Continued.

Plant Taxa	Grazing Unit				
	Hay Draw	Whitetail	Slate School	Mystic	Plantation
Browse					
Rosa spp.	3.9	0.1	0.1	0.1	1.1
Rubus spp.	--	--	--	--	--
Symphoricarpos occidentalis	6.2	1.2	3.8	1.3	6.8
Other taxa	1.0	0.0	0.0	0.2	0.1
Total browse	10.2	1.3	4.0	1.6	8.0
Total	100.0	100.0	100.0	100.0	100.0

Table 5. Percentage composition of forage available on bottom sites, based on oven-dried weight, 1972.

Plant Taxa	Grazing Unit				
	Whitetail	Slate School	Plantation	Hay Draw	Mystic
Grasses and sedges					
Agropyron smithii	0.5	3.0	0.6	1.9	3.3
Agropyron subsecundum	--	--	1.8	--	0.1
Bromus sp.	--	3.7	3.0	--	0.5
Carex spp.	12.1	23.1	2.0	2.8	6.7
Phleum pratense	4.1	6.2	0.5	2.9	5.4
Poa pratensis	52.6	37.1	68.0	76.5	58.7
Other taxa	1.5	4.0	0.8	1.1	6.7
Total grasses and sedges	70.8	77.1	76.7	85.2	81.4
Forbs					
Achillea millefolium	2.8	1.4	1.2	4.2	4.9
Artemisia frigida	2.5	0.6	0.1	1.5	2.9
Artemisia ludoviciana	--	--	1.9	--	--
Aster ericoides	0.9	2.3	1.8	0.2	1.9
Cerastium arvense	0.2	0.1	0.2	0.5	0.5
Linaria vulgaris	2.9	--	--	--	--
Potentilla spp.	0.4	1.4	0.7	0.5	0.7
Solidago canadensis	--	1.3	3.8	0.2	0.2
Solidago spp.	0.7	1.0	3.0	0.4	0.3
Trifolium repens	9.7	2.3	2.2	2.1	0.6
Other taxa	1.7	2.7	1.1	0.7	4.0
Total forbs	21.8	13.1	21.6	10.3	16.0

Table 5. Continued.

Plant Taxa	Grazing Unit				
	Whitetail	Slate School	Plantation	Hay Draw	Mystic
Browse					
Rosa spp.	0.3	1.7	0.6	0.6	0.4
Rubus spp.	--	--	--	1.2	0.2
Symphoricarpos occidentalis	5.3	7.6	0.9	2.2	2.0
Other taxa	1.8	0.5	0.2	0.5	0.0
Total browse	7.4	9.8	1.7	4.5	2.6
Total	100.0	100.0	100.0	100.0	100.0

Table 6. Percentage composition of forage available on the upland meadow site, expressed as a percentage of oven-dried weight, Hay Draw Unit, 1971-72.

Plant Taxa	Year 1971	Year 1972
Grasses and sedges		
Carex spp.	2.3	2.9
Poa pratensis	40.9	57.0
Other taxa	2.5	7.9
Total grasses and sedges	45.7	67.8
Forbs		
Achillea millefolium	3.8	1.2
Agoseris glauca	2.3	3.4
Artemisia dracunculoides	3.6	2.4
Artemisia frigida	4.2	1.2
Aster ericoides	--	1.7
Erigeron subtrinervis	4.8	1.3
Monarda fistulosa	4.3	1.1
Solidago spp.	5.9	8.3
Vicia americana	2.6	T[a]
Other taxa	11.7	7.6
Total forbs	43.2	28.2
Browse		
Rosa spp.	3.1	1.3
Rubus spp.	1.3	0.2
Symphoricarpos occidentalis	5.6	2.2
Other taxa	1.1	0.3
Total browse	11.1	4.0
Total	100.0	100.0

[a]T indicates less than 0.1 percent.

Table 7. Percentage composition of forage available on the prairie site, expressed as a percentage of oven-dried weight, Slate School Unit, 1971-72.

Plant Taxa	Year 1971	Year 1972
Grasses and sedges		
Carex spp.	4.4	3.3
Koeleria cristata	0.9	3.2
Poa pratensis	65.7	50.9
Stipa comata	2.2	2.5
Other taxa	10.3	17.9
Total grasses and sedges	83.5	77.8
Forbs		
Achillea millefolium	1.6	0.6
Agoseris glauca	0.6	3.6
Artemisia frigida	1.6	1.1
Aster ericoides	4.6	4.5
Monarda fistulosa	2.0	0.9
Solidago spp.	1.4	1.5
Other taxa	4.6	9.3
Total forbs	16.4	21.5
Browse		
Symphoricarpos occidentalis	0.1	0.7
Other taxa	0.0	0.0
Total browse	0.1	0.7
Total	100.0	100.0

Table 8. Percentage composition of forage available on open slope sites, based on oven-dried weight, 1971.

Plant Taxa[a]	Grazing Unit				
	Hay Draw	Whitetail	Slate School	Mystic	Plantation
Grasses and sedges					
Andropogon scoparius	9.6	--	13.1	4.1	2.2
Carex spp.	4.4	6.1	15.6	6.8	3.9
Danthonia intermedia	19.8	6.1	--	3.1	11.6
Koeleria cristata	0.9	--	3.2	1.3	2.3
Poa pratensis	10.9	8.1	0.9	3.4	5.3
Stipa comata	0.3	0.6	13.0	--	--
Other taxa	4.0	2.5	27.7	1.1	1.7
Total grasses and sedges	49.9	23.4	73.5	19.8	27.0
Forbs					
Agoseris glauca	0.1	--	0.4	--	--
Artemisia campestris	0.2	1.6	--	2.5	5.1
Artemisia frigida	3.4	0.6	4.3	7.7	6.1
Aster ericoides	--	0.2	2.3	2.5	1.5
Heterotheca villosa	1.7	0.6	4.1	1.0	4.7
Monarda fistulosa	0.2	1.5	--	0.6	--
Potentilla spp.	5.1	1.0	0.3	8.3	1.2
Solidago spp.	11.8	15.4	4.7	20.1	8.9
Vicia americana	1.6	11.5	0.2	--	--
Other taxa	17.9	6.5	9.4	5.4	8.8
Total forbs	42.0	38.9	25.7	48.1	36.3

Table 8. Continued.

