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MANAGING GRAZING ANIMAL RESPONSE TO FORESTLAND VEGETATION

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ABSTRACT

Various studies were conducted on forestland in northeastern Oregon. Yearling heifer gains on forest pastures exceeded those on the grassland during mid and late summer. Cattle grazing a grassland-forest rotation strategy gained 11.3 kg more than cattle allowed season long use of forest and grassland plant communities. Meadow pastures can also be successfully incorporated into a plant community rotation grazing program. A cow-calf operation can be grazed on different plant communities so that weight gains are better than if cattle had free choice to all communities season long. In another study potential cattle production on native plant communities was compared to the same communities that had been treated to enhance forage. Plowing and reseeding rangeland, precommercial thinning of lodgepole pine, logging and grass reseeding on mixed conifer stands, and plowing and reseeding moist mountain meadows increased the potential beef production per hectare.

INTRODUCTION

Cattle grazing is presently considered a secondary activity on many forestlands. Little management has been applied, and often cattle are grazed in large units season long. However, it is predicted that forest ranges will be expected to increase livestock grazing during the next 20 years (Forest and Range Task Force, 1972). Rummel and Holscher (1955) referred to the forestlands of eastern Oregon and Washington as "summer range." Within this area they identified 6 million hectares (15 million acres) of forested range, 607,100 hectares (1.5 million acres) of grassland, 280,300 hectares (700,000 acres) of mountain meadow and 400,700 hectares (1 million acres) of subalpine grassland. The authors also stated that in 1955 forage demands of livestock and big game were not being met.

With no addition in hectareage possible, any increase must be accommodated by improved grazing efficiency and forage production. The wide array of soil types, slope exposures, elevation changes and precipitation amounts create a wide diversity of plant communities. A broad range of phenological development across these communities at any given date provides potential for improved efficiency in livestock production. Silvicultural practices provide still other plant communities. Changes in forage nutritional quality are related to advancing plant phenology. However, little attention has been paid to coordinating specific grazing management practices with changes in forage quality (Vavra and Raleigh, 1976). If this were done, efficiency of production in terms of kilograms of red meat produced per hectare could be improved.

ANIMAL NUTRITION

Satisfying the grazing animal's nutritional requirements ranks as the number one priority in beef production improvement. Each class of cattle has its own nutrient requirements which change with age and stage of production; growth, lactation, pregnancy (NRC 1976). On rangelands forage quality changes as a spring through fall grazing season progresses and plants mature (Fig. 1). Forages may even become deficient in

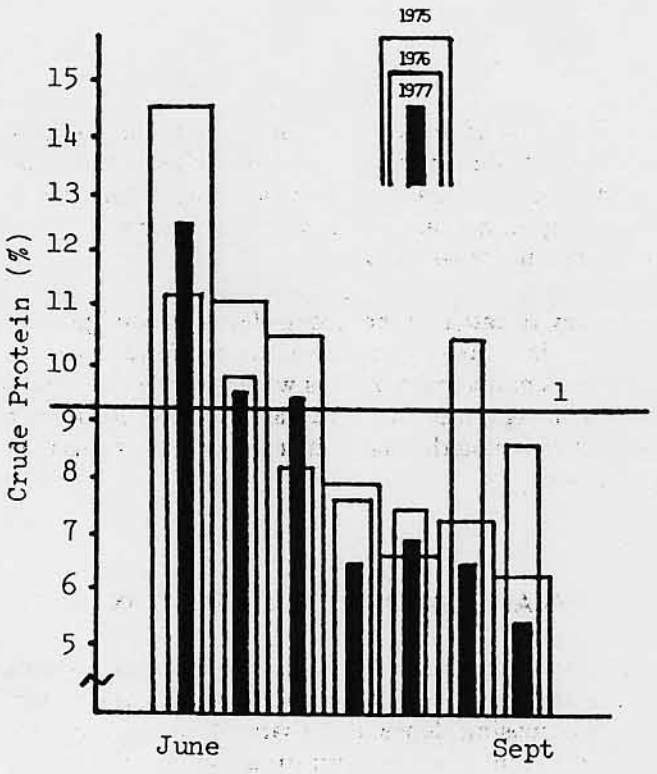

Figure 1. Percent crude protein in cattle diets.

