# Effects of Grazing Intensity upon the Nutritive Value of Range Forage

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### INTRODUCTION

THE desert ranges of the intermountain area furnish forage for grazing animals for approximately five months annually during the winter. A large percentage of these animals receive little or no supplement during this period. Some livestock receive supplemental feeds only during severe winter weather, whereas, others receive it only late in the season when feed is short and spring growth is delayed. vestment in land and livestock is dependent upon high producing efficiency of the livestock grazing the lands which, in turn, is dependent upon well managed ranges. Heavy utilization of the ranges over a long period of time reduces the yield of forage and in addition desirable plants are replaced by undesirable plants because of their high palatability.

However, the effects of heavy stocking are frequently reflected in livestock production long before actual changes in



FIGURE 1. Left—Conservatively stocked range showing a vigorous stand of winterfat. Right— Heavily stocked range showing only vestiges of the once vigorous clumps of winterfat. Grazing animals must consume more fibrous material than under less intense grazing.

Some ranges are conservatively stocked but many are subjected to heavier use than they can withstand over a longtime period (Figure 1). Adjustments in grazing because of too heavy utilization are frequently not made until the results are reflected in animal responses. However, the reproductive efficiency of the animal may be materially reduced long before its general appearance suggests the addition of a supplement or a reduction in grazing intensity.

A high rate of return from capital in-

the range are evident (1, 5, 6, 9). It has been shown that animals on moderately used ranges weigh considerably more than animals on heavily used ranges and in addition both lamb and calf crops are increased by moderate use compared to heavy use (1, 5, 6, 7, 8, 9).

It was noted by Cook *et al.* (3) that the chemical analyses of after-grazing plant samples showed that continued heavy use of the range caused the nutritive content of the foraging sheep's diet to become less favorable as a balanced ra-

tion. This was the result of animals being forced to eat the more fibrous and less nutritious material. Such findings prompted an analysis of the effect of grazing intensity upon the nutritive value of the grazing animal's diet.

# Method and Procedure

During the winter grazing seasons of 1949 to 1952, digestion studies were conducted on typical saltbush ranges on the west desert in Utah to evaluate the factors affecting the nutritional qualities of the diet.

The method for determining the consumption and digestibility of forage plants under range conditions has been reported by Cook *et al.* (4). Briefly the method consisted of using seven wether sheep which were equipped with specially constructed fecal bags and allowed to graze ranges in a normal manner. Temporary enclosures of about two to four acres were used on both pure stands of a single species and various mixtures.

The wethers were allowed an 8-day preliminary grazing period followed by a 6-day collection period. The fecal bags were emptied once daily and a sample for chemical analysis was composited from the total collection for each sheep.

When trials were being conducted on types composed of a single species, forage samples were taken by observing individual animals and hand plucking forage comparable to the material actually being consumed by the sheep. Several thousand random plucks were taken over the area as sheep were normally grazing.

When determining digestibility of mixed floral cover, the botanical and nutritive composition of the grazing sheep's diet was determined by the "before and after method" as presented by Cook *et al.* (2, 3).

In the present study three vegetation types were grazed and the composition of the diet determined. The same areas were then regrazed in a similar manner and the diet composition again determined. The data thus obtained can be used to compare nutritive level of ranges lightly grazed with the same range more heavily used.

# **Results and Discussion**

Unfavorable responses of livestock resulting from heavy utilization of the range have long been recognized but never adequately explained.

Animals normally prefer to consume largely leaves and tender stem tips and reject the tougher and more fibrous parts of the plant. This is particularly true for sheep (2). A sample of current-year'sgrowth of a shrub may contain 10 percent protein, whereas, a similar sample after it has been grazed may contain only 6 percent. This is because the more nutritious portion has been removed by the grazing animal. Therefore, if the area is grazed a second time the available forage does not contain 10 percent crude protein but contains only 6 percent. A similar relationship has been found in grasses (3). The entire growth from ground level may contain as much as 4 percent crude protein and 35 percent cellulose, however, after 50 percent utilization, the remaining growth may contain only 3 percent protein and 30 percent cellulose.

The effect of increased degree of utilization upon nutritive value of forage is further illustrated in Table 1. The content of protein, phosphorus, cellulose and gross energy in the forage decreased with heavier utilization, whereas, lignin increased.