Plant Taxa[a]	Grazing Unit				
	Hay Draw	Whitetail	Slate School	Mystic	Plantation
Browse					
Amelanchier alnifolia	1.4	0.5	--	6.2	3.9
Prunus virginiana	1.7	--	--	3.3	1.9
Rosa spp.	3.8	1.0	0.8	12.7	8.7
Shepherdia canadensis	--	35.4	--	--	--
Symphoricarpos albus	1.0	0.5	--	4.0	1.9
Other taxa	0.2	0.3	--	5.9	20.3
Total browse	8.1	37.7	0.8	32.1	36.7
Total	100.0	100.0	100.0	100.0	100.0

[a]Listed are the most abundant taxa and other selected taxa which occurred on at least one unit.

Table 9. Percentage composition of forage available on open slope sites, based on oven-dried weight, 1972.

Plant Taxa	Grazing Unit				
	Whitetail	Slate School	Plantation	Hay Draw	Mystic
Grasses and sedges					
Andropogon scoparius	--	15.6	4.2	12.2	6.6
Carex spp.	4.2	6.6	2.6	2.6	11.5
Danthonia intermedia	11.3	--	17.2	32.8	6.3
Koeleria cristata	1.5	9.6	3.2	1.2	2.0
Poa pratensis	14.7	8.6	13.2	16.7	10.1
Stipa comata	0.1	8.0	--	0.5	--
Other taxa	7.7	21.8	8.4	6.0	8.7
Total grasses and sedges	39.5	70.2	48.8	72.0	45.2
Forbs					
Agoseris glauca	0.1	5.6	T[a]	0.1	--
Artemisia campestris	2.1	0.1	5.2	0.2	4.5
Artemisia frigida	0.5	1.6	3.7	2.0	5.3
Aster ericoides	0.5	1.8	4.8	1.0	1.7
Heterotheca villosa	0.2	4.9	5.2	0.3	0.1
Monarda fistulosa	2.1	--	--	1.0	1.2
Potentilla spp.	2.2	0.1	0.6	4.7	5.0
Solidago spp.	8.3	2.7	4.6	7.4	10.8
Vicia americana	3.3	--	--	0.1	0.1
Other taxa	15.1	12.0	7.9	5.4	14.1
Total forbs	34.4	28.8	32.0	22.2	42.8

Table 9. Continued.

Plant Taxa	Grazing Unit				
	Whitetail	Slate School	Plantation	Hay Draw	Mystic
Browse					
Amelanchier alnifolia	5.5	--	1.5	1.3	0.5
Prunus virginiana	3.4	--	--	0.4	2.8
Rosa spp.	6.4	1.0	10.5	1.4	4.1
Shepherdia canadensis	--	--	--	0.5	--
Symphoricarpos albus	7.0	--	3.0	0.6	4.0
Other taxa	3.8	--	4.2	1.6	0.6
Total browse	26.1	1.0	19.2	5.8	12.0
Total	100.0	100.0	100.0	100.0	100.0

[a]T indicates less than 0.1 percent.

Table 10. Percentage composition of forage available on open forest sites, expressed as a percentage of oven-dried weight, 1971-72.

Plant Taxa	Grazing Unit					
	Whitetail		Mystic		Plantation	
	1971	1972	1971	1972	1971	1972
Grasses and sedges						
Danthonia intermedia	37.8	34.4	19.7	46.0	3.8	11.7
Koeleria cristata	0.2	T[a]	0.1	0.5	2.7	5.3
Poa pratensis	3.6	3.3	4.3	6.0	12.3	24.0
Other taxa	0.8	2.8	1.8	6.5	6.1	9.0
Total grasses and sedges	42.4	40.5	25.9	59.0	24.9	50.0
Forbs						
Apocynum androsaemifolium	4.8	7.4	0.2	0.2	0.5	0.1
Aster ericoides	0.8	1.5	--	2.4	4.6	5.5
Aster laevis	0.2	0.3	1.3	0.7	2.5	4.7
Potentilla spp.	0.3	2.8	2.3	0.6	0.9	T
Solidago spp.	8.6	6.4	42.5	15.0	34.0	11.5
Vicia americana	3.2	0.9	--	0.6	0.1	0.2
Other taxa	3.1	11.6	19.8	19.1	18.6	18.2
Total forbs	21.0	30.9	66.1	38.6	61.2	40.2
Browse						
Amelanchier alnifolia	25.4	6.9	--	0.2	1.5	1.1
Populus tremuloides	--	1.4	0.9	0.3	1.3	1.2
Rosa spp.	4.0	8.0	2.8	0.8	9.7	5.4
Spiraea sp.	3.8	4.9	1.3	0.6	--	T
Symphoricarpos albus	2.7	4.5	2.5	0.5	1.2	1.4
Other taxa	0.7	2.9	0.5	--	0.2	0.7
Total browse	36.6	28.6	8.0	2.4	13.9	9.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

[a]T indicates less than 0.1 percent.

A lesser variety and abundance of browse was found on bottom, upland meadow, and prairie sites. Western snowberry was the most abundant species found on these sites (Tables 4 to 7). Open slope and open forest sites supported the greatest variety and abundance of browse. Prevalent species on the open slope sites were rose, snowberry (Symphoricarpos albus), and russet buffaloberry (Shepherdia canadensis) (Tables 8 and 9). Rose, as well as serviceberry (Amelanchier alnifolia), was abundant on open forest sites (Table 10).

Consumption of Vegetation by Cattle

Estimated utilization of all forage classes by cattle was heaviest on bottom, upland meadow, and prairie sites; utilization was lightest on open slope and open forest sites throughout the grazing season in both 1971 and 1972 (Tables 11 to 18). Grasses and sedges was the major forage class grazed by cattle on bottom, upland meadow, and prairie sites (Tables 19 to 22). It was found in range studies in Utah that grasses were preferred by cattle (Stoddart and Rasmussen 1945b, Julander 1955).