[1]NRC (1976) crude protein requirement for a 450 kg lactating cow.

some nutrients later in the grazing season (Fig. 1). The response of cattle in terms of weight change per day is related to the changes in forage quality available. Figure 2 shows the weight of lactating cows declines as crude protein (Fig. 1) in the diet declines and then increases when forage quality increases.

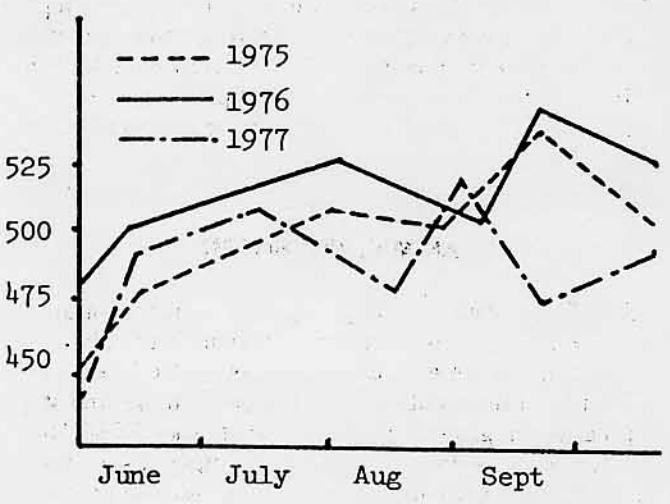

Figure 2. Cow weights (kg) for the summer grazing seasons.

On mountain grasslands in northern California, Ratliff et al. (1972) found yearling cattle made 73 percent of their gain by August 1 in 2 years and 81 percent before August 15 in 3 other years. The grazing season was from late June through October. McLean (1967) also reported cattle gained 1 kg per day in June but only .4 kg per day in September on pinegrass *(Calamagrostis rubescens)* in British Columbia.

The key to cattle management for increased production then, is to take advantage of the nutrients available on various plant communities when they are in excess of the grazing animal's requirements so the declines in gain noted during the last half of the grazing season are minimized.

PLANT COMMUNITY INTEGRATION

Plant communities on forestland may exist in the same precipitation zone and the same elevation, and in fact occur as opposing slopes in the same drainage but have vastly different plant communities present because of soil type and depth and slope exposure. Riparian zones present still another potential community difference.

Grassland and Forest

Three years' data were collected on cattle diet quality and botanical composition, and daily intake on grassland and forest communities of the Blue Mountains (Holechek et al., 1981; Holechek et al., 1982a, 1982b, and 1982c). Sampling was divided into 4 periods through the grazing season (late spring June 15-July 15; early summer July 15-Aug. 15; late summer Aug. 15-Sept. 15 and fall Sept. 20-Oct. 15). Data in Table 1 show diet diversity with advance in season as well as between plant communities. Although the three-year average indicates no change in the seasonal consumption of shrubs on the forest, individual year's data were quite different (Holechek et al., 1982b). More shrubs were consumed during the latter half of the grazing season in 1976 and 1978, while the opposite was true in the drought year of 1977.

Table 1. Three-year average (1976, 1977 and 1978) of cattle diets on forest and grassland range.

	Grasses		Forbs		Shrubs	
	F[1]	G[2]	F	G	F	G
	%					
Late Spring	46	66	29	17	25	7
Early Summer	66	79	13	15	21	6
Late Summer	65	90	11	5	23	5
Fall	69	89	9	5	21	6

[1]Forest [2]Grassland

Different forage classes are known to differ in nutritional quality (Hickman, 1975); and therefore diets of varying percentages of forage classes can be expected to be diverse in nutritional quality (Table 2). NRC (1976) states that a 300 kg heifer requires .63 kg of crude protein and 18.06 Mcal of DE daily for an average daily gain of .30 kg. Comparing requirements to actual consumption can give an indication of expected beef production. Twice during the study cattle on the forest consumed less than the required amount of crude protein. Four periods of protein deficiency occurred on the grassland. Digestible energy was deficient during 6 sampling periods on the forest and during the 8 periods on the

Table 2. Average daily intake of crude protein (kilograms) and digestible energy (megacalories) on the forest and grassland in 1976, 1977 and 1978.