With heavier utilization the animals were forced to consume the less nutritious portion of the plants and as a result the diet contained a smaller percentage of the more desirable nutrients.

In addition to the decreased content of

desirable nutrients accompanying heavy utilization, the digestibility of these nutrients was materially decreased. As shown in Table 2, the digestibility of protein decreased as much as 10 percent in some cases and the digestibility of celluanimal use. The differences in some cases are sufficiently great to show that serious deficiencies may be present when the range is heavily used, whereas, when moderately grazed, the nutritional requirements are more nearly satisfied.

TABLE I	BLE I
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Chemical composition of two important desert forage plants and of a mixed diet under two intensities of utilization

FORAGE SPECIES AND DEGREE OF UTILIZATION IN PERCENT	ETHER EXTRACT	TOTAL PROTEIN	LIGNIN	CELLULOSE	OTHER CARBO- HYDRATES	TOTAL ASH	CALCIUM	PHOS- PHORUS	GROSS ENERGY
	Perceni								
Shadscale									
0 to 20	<b>2.4</b>	8.7	11.2	17.5	34.8	25.4	2.24	0.09	3700
21 to 50	2.6	8.1	13.5	14.2	35.2	26.4	2.73	0.07	3555
Black sage									
0 to 30	10.3	8.5	15.6	25.6	33.9	6.1	0.57	0.16	5172
31 to 55	8.4	7.8	18.2	23.7	33.7	8.2	0.60	0.12	4977
Mixed diet <sup>1</sup>									
0 to 18	1.5	5.4	7.6	26.7	41.4	17.4	0.82	0.09	3733
19 to 40	2.4	4.3	8.7	26.5	41.5	16.6	0.66	0.09	3498

<sup>1</sup> Diet composed of 50 percent browse [black sage (Artemisia nova), shadscale (Atriplex confertifolia), and winterfat (Eurotia lanata)] and 50 percent grass [galleta grass (Hilaria jamesii), Indian ricegrass (Oryzopsis hymenoides) and sand dropseed (Sporobolus cryptandrus)].

TABLE 2

Dry matter consumed daily and digestibility of the nutrients for the two forage species and the mixed diet under two intensities of utilization as shown in Table 1

FORAGE SPECIES AND DEGREE OF UTILIZATION IN PERCENT	DRY MAT- TER CON- SUMED	PERCENT DIGESTED							DIGEST-	DIGEST-
		Dry matter	Ether extract	Total protein	Cellulose	Other carbo- hydrates	Gross energy	DIGEST- IBLE NUTRIENTS		IBLE ENERGY
	Pounds Percent									Cal./kg
Shadscale										
$0 \text{ to } 20 \dots$	3.5	47.8	44.6	61.4	37.7	61.3	37.7	35.7	5.3	1462
21 to 50	3.2	42.3	38.2	59.1	12.3	56.1	33.3	28.5	4.8	1210
Black sage										
0 to 30	2.9	41.1	63.5	54.5	35.9	58.2	43.6	48.3	4.6	2250
31 to 55	2.4	34.1	56.2	53.9	24.5	55.3	35.9	39.3	4.2	1770
Mixed diet										
0 to 18	3.6	52.0	33.0	40.6	48.8	63.0	48.5	42.4	2.2	1845
19 to 40	3.5	48.3	41.0	36.4	44.0	61.6	42.9	40.9	1.6	1530

lose as much as 67 percent as the degree of utilization increased. This decrease in digestibility with increased intensity of grazing results in even greater reduction of available protein and energy for In addition to the decreased content of the more desirable nutrients and the decreased digestibility of these nutrients with increased degree of utilization, there is an indication that animals actually consume less feed per day on heavier utilized areas compared to more moderately used areas (Table 2). This of course further adds to the seriousness of the nutritional deficiencies already indicated, since the actual amount of the various constituents ingested is the only true measure of a balanced or an unbalanced ration.

In many localities sheep herds graze over the range as many as three to four times during the winter grazing season and utilize the range considerably heavier than was tested in this study. The first time it is grazed only lightly and with each successive grazing the degree of utilization becomes greater. As a result the choice of palatable material