Kentucky bluegrass was the major component of the total forage grazed on bottom, upland meadow, and prairie sites (Tables 19 to 22). Most other forage taxa occurred scattered throughout the Kentucky bluegrass and were consumed inadvertently throughout the grazing season. The forage taxa growing in the greatest abundance with Kentucky bluegrass composed the largest part of the other forages grazed from these sites.

Table 11. Utilization of forage by cattle on bottom sites, expressed as mean estimated percentage utilization obtained by an ocular comparison of ungrazed plots with grazed plots, 1971.

Plant Taxa	Grazing Unit			
	Hay Draw	Whitetail	Slate School	Mystic
Grasses and sedges				
Poa pratensis	35	50	55	56
All grasses and sedges	33	48	49	52
Forbs				
Achillea millefolium	7	17	5	4
Aster *ericoides*	--	39	39	20
Potentilla spp.	10	20	31	13
Solidago spp.	14	31	13	11
Trifolium *repens*	1	21	11	26
All forbs	7	20	18	11
Browse				
Symphoricarpos occidentalis	11	32	28	8
All browse	10	27	29	6

Table 12. Utilization of forage by cattle on bottom sites, expressed as mean estimated percentage utilization obtained by an ocular comparison of ungrazed plots with grazed plots, 1972.

Plant Taxa	Grazing Unit			
	Whitetail	Slate School	Plantation	Hay Draw
Grasses and sedges				
Poa pratensis	44	38	60	55
All grasses and sedges	48	33	48	45
Forbs				
Achillea millefolium	43	33	31	50
Aster ericoides	50	61	40	40
Solidago canadensis	--	5	44	30
Trifolium *repens*	36	25	62	44
All forbs	20	28	30	33
Browse				
Symphoricarpos occidentalis	17	19	16	8
All browse	27	22	15	6

Table 13. Utilization of forage by cattle on the upland meadow site, expressed as mean estimated percentage utilization obtained by an ocular comparison of ungrazed with grazed plots, Hay Draw Unit, 1971-72.

Plant Taxa	Year 1971	Year 1972
Grasses and sedges		
Poa pratensis	35	27
All grasses and sedges	31	20
Forbs		
Agoseris glauca	23	17
Aster ericoides	--	20
Erigeron subtrinervis	33	1
Solidago spp.	15	7
All forbs	14	12
Browse		
Rosa spp.	7	2
Symphoricarpos occidentalis	4	3
All browse	5	1

Table 14. Utilization of forage by cattle on the prairie site, expressed as mean estimated percentage utilization obtained by an ocular comparison of ungrazed plots with grazed plots, Slate School Unit, 1971.

Plant Taxa	Mean Estimated Percentage Utilized
Grasses and sedges	
Poa pratensis	48
All grasses and sedges	26
Forbs	
Achillea millefolium	6
Artemisia frigida	8
Aster ericoides	42
Monarda fistulosa	3
All forbs	16
Browse	
Symphoricarpos occidentalis	15
All browse	15

Table 15. Utilization of forage by cattle on the prairie site, expressed as mean estimated percentage utilization obtained by an ocular comparison of ungrazed plots with grazed plots, Slate School Unit, 1972.

Plant Taxa	Mean Estimated Percentage Utilized
Grasses and sedges	
Poa pratensis	29
All grasses and sedges	17
Forbs	
Agoseris glauca	25
Aster ericoides	52
Solidago spp.	17
All forbs	23
Browse	
Symphoricarpos occidentalis	10
All browse	10

Table 16. Utilization of forage by cattle on open slope sites, expressed as mean estimated percentage utilization obtained by an ocular comparison of ungrazed plots with grazed plots, 1971.

Plant Taxa	Grazing Unit			
	Hay Draw	Whitetail	Slate School	Mystic
Grasses and sedges				
Carex spp.	7	4	14	1
Danthonia intermedia	5	2	--	13
Poa pratensis	10	7	6	8
All grasses and sedges	7	4	13	5
Forbs				
Artemisia frigida	T[a]	0	0	0
Aster ericoides	--	10	28	4
Potentilla spp.	1	2	0	0
Solidago spp.	4	3	18	1
Vicia americana	22	16	--	--
All forbs	4	5	15	1
Browse				
Amelanchier alnifolia	4	2	--	0
Prunus virginiana	5	4	--	5
Rosa spp.	1	4	23	6
Shepherdia canadensis	--	0	--	--
All browse	1	2	23	3

[a]T indicates less than 1.0 percent.

Table 17. Utilization of forage by cattle on open slope sites, expressed as mean estimated percentage utilization obtained by an ocular comparison of ungrazed plots with grazed plots, 1972.

Plant Taxa	Grazing Unit			
	Whitetail	Slate School	Plantation	Hay Draw
Grasses and sedges				
Andropogon scoparius	--	21	0	0
Danthonia intermedia	2	--	T[a]	T
Poa pratensis	7	11	8	T
All grasses	4	9	3	T
Forbs				
Agoseris glauca	--	37	20	0
Artemisia campestris	1	--	1	0
Aster ericoides	10	22	36	T
Heterotheca villosa	6	36	11	0
Solidago spp.	3	15	3	T
All forbs	5	17	7	T
Browse				
Rosa spp.	1	12	4	0
Symphoricarpos albus	1	--	1	0
All browse	2	12	2	T

[a]T indicates less than 1.0 percent.

Table 18. Utilization of forage by cattle on open forest sites, expressed as mean estimated percentage utilization obtained by an ocular comparison of ungrazed plots with grazed plots, 1971-72.

Plant Taxa	Grazing Unit			
	Whitetail		Plantation[a]	Mystic[b]
	1971	1972	1972	1971
Grasses and sedges				
Danthonia intermedia	2	3	2	6
Poa pratensis	4	4	14	12
All grasses and sedges	2	2	6	8
Forbs				
Apocynum androsaemifolium	2	10	13	0
Aster ericoides	2	1	32	--
Solidago spp.	2	2	8	T[c]
All forbs	4	4	11	3
Browse				
Amelanchier alnifolia	2	0	8	0
Rosa spp.	2	1	4	14
Symphoricarpos albus	T	1	1	0
All browse	1	1	3	4

[a]Rested from grazing by cattle in 1971.
[b]Rested from grazing by cattle in 1972.
[c]T indicates less than 1.0 percent.