Sampling period	1976		1977		1978	
	Forest	Grassland	Forest	Grassland	Forest	Grassland
			Crude protein intake			
Late spring	.45	.66	.84	.76	.85	.80
Early summer	.68	.60	.63	.51	.72	.63
Late summer	.87	.78	.66	.47	.50	.38
Fall	.72	.66	.67	.70	.84	.63
			Digestible energy intake			
Late spring	11.4	13.7	20.6	19.9	18.8	21.3
Early summer	19.9	17.1	16.1	14.4	18.7	17.3
Late summer	18.2	17.6	17.2	12.6	12.4	12.1
Fall	14.7	19.9	16.0	19.3	19.9	14.3

Table 3. Average daily gain (kilograms) for cattle on the forest and grassland in 1976, 1977, 1978, 1979 and 1980.

Sampling period	1976		1977		1978		1979		1980	
	Forest	Grass-land	Forest	Grass-land	Forest	Grass-land	Forest	Grass-land	Forest	Grass-land
Late spring	-.06	+.22	+.63	+.50	+.67	+.80	+.26	+.51	+1.40	+1.64
Early summer	+.61	+.43	.00	+.33	+1.10	+.41	+1.84	+.90	+.41	+.28
Late summer	+.51	+.41	+.72	+.08	-.37	-.40	+.67	+.85	+.77	+.37
Fall	+.42	+.57	-.01	+.27	+.46	+.28	+.27	-.25	+.22	-.46
Mean daily gain	+.38	+.40	+.33	+.29	+.47	+.27	+.76	+.50	+.70	+.46

grassland. Generally, late spring diets were nutritionally adequate on either pasture. However, during early and late summer cattle on the forest consumed diets that were nutritionally superior to those consumed on the grassland. During fall, cattle diets on the grassland were of better energy quality than those on the forest while the reverse was true for crude protein. Cattle then, could be expected to gain similarly during late spring on either pasture, gain better on the forest in early and late summer, and vary from year to year during fall. Actual cattle response was similar to that expected (Table 3). Data in Tables 2 and 3 indicate a management strategy incorporating both grassland and forest pastures into a grazing system that takes full advantage of forage at its highest quality and can improve beef production. Cattle grazing the grassland in late spring, the forest in early and late summer and then the grassland again in fall should gain better than cattle grazed exclusively on one type or perhaps even allowed free choice of both types. A study involving cattle so managed was initiated in 1982. Average daily gains during late summer, 1982 were better on the managed system than for cattle grazing grassland and forest free choice. Although ample precipitation and hence near optimum forage conditions in 1982 likely negated larger differences, managed cattle did gain 11.3 kg more than free choice cattle.

Continued late spring use of the grassland pasture may cause a decline in range condition. A system designed to prevent this would incorporate two each of forest and grassland pastures so that one grassland pasture would be grazed in the growing season every other year. Forest pastures could also be rotated.

Meadow Grazing

Another alternative exists where riparian meadows are large enough to accommodate inclusion as a distinct grazing unit. It has been suggested that if riparian zones are grazed, deferment until late summer or fall benefits other uses such as bird nesting (Kaufmann et al., 1982). Cattle grazing a riparian zone located between the forest and grassland pastures previously discussed was grazed by cattle on a deferred rotation basis for 5 years beginning about August 20 each year (Holechek et al., 1982d). Average daily gains were equal to or superior to those on the grassland and forest for the same time periods (Table 4). Riparian meadow pastures large enough to be practically grazed can be incorporated into a system of grassland and forest pastures during late summer and fall.

Table 4. Average daily gain (kg) of cattle grazing a riparian zone meadow in late summer and fall.

	1976	1977	1978	1979	1980
Late summer	+.99	+.46	-.04	+.12	+.61
Fall	+.13	+.16	+.74	+.16	+.05

A Working Example

The grazing system used on the Eastern Oregon Agricultural Research Center's Hall Ranch provides an example of how a cow-calf system can be integrated over several plant communities to provide improved beef production (Vavra and Phillips, 1979 and 1980). The system made use of sub-irrigated meadows; pine-upland pastures dominated by pinegrass, elk sedge *(Carex geyeri)* and Kentucky bluegrass *(Poa pratensis);* and mixed-fir slopes dominated by the same understory species (Fig. 3). Meadows are grazed first, for a short time period so that regrowth occurs providing fall forage. Open ponderosa pine stands dominate the pastures grazed during the June 15 to August 20 period. Forage quality on these pastures deteriorates below required levels by late August. Autumn pine needle fall also reduces use under the canopy so early grazing is usually more efficient. Late summer and fall use on the Hall Ranch is one of the options. Cattle may be grazed on meadow pastures

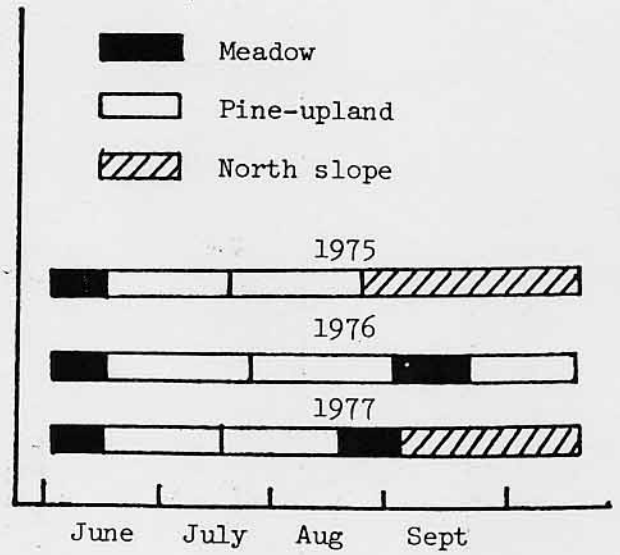

Figure 3. The summer grazing schedule by pasture type.

that are sub-irrigated and still provide nutritious forage or grazed on mixed conifer stands on north slopes where plant phenology is not as advanced as on the ponderosa pine stands. The less advanced phenological stage of north slope understory vegetation is also a more nutritious forage than vegetation on the pine uplands.

Measured dietary crude protein and in vitro digestibility declined as the grazing season on the Hall Ranch advanced (Figs. 4 and 5). Pasture changes in late August were effective in increasing the crude protein content and in vitro digestibility of cattle diets. Cow weight changes and calf average daily gains responded to changes in forage quality (Figs. 6 and 7). Cows initially gained weight on range, then as forage quality declined, cows actually lost weight until moved to a higher quality pasture. Calves gained weight throughout the grazing season but the actual amount per day varied with forage quality. Forage on all pastures on the Hall Ranch is usually of marginal nutrient quality by September 15 of most years. Therefore calves are usually weaned at that time to prevent possible weight loss. Skovlin (1962) weighed cows and calves grazing the Blue Mountains of Oregon and actually recorded a weight loss on suckling calves during the fall grazing period of some years. Calves on the Hall Ranch were not weaned on September 15 in 1975 and a rapid decrease in average daily gain was noted late in the fall. During the drought year of 1977 this rapid decline in average daily gain was noted earlier in the grazing season.

FORAGE PRODUCTION IMPROVEMENT

In a study conducted in Grant County, Oregon (Svejcar and Vavra, 1983) specific forage enhancement practices were compared to unimproved ("native") plant communities for potential beef production. Grassland, lodgepole pine, mixed conifer and moist meadow communities were compared. Previously applied treatments sampled were Idaho fescue-bluebunch wheatgrass *(Festuca Idahoensis-Agropyron spicatum)* grassland which was plowed and reseeded to alfalfa *(Medicago sativa)* and intermediate wheatgrass *(Agropyron intermedium);* lodgepole pine stand that was thinned; a mixed-conifer stand that was commercially logged, the slash piled and burned and the area reseeded to orchardgrass *(Dactylis glomerata)* and timothy *(Phleum pratense);* and a moist meadow that was plowed and reseeded to intermediate wheatgrass, timothy and smooth brome *(Bromus inermis).* The unlogged mixed conifer stand contained 428 trees and 95 saplings per hectare, and the logged stand contained 277 and 9, respectively. Thinned and unthinned lodgepole pine contained 489 and 2,867, respectively. Estimated kg/ha of forage was recorded monthly from April through September and each major forage species present was sampled and analyzed for crude protein content and in vitro dry matter digestibility. A modification of the carrying capacity formula of Mautz (1978) was utilized to estimate potential beef production. Beef production was estimated as heifer-unit-days (HUD) per hectare and kilograms of gain produced per hectare. Estimated metabolizable energy (ME) and crude protein (CP) per hectare were calculated from the total kilograms of useable forage produced per hectare and the ME and CP content of the forage. Each of these was divided by the ME and CP requirements of a yearling heifer gaining 0, .4, and .6 kilograms per day to estimate HUD and kilograms of beef produced per hectare.