Table 19. Approximate percentage composition of forage grazed by cattle on bottom sites, derived from oven-dried weight of taxon grazed divided by the oven-dried weight of all taxa grazed from each site, 1971.

Plant Taxa	Grazing Unit			
	Hay Draw	Whitetail	Slate School	Mystic
Grasses and sedges				
Bromus sp.	0.0	0.0	9.6[a]	1.8
Carex spp	4.5	1.5	24.1	17.9
Poa pratensis	67.7	68.0	49.7	57.9
All grasses and sedges	72.2	76.8	88.2	83.8
Forbs				
Achillea millefolium	2.0	5.1	1.6	3.1
Aster ericoides	0.0	1.6	1.9	0.8
Potentilla spp.	0.3	3.7	3.0	1.5
Solidago spp.	4.1	1.0	1.4	0.8
Trifolium repens	0.0	4.0	0.3	2.6
All forbs	17.8	22.9	9.5	16.0
Browse				
Symphoricarpos occidentalis	5.9	0.4	2.3	0.4
All browse	10.0	0.3	2.3	0.2

[a]Figures are approximate percentages because the weight of some taxa were greater in the grazed plots than in the ungrazed plots after grazing.

Table 20. Approximate percentage composition of forage grazed by cattle on bottom sites, derived from oven-dried weight of taxon grazed divided by the oven-dried weight of all taxa grazed from each site, 1972.

Plant Taxa	Grazing Unit			
	Whitetail	Slate School	Plantation	Hay Draw
Grasses and sedges				
Bromus sp.	0.0	3.3[a]	2.8	0.0
Carex spp.	14.9	13.4	1.6	2.0
Poa pratensis	57.4	31.6	74.6	87.3
All grasses and sedges	81.0	79.9	83.3	92.8
Forbs				
Achillea millefolium	2.9	1.2	1.4	5.9
Aster ericoides	1.2	2.7	1.4	0.3
Solidago canadensis	0.0	1.0	2.6	0.2
Trifolium repens	3.6	0.0	1.9	0.0
All forbs	15.0	14.2	16.0	6.5
Browse				
Symphoricarpos occidentalis	2.1	1.5	0.7	1.0
All browse	4.0	5.9	0.7	0.7

[a]Figures are approximate percentages because the weight of some taxa were greater in the grazed plots than in the ungrazed plots after grazing.

Table 21. Approximate percentage composition of forage grazed by cattle on the upland meadow site, derived from oven-dried weight of taxon grazed divided by the oven-dried weight of all taxa grazed, Hay Draw Unit, 1971-72.

Plant Taxa	Year 1971	Year 1972
Grasses and sedges		
Poa pratensis	39.6[a]	62.2
All grasses and sedges	41.5	74.0
Forbs		
Agoseris glauca	1.6	4.8
Aster ericoides		3.2
Erigeron subtrinervis	8.0	
Solidago spp.	1.1	1.9
All forbs	47.6	25.1
Browse		
Rosa spp.	0.7	0.3
Symphoricarpos occidentalis	6.2	0.3
All browse	11.9	0.9

[a]Figures are approximate percentages because the weight of some taxa were greater in the grazed plots than in the ungrazed plots after grazing.

Table 22. Approximate percentage composition of forage grazed by cattle on the prairie site, derived from oven-dried weight of taxon grazed divided by the oven-dried weight of all taxa grazed, Slate School Unit, 1971-72.

Plant Taxa	Year 1971	1972
Grasses and sedges		
Poa pratensis	87.2[a]	52.0
All grasses and sedges	85.2	75.9
Forbs		
Achillea millefolium	2.1	0.3
Agoseris glauca	1.0	5.0
Aster ericoides	5.3	4.5
Solidago spp.	1.2	1.5
All forbs	14.8	24.1
Browse		
Symphoricarpos occidentalis	0.0	T[b]
All browse	0.0	T

[a]Figures are approximate percentages because the weight of some taxa were greater in the grazed plots than in the ungrazed plots after grazing.

[b]T indicates less than 0.1 percent.

Yarrow, cinquefoil, goldenrod, and western snowberry were grazed in this manner. Solid stands of these species were lightly, if at all, grazed.

An apparent preference by cattle was observed for white clover and white heath aster throughout the grazing season. These species also occurred dispersed throughout the Kentucky bluegrass, but were heavily grazed when in solid stands. White clover was usually preferred over all other forage species, including Kentucky bluegrass. None of the solid stands of clover remained ungrazed. Utilization of these stands was often estimated at 90 percent by the end of the grazing period. This degree of utilization eventually resulted in the exposure of bare ground. However, those stands grazed in 1971 were fully recovered in 1972.

The flower heads of white heath aster were the most heavily utilized part of the plant. These heads were usually grazed early in the grazing period for each unit. Small mammals, such as the least chipmunk (Eutamias minimus), also utilized the flower heads of white heath aster; however, an attempt was made to exclude this from estimated utilization by cattle.

A preference by cattle was also observed for mountain-dandelion in late spring and early summer. This species was often completely consumed before other forages were grazed. Ground around individual plants was often pawed by cattle in an apparent attempt to graze it down to ground

level. This pawing activity was especially prevalent on the upland meadow site of the Hay Draw Unit and on the open slope and prairie sites of the Slate School Unit where mountain-dandelion was most abundant. Mountain-dandelion was less important late in the grazing season, even on sites where it had been abundant in early spring, because by late summer it had withered and nearly disappeared.

Cattle generally avoided horsemint (Monarda fistulosa), a highly aromatic species. Solid stands of horsemint were completely avoided by cattle at all times during the grazing season. Fringed sagewort (Artemisia frigida), another aromatic species, was not utilized in proportion to its abundance.