Data in Table 5 demonstrate the improvement in livestock production possible with various cultural practices and also aid the development of grazing systems whereby each plant community type can be grazed when maximum beef production can be obtained. Loss or no gain stated in the table occurs when the crude protein or energy requirement (NRC 1976) for animal maintenance was not met or just met. Gains are listed when requirements for specific amounts of gain were met. Data presented are conservative estimates as the tables are strictly based on requirements for crude protein and energy based on a predetermined dry matter intake. Grazing animals are capable, to an extent, of increasing intake above values listed by the NRC (1976). No gain or loss then, appears sooner on these estimates than if cattle were actually weighed.

Foothill grasslands are currently used as spring range and these data verify that is the best time. Lodgepole and mixed conifer stands begin to decline in metabolizable energy more rapidly than crude protein. Actual cattle diets from other studies (Tables 2 and 3 and Figures 4 and 5) reflect this as well. Energy can be considered the first limiting nutrient on forestlands. Drought conditions intensify this deficiency. Lodgepole pine stands should be grazed as early in summer as possible as quality declines and the principal understory vegetation present (pinegrass) becomes unpalatable as the summer progresses (Hedrick et al., 1969). Stout et al. (1980) provide an excellent discussion on proper grazing of pinegrass.

The unimproved mixed conifer stand maintained crude protein requirements better than the improved because the shrub snowberry *(Symphoricarpos alba)* was present in the unimproved understory. Shrubs contain higher levels of crude protein later in the grazing season than

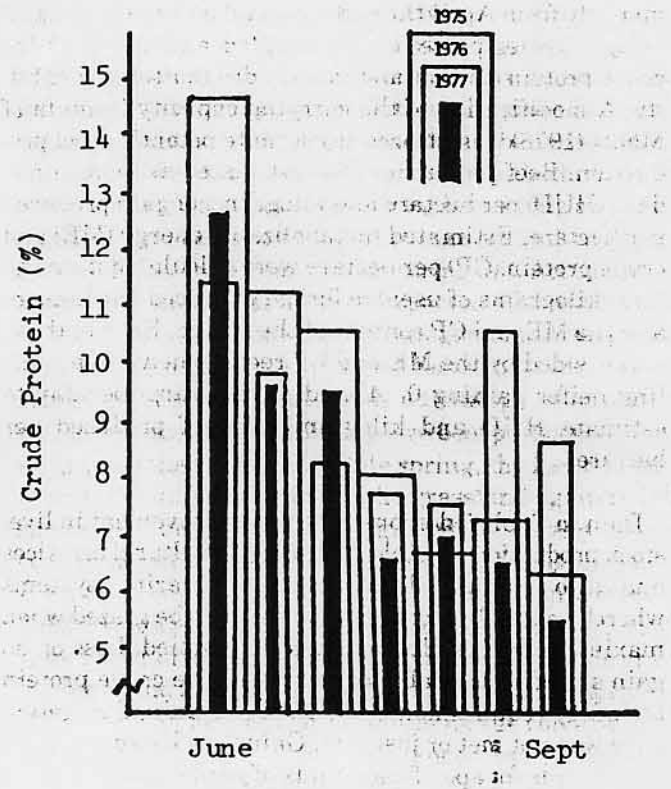

Figure 4. Percent crude protein in cattle diets.

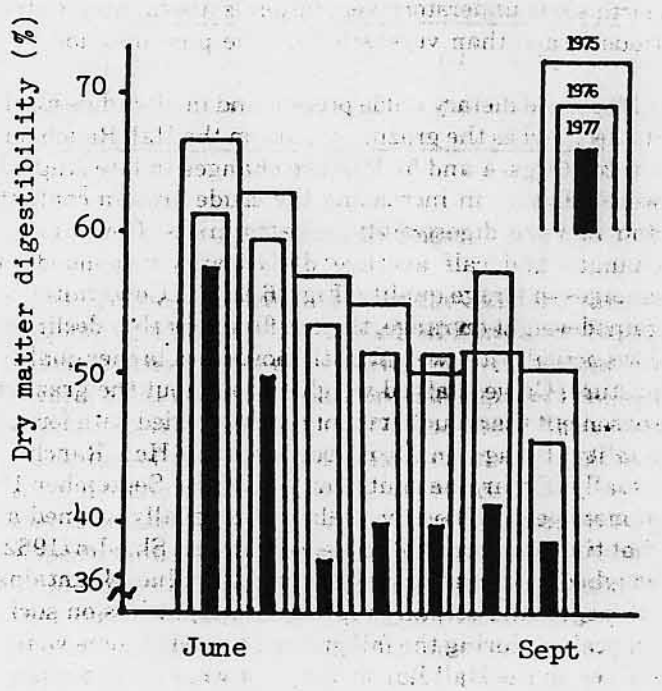

Figure 5. In vitro digestibility (DMD) of cattle diets.

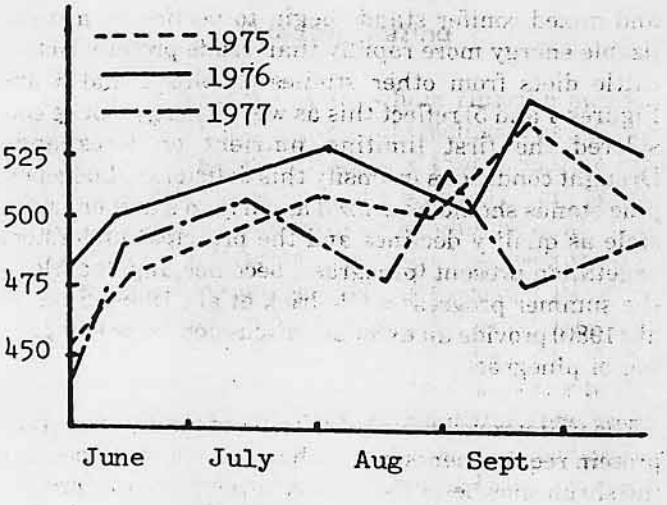

Figure 6. Cow weights (kg) for the summer grazing seasons.

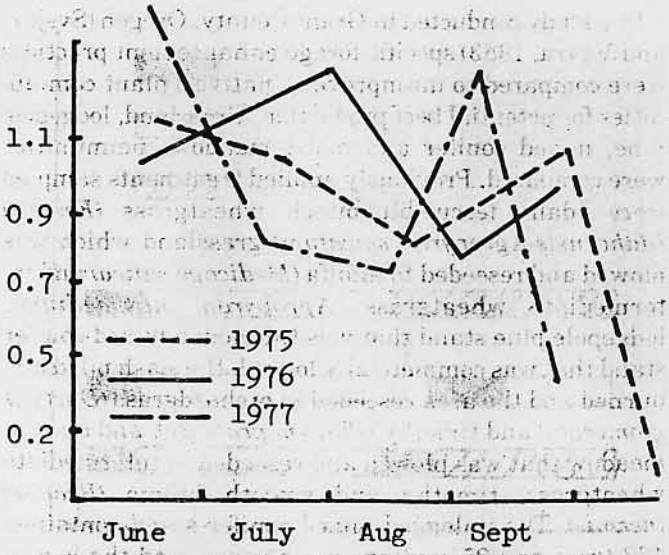

Figure 7. Average daily gain (kg/day) of calves for the summer grazing seasons.

Table 5. Estimated heifer unit days (HUD) and beef production (kg) per hectare for 300 kg heifers on improved and unimproved grassland, mixed conifer, lodgepole and moist meadow sites. Values were calculated on the basis of metabolizable energy (ME) or crude protein (CP) available in forage on the given dates.[1]