Grazing pressure on browse by cattle appeared to be related to the time of year it was exposed to grazing and its abundance. Western snowberry received heaviest direct grazing pressure on bottom sites in June when it was most succulent. Use of this browse species on units subsequently grazed was substantially less as new growth matured and leaves were shed. Western snowberry composed a larger part of the total forage grazed from bottom sites where it was most abundant. Utilization of browse was not considered severe at any time during the grazing season either year, regardless of its abundance. However, results of preliminary deer-rumen analysis being conducted by the U. S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Rapid City, South Dakota, indicate that western snowberry may be an important forage item in the

winter diet of whitetail deer on the McVey Burn (Personal communication, D. R. Dietz). Allen (1968) reported that western snowberry is the most important fall and winter food item of whitetail deer in Montana.

Grazing of forage by cattle was negligible on all open slope and open forest sites, except for the open slope site on the Slate School Unit and the open forest site on the Plantation Unit that received relatively heavy grazing (Tables 16 to 18). The open slope site on the Slate School Unit was similar to the prairie site in forage composition and appearance, and that may have been the reason for heavier grazing. This slope also had an abundance of shade from scattered pine trees. The slope of the open forest site on the Plantation Unit was less steep than the other open forest sites, and thus it may have been more suitable for grazing.

The steepness of the slopes and the relative scarcity of preferred or palatable forage species on open slope and open forest sites may have caused them to be lightly grazed. However, open slope sites on units grazed early in the grazing season appeared to have more use than those on units grazed later. The succulent forage and cool air temperatures in late spring and early summer may have contributed to heavier usage early in the year.

Salt was placed by the permittee on ridge tops in an attempt to secure more intensive utilization of slopes by cattle. Ridge tops of the open slope and open forest sites in the Plantation Unit and the

upland meadow site in the Hay Draw Unit were salted in 1972. It appeared that salting increased forage utilization in the immediate vicinity of the salting site, but not appreciably on the slopes.

Calculation of the percentage composition by weight of forage grazed by cattle on open slope and open forest sites was not made because sampling methods used in this study were not accurate enough to detect the low levels of forage utilization observed.

In hot weather, cattle grazed near water as long as the supply of forage was sufficient. Heavy utilization was often observed near water before similar areas away from water were grazed. However, cattle would readily graze areas away from water on cool days, even though forage was still abundant on bottom sites near water. All sites used in this study were within easy access of water, especially bottom sites in the Slate School and Whitetail Units that had a stream flowing through them. Grazing of forage on these sites was not appreciably different from that observed on other bottom sites where stock dams supplied water. Shade was available on or near all study sites.

Weekly Changes in Food and Foraging Habits of Cattle

Forage utilization by cattle on bottom, upland meadow, and prairie sites was concentrated on grasses, sedges, and forbs throughout the grazing period for each unit (Tables 23 to 26). Grazing of browse was light during the first week of grazing, but increased slightly in

Table 23. Utilization of plant taxa by cattle on three study sites in Whitetail Unit, expressed as mean weekly estimated percentage utilization obtained by a weekly ocular comparison of grazed with ungrazed plots, June 1 - July 8, 1972.

Study Site/ Plant Taxa	Number of Observations Per Week	Week[a] 1	4	5	6[b]
Bottom					
Grasses and sedges					
Poa pratensis	75	12	32	38	44
All grasses and sedges	86	11	31	37	48
Forbs					
Achillea millefolium	48	6	21	30	43
Artemisia frigida	26	0	5	6	5
Trifolium repens	22	13	32	36	36
All forbs	203	5	17	21	20
Browse					
Symphoricarpos occidentalis	17	0	5	9	17
All browse	22	0	7	10	27
Open slope					
Grasses and sedges					
Danthonia intermedia	26	0	2	2	2
Poa pratensis	51	0	3	6	7
All grasses and sedges	143	0	3	4	4
Forbs					
Solidago spp.	67	0	2	3	3
Vicia americana	22	0	6	9	21
All forbs	411	T[c]	1	3	5
Browse					
Amelanchier alnifolia	16	0	T	T	1
Prunus virginiana	6	0	0	3	4
Rosa spp.	35	0	0	T	1
Symphoricarpos albus	58	0	0	T	1
All browse	143	0	T	1	2

Table 23. Continued.

Study Site/ Plant Taxa	Number of Observations Per Week	Week 1	4	5	6
Open Forest					
Grasses and sedges					
Danthonia intermedia	72	0	2	3	3
Poa pratensis	26	T	3	3	4
All grasses and sedges	121	T	2	2	2
Forbs					
Apocynum androsaemifolium	30	0	5	8	10
Potentilla spp.	9	0	0	0	0
Solidago spp.	46	0	1	3	2
All forbs	181	T	3	4	4
Browse					
Amelanchier alnifolia	14	0	0	0	0
Prunus virginiana	6	0	0	2	0
Rosa spp.	30	0	1	1	1
Symphoricarpos albus	47	0	T	T	1
All browse	123	0	1	1	1

[a]Data not available for second and third weeks.
[b]Three days only.
[c]T indicates less than 1.0 percent.

Table 24. Utilization of plant taxa by cattle on three study sites in Slate School Unit, expressed as mean weekly estimated percentage utilization obtained by a weekly ocular comparison of grazed with ungrazed plots, July 8 - August 19, 1972.

Study Site/ Plant Taxa	Number of Observations Per Week	Week 1	2	3	4	5	6
Bottom							
Grasses and sedges							
Poa pratensis	73	7	9	14	15	19	38
All grasses and sedges	149	9	11	16	17	21	33
Forbs							
Achillea millefolium	46	2	3	6	8	13	33
Aster ericoides	23	13	20	31	32	37	61
Trifolium repens	25	5	7	10	12	14	25
All forbs	227	5	6	11	12	17	28
Browse							
Symphoricarpos occidentalis	35	1	2	4	5	6	19
All browse	39	2	2	4	6	7	22
Open Slope							
Grasses and sedges							
Andropogon scoparius	9	0	7	7	15	16	21
Koeleria cristata	49	0	0	1	2	3	8
Poa pratensis	10	0	1	1	4	16	11
All grasses and sedges	283	0	1	2	5	6	9
Forbs							
Agoseris glauca	31	0	13	17	26	27	37
Aster ericoides	22	0	3	5	6	11	22
Heterotheca villosa	22	0	1	2	16	21	36
Solidago spp.	26	0	T[a]	2	5	6	15
All forbs	284	0	3	5	11	14	17
Browse							
Rosa spp.	7	0	0	0	1	7	12
All browse	7	0	0	0	1	7	12

Table 24. Continued.

Study Site/ Plant Taxa	Number of Observations Per Week	Week 1	2	3	4	5	6
Prairie							
Grasses and sedges							
Poa pratensis	41	1	4	8	12	15	29
All grasses and sedges	199	1	3	5	7	9	17
Forbs							
Agoseris glauca	51	6	14	16	17	18	25
Aster ericoides	45	9	12	23	27	31	52
Solidago spp.	36	T	2	6	9	10	17
All forbs	324	2	7	11	14	16	21
Browse							
Symphoricarpos occidentalis	1	0	0	0	0	0	10
All browse	1	0	0	0	0	0	10

[a]T indicates less than 1.0 percent.

Table 25. Utilization of plant taxa by cattle on three study sites in Plantation Unit, expressed as mean weekly estimated percentage utilization obtained by a weekly ocular comparison of grazed with ungrazed plots, August 19 - September 16, 1972.

Study Site/ Plant Taxa	Number of Observations Per Week	Week 1	2	3	4
Bottom					
Grasses and sedges					
Poa pratensis	75	9	17	29	60
All grasses and sedges	151	6	12	22	48
Forbs					
Aster ericoides	22	14	22	42	40
Solidago canadensis	8	0	16	25	44
Solidago spp.	32	1	5	11	38
Trifolium repens	26	22	31	42	62
All forbs	312	6	11	21	30
Browse					
Symphoricarpos occidentalis	15	0	0	3	16
All browse	34	T[a]	1	5	15
Open Slope					
Grasses and sedges					
Danthonia intermedia	47	T	T	T	T
Poa pratensis	43	0	T	8	8
All grasses and sedges	187	T	T	3	3
Forbs					
Artemisia campestris	23	0	0	0	1
Aster ericoides	22	0	0	20	36
Heterotheca villosa	25	0	0	8	11
Solidago spp.	39	0	T	2	3
All forbs	269	0	T	5	7
Browse					
Amelanchier alnifolia	12	0	0	3	1
Rosa spp.	47	0	0	1	4
Symphoricarpos albus	47	0	0	T	1
All browse	127	0	0	1	2

Table 25. Continued.

Study Site/ Plant Taxa	Number of Observations Per Week	Week 1	2	3	4
Open Forest					
Grasses and sedges					
Danthonia intermedia	43	1	2	2	2
Poa pratensis	64	5	8	10	14
All grasses and sedges	192	2	4	5	6
Forbs					
Aster ericoides	43	7	15	19	32
Aster laevis	23	5	5	6	10
Solidago spp.	61	2	3	4	8
All forbs	340	4	7	8	11
Browse					
Amelanchier alnifolia	4	1	1	1	8
Rosa spp.	43	1	2	3	4
Symphoricarpos albus	34	T	T	T	1
All browse	87	1	1	2	3

[a]T indicates less than 1.0 percent.

Table 26. Utilization of plant taxa by cattle on three study sites in Hay Draw Unit, expressed as mean weekly estimated percentage utilization obtained by a weekly ocular comparison of grazed with ungrazed plots, September 16 - October 13, 1972.

Study Sites/ Plant Taxa	Number of Observations Per Week	Week 1	2	3	4
Bottom					
Grasses and sedges					
Poa pratensis	75	14	29	42	55
All grasses and sedges	121	10	22	33	45
Forbs					
Achillea millefolium	57	11	21	34	50
Aster ericoides	5	14	14	20	40
Trifolium repens	20	20	32	35	44
All forbs	184	8	16	22	33
Browse					
Symphoricarpos occidentalis	23	1	2	4	8
All browse	44	1	2	3	6
Open Slope					
Grasses and sedges					
Danthonia intermedia	68	0	T[a]	T	T
Poa pratensis	55	0	T	T	T
All grasses and sedges	206	0	T	T	T
Forbs					
Aster ericoides	25	0	0	T	T
Potentilla spp.	35	0	0	0	0
Solidago spp.	45	0	0	0	T
All forbs	233	0	T	T	T
Browse					
Amelanchier alnifolia	6	0	0	0	0
Prunus virginiana	2	0	0	0	0
Rosa spp.	28	0	0	0	0
All browse	79	0	T	T	T

Table 26. Continued.

Study Site/ Plant Taxa	Number of Observations Per Week	Week 1	2	3	4
Upland Meadow					
Grasses and sedges					
Poa pratensis	75	5	13	19	27
All grasses and sedges	132	3	10	15	21
Forbs					
Agoseris glauca	33	8	12	13	17
Aster ericoides	20	9	17	18	20
Solidago spp.	53	1	4	5	7
All forbs	292	3	7	9	11
Browse					
Rosa spp.	25	1	1	1	2
Symphoricarpos occidentalis	8	1	1	3	3
All browse	50	1	1	1	2

[a]T indicates less than 1.0 percent.

subsequent weeks. Browse was never severely grazed throughout the grazing season.

The largest percentage utilization of forage on bottom, upland meadow, and prairie sites often occurred during the last week of grazing, regardless of how long or what time of year the units were grazed. A possible explanation for this grazing pattern may be that cattle concentrated on these sites to graze the highly palatable regrowth on Kentucky bluegrass and white clover. This heavy grazing was also reflected in a higher percentage utilization of other forages which were grazed incidental to these two species.

Grazing of all forages was light on open slope and open forest sites at all times (Tables 23 to 26). Little grazing was observed on these sites during the first week of grazing on all units because grazing during that time was concentrated on bottom sites where grasses were abundant and water was readily available. Grazing of other sites in subsequent weeks often occurred only after bottoms had been heavily utilized.

Mean weekly estimates of percentage utilization of the forage production on bottom sites were approximately 9 percent per week for grasses and sedges, 6 percent for forbs, and 3 percent for browse. Mean percentages for upland meadow and prairie sites were less than for bottom sites. The upland meadow site had 5 percent of grasses and sedges, 3 percent of forbs, and only 0.5 percent of browse utilized per week.

Utilization on the prairie site was 3, 4, and 2 percent, respectively. Open slope sites averaged 1 percent utilization per week of all forage classes. Weekly consumption of forage on open forest sites was similar to that of open slope sites, with 1 percent for grasses and sedges, 2 percent for forbs, and 0.5 percent for browse.

Relative Use of Sites by Deer and Cattle

Cattle use of study sites in summer, as determined by cow chips per day of grazing, was heaviest on bottom, upland meadow, and prairie sites and was lightest on open slope and open forest sites both years (Table 27). This use pattern was the same regardless of whether a unit was grazed early or late in the grazing season.

Deer use of study sites in summer, as determined by pellet groups per day of grazing by cattle, was light on all sites throughout the 1971 and 1972 grazing seasons (Table 28). Only three deer were observed on the study area during the two grazing seasons. Use of study sites by deer showed no seasonal change throughout the grazing season and only minor variation between years.

Deer use of study sites in winter was heavier than in summer and heaviest use was on bottom sites (Table 29). Much of this use may have occurred in early spring (March and April) when Kentucky bluegrass began new growth. This new growth was easily accessible to deer because most old growth had been removed through heavy grazing by cattle the previous grazing season. The upland meadow site may have been heavily

Table 27. Cattle use of study sites in summer as determined by cow chips per day of grazing, 1971-72.

	Grazing Unit									
	Hay Draw		Whitetail		Slate School		Mystic		Plantation	
Study Site	1971	1972	1971	1972	1971	1972	1971[a]	1972	1971	1972
Bottom	1.8	10.9	5.4	3.5	4.7	4.9	3.1	Rested[b]	Rested	9.0
Open slope	0.3	0.1	0.2	0.3	0.6	0.9	T[c]	Rested	Rested	0.7
Open forest	--	--	0.2	0.1	--	--	.2	Rested	Rested	2.1
Upland meadow	2.4	4.7	--	--	--	--	--	--	--	--
Prairie	--	--	--	--	2.5	3.7	--	--	--	--

[a]Snow cover prevented the collection of data from Mystic Unit until April, 1972.

[b]Rested from grazing by cattle.

[c]T indicates less than 0.1 percent.

Table 28. Deer use of study sites in summer as determined by pellet groups per day of grazing by cattle, 1971-72.

	Grazing Unit									
	Hay Draw		Whitetail		Slate School		Mystic		Plantation	
Study Site	1971	1972	1971	1972	1971	1972	1971[a]	1972	1971	1972
Bottom	0.03	0.00	0.02	0.08	0.03	0.00	--	Rested[b]	Rested	0.03
Open slope	0.00	0.03	0.70	0.03	0.09	0.02	--	Rested	Rested	0.03
Open forest	--	--	0.01	0.00	--	--	--	Rested	Rested	0.00
Upland meadow	0.10	0.03	--	--	--	--	--	--	--	--
Prairie	--	--	--	--	0.06	0.05	--	--	--	--

[a]Snow covered the area before data could be collected.
[b]Rested from grazing by cattle.

Table 29. Deer use of study sites in winter as determined by the total number of pellet groups deposited from about October 20, 1971, to April 30, 1972.

Study Site	Grazing Unit					Site Total
	Hay Draw	Whitetail	Slate School	Mystic[a]	Plantation	
Bottom	56	137	48	76	166	483
Open slope	98	52	86	41	182	459
Open forest	--	97	--	74	232	403
Upland meadow	80	--	--	--	--	80
Prairie	--	--	7	--	--	7

[a]Transects on Mystic Unit could not be checked for pellet groups after grazing by cattle in 1971 because of snow cover, so data includes an extra 33 days of fall use in 1971.

used by deer for the same reason. Normally bottoms are inaccessible to deer during the winter because of deep snow. However, the 1971-72 winter was mild, with less than normal snow accumulation, and bottoms remained accessible most of the winter. This may have resulted in an above-normal use of these sites. On the Oak Creek Range in Utah, productive areas used heavily by cattle were also used heavily by deer because they had both good grass and browse (Julander and Robinette 1950). Some of the bottoms on the study area that were not sampled were observed to have considerable browse on them.

Open slope and open forest sites were used by deer during the winter; tree cover and an abundance of forbs and browse may have made them attractive for winter use by deer. Most of these sites were on slopes that may also have given the deer an observational advantage. Open slope and open forest sites are relatively free of deep snow in normal winters, which may attract deer. A lack of readily accessible cover and a relatively sparse supply of browse during winter may have resulted in light use of the prairie site by deer.

Julander and Robinette (1950) found that steepness of slopes reduced forage utilization by cattle, but that deer sign was heavy in areas where preferred forage was most abundant regardless of the slope. Stoddart and Rasmussen (1945b) reported that deer usually graze on steep slopes and areas away from water that are not used by cattle.

Personnel of the South Dakota Department of Game, Fish and Parks and the U. S. Forest Service reported that the arrival of deer on the study area in the winter of 1971-72 was much later than normal because of the mild weather. Deer also wintered at large logging sites outside the study area on their migration routes where palatable browse was abundant (Personal communication, R. Butterfield, and D. N. Morin). For these reasons, the use of study sites by deer in winter observed in this study may be less than normal.

SUMMARY AND CONCLUSIONS

Bottom, upland meadow, and prairie sites were dominated by grasses and sedges, and the open slope and open forest sites had a variety of grasses, sedges, and forbs. Kentucky bluegrass, yarrow, and western snowberry were principal grass, forb, and browse species observed on bottom, upland meadow, and prairie sites. Timber oatgrass, goldenrod, and rose were principal species on open slope and open forest sites.

Estimated utilization of forage by cattle was heaviest on bottom, upland meadow, and prairie sites and was lightest on open slope and open forest sites throughout the grazing season. Kentucky bluegrass was the major component of the total forage grazed. Most forage was taken inadvertently with Kentucky bluegrass. However, preference was shown for white clover, white heath aster, and mountain-dandelion.

Grazing pressure on browse appeared to be related to both the time of year browse was exposed to grazing and its abundance. Western snowberry received the heaviest direct grazing in June when it was most succulent. Browse was not severely grazed by cattle on any site or at any time.

Grazing by cattle was negligible on open slope and open forest sites. The light grazing may have resulted from the steepness of slopes and scarcity of preferred forage species on these sites.

Grazing pressure was concentrated on grasses, sedges, and forbs on bottom sites at all times during the grazing season. Grazing

pressure was light on open slope and open forest sites throughout the grazing season.

Study sites where forage was heavily utilized by cattle also had the highest number of cow chips per day of grazing. Deer use of study sites in summer was negligible. Counts of deer pellet groups showed that deer use was much heavier in winter. Deer use was comparable on all sites, except that the prairie site was lightly used in winter; the lack of readily available cover and a scarce supply of browse may have resulted in this light use.

Winter deer foods were lightly grazed by cattle in summer. In addition, cattle grazed most heavily on bottom, upland meadow, and prairie sites; these sites are normally unavailable to deer in winter because of heavy snow cover. Thus, based on forage supply, the winter carrying capacity of the study area for deer did not appear to be significantly affected by cattle grazing in summer.

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APPENDIX

Appendix Table 1. Plant taxa observed on the Slate Prairie Grazing Allotment, 1971-72.

Scientific Name	Common Name
Grasses and sedges	
Agropyron smithii Rydb.	Western wheatgrass
Agropyron subsecundum (Link.) Hitchc.	Bearded wheatgrass
Agropyron trachycaulum (Link.) Malte.	Slender wheatgrass
Andropogon gerardi Vit.	Big bluestem
Andropogon scoparius Michx.	Little bluestem
Bouteloua gracilis (H.B.K.) Lag.	Blue grama
Bromus inermis Leyss.	Smooth brome
Bromus tectorum L.	Cheatgrass brome
Carex spp.	Sedge
Danthonia intermedia Vasey.	Timber Oatgrass
Koeleria cristata (L.) Pers.	Junegrass
Muhlenbergia cuspidata (Torr.) Rydb.	Stonyhills muhly
Oryzopsis micrantha (T. & R.) Thurb.	Littleseed ricegrass
Phleum pratense L.	Timothy
Poa compressa L.	Canada bluegrass
Poa pratensis L.	Kentucky bluegrass
Sitanion hystrix (Nutt.) J. G. Smith	Bottlebrush squirreltail
Stipa comata Trin. & Rupr.	Needle and thread
Stipa viridula Trin.	Green needlegrass
Forbs	
Achillea millefolium L.	Yarrow
Agoseris glauca (Pursh) D. Dietr.	Mountain-dandelion
Anemone spp.	Anemone
Antennaria spp.	Pussytoes
Apocynum androsaemifolium L.	Spreading dogbane
Artemisia campestris L.	Western sagebrush
Artemisia dracunculus L.	Dragon sagewort
Artemisia frigida Willd.	Fringed sagewort
Artemisia ludoviciana Nutt.	White sage
Aster ericoides L.	White heath aster
Aster laevis L.	Blue aster
Astragalus spp.	Milkvetch
Calochortus nuttallii Torr.	Mariposa lily
Campanula rotundifolia L.	Harebell
Cerastium arvense L.	Starry cerastium
Cirsium spp.	Thistle
Convolvulus arvensis L.	Field bindweed
Daucus carota L.	Wild carrot

Appendix Table 1. Continued.

Scientific Name	Common Name
Delphinium bicolor Nutt.	Blue larkspur
Equisetum sp.	Horsetail
Erigeron subtrinervis Rydb.	Fleabane
Erysimum asperum (Nutt.) DC.	Plains wallflower
Fragaria sp.	Wild strawberry
Galium sp.	Bedstraw
Geranium richardsonii	Geranium
Geum sp.	Avens
Glycyrrhiza lepidota Pursh.	Wild licorice
Helianthus sp.	Sunflower
Helianthus annuus L.	Common sunflower
Heterotheca villosa (Pursh) Shinners.	Hairy goldaster
Iris missouriensis Nutt.	Blue flag
Leucocrinum montanum Nutt.	Common starlily
Liatris ligulistylis (A. Nels.) K. Schum	Gay feather
Liatris punctata Hook.	Dotted gay feather
Linaria canadensis (L.)	Toadflax
Linaria vulgaris Hill	Butter-and-eggs
Matricaria matricarioides (Less.) Porter	Pineapple weed
Mentha sp.	Mint
Monarda fistulosa L.	Horsemint
Oenthera sp.	Evening primrose
Orthocarpus luteus Nutt.	Owl clover
Oxalis sp.	Woodsorrel
Petalostemon candidum (Willd.) Michx.	White prairie clover
Petalostemon purpureum (Vent.) Rydb.	Purple prairie clover
Plantago sp.	Plantain
Potentilla spp.	Cinquefoil
Psoralea spp.	Scurfpea
Psoralea esculenta Pursh.	Common breadroot scurfpea
Rudbeckia hirta L.	Black-eyed susan
Rumex crispus L.	Curled dock
Saxifraga cernua L.	Saxifrage
Smilacina sp.	False Solomon's seal
Solidago spp.	Goldenrod
Solidago canadensis L.	Canada goldenrod
Taraxacum officinale Weber	Dandelion
Thalictrum venulosum Trel.	Meadow rue
Thermopsis rhombifolia Nutt.	Goldenpea
Tragopogon dubius Scop.	Goatsbeard
Trifolium pratense L.	Red clover

Appendix Table 1. Continued.

Scientific Name	Common Name
Trifolium repens L.	White clover
Verbascum thapsus L.	Flannel mullein
Vicia americana Muhle.	American vetch
Viola sp.	Violet
Zigadenus venenosus Wats.	Death camas
Shrubs	
Amelanchier alnifolia Nutt.	Serviceberry
Prunus americana Marsh.	Wild plum
Prunus virginiana L.	Chokecherry
Rosa spp.	Rose
Rubus spp.	Raspberry
Shepherdia canadensis (L.) Nutt.	Russet buffaloberry
Spiraea sp.	Spiraea
Symphoricarpos albus (L.) Blake	Snowberry
Symphoricarpos occidentalis Hook.	Western snowberry
Trees	
Picea glauca (Moench.) Voss	White spruce
Pinus ponderosa Laws	Ponderosa pine
Populus tremuloides Michx.	Quaking aspen