DATE	1980				1981			
	ME (M cal/kg)		CP (%)		ME (M cal/kg)		CP (%)	
	HUD	Kg BEEF	HUD	Kg BEEF	HUD	Kg BEEF	HUD	Kg BEEF
GRASSLAND								
APRIL								
Unimproved	7.0	5.2	11.5	8.6	6.7	5.0	10.2	7.7
Improved	18.8	14.1	34.0	25.5	9.6	7.2	21.5	16.1
MAY								
Unimproved	34.7	17.3	35.2	17.6	14.0	10.5	16.2	12.2
Improved	143.3	107.5	228.6	171.5	33.9	25.5	53.0	39.8
JUNE								
Unimproved	80.8	Loss	62.5	15.6	59.3	Loss	22.4	11.2
Improved	165.3	124.0	232.4	174.3	104.7	78.5	164.3	123.2
JULY								
Unimproved	62.5	Loss	60.0	Loss	45.8	Loss	59.1	Loss
Improved	287.5	Loss	179.4	89.7	105.1	52.6	119.7	89.8
MIXED CONIFER								
JUNE								
Unimproved	7.9	3.9	8.2	6.2	17.0	8.5	12.5	9.4
Improved	40.8	30.6	43.7	21.9	30.0	22.5	34.1	25.6
JULY								
Unimproved	21.2	Loss	12.4	9.3	20.9	Loss	13.2	9.9
Improved	219.6	Loss	231.7	No Gain	103.2	Loss	83.8	21.0
AUGUST								
Unimproved	41.2	Loss	25.2	12.6	25.9	Loss	16.6	8.3
Improved	260.8	Loss	230.6	57.7	144.4	Loss	144.3	Loss
SEPTEMBER								
Unimproved	38.4	Loss	42.9	Loss	26.0	Loss	26.6	Loss
Improved	240.6	Loss	153.4	Loss	142.3	Loss	100.9	Loss
LODGEPOLE								
JUNE								
Unimproved	2.5	1.3	3.4	2.6	2.6	1.3	3.6	2.7
Improved	6.1	3.1	7.5	5.6	16.9	Loss	12.6	9.5
JULY								
Unimproved	4.7	Loss	5.8	4.3	8.2	Loss	5.4	4.1
Improved	7.9	Loss	9.0	6.8	20.2	Loss	13.0	9.8
AUGUST								
Unimproved	10.4	Loss	7.7	3.9	8.5	Loss	6.0	3.0
Improved	15.6	Loss	14.2	3.6	19.3	Loss	24.9	No Gain
SEPTEMBER								
Unimproved	11.0	Loss	12.0	Loss	8.2	Loss	10.6	No Gain
Improved	14.6	Loss	12.0	Loss	18.2	Loss	15.7	Loss
MOIST MEADOW								
JULY								
Unimproved	17.3	13.0	17.5	13.1	27.3	20.5	29.3	14.7
Improved	65.5	49.1	67.7	33.8	63.1	47.4	88.0	22.0
AUGUST								
Unimproved	31.1	Loss	49.3	Loss	No available forage			
Improved	154.1	Loss	92.9	Loss	134.6	Loss	101.1	Loss
SEPTEMBER								
Unimproved	No available forage				No available forage			
Improved	129.8	Loss	54.6	Loss	116.9	Loss	61.4	

[1]Calculations of potential carrying capacity and beef production assume pasture is grazed only during a given month, thus months cannot be added to estimate total seasonal potential.

herbaceous species. Grazing should occur on the improved mixed conifer site prior to the unimproved.

Moist meadows similar to those studied should be grazed prior to August for beef production purposes. The unimproved meadow studied was composed primarily of the forbs wyethia *(Wyethia amplexicaulis)* and cinquefoil *(Potentilla* sp.). Both forbs dried and shattered (designated in tables by "no available forage") during the study period. Improved meadows had forage available later in the summer although yearling cattle could not be expected to perform well.

SUMMARY

The foregoing discussion has attempted to cite examples of how various forage resources can be incorporated into a grazing program that will improve the kilograms of beef produced from a given unit of land without increasing the demand on the forage resource. Only livestock requirements for grazing have been discussed. A rancher or land manager must first consider the physiological needs of the forage resource and develop a grazing program that provides for such. Once assured of a stable forage resource, modifications that enable improved cattle production are possible.

Cattle grazing in managed pastures also provides opportunities for multiple use. For example, deferring cattle grazing on riparian zones until late summer allows bird nesting (particularly ground nesting species) and fledging without disturbance (Kaufmann et al., 1982). Cattle that use south slope grasslands in spring only, may provide a residual forage base that is beneficial to wintering big game (Anderson and Scherzinger, 1976). Therefore, forestland managed for improved cattle production may actually increase the opportunity for multiple use. Cost of improvements, primarily fencing, could be spread over a greater base and be more cost efficient.

References that may be of interest are Pickford and Reid (1948), McLean (1967 and 1972) and Miller and Krueger (1976) on forage utilization and beef production; McClure (1958), McConnell and Smith (1970), McLean and Bawtree (1971) and McLean and Clark (1980) on logging, forage seeding and cattle grazing; Skovlin (1965) and Skovlin et al. (1976) on cattle grazing methods and distribution.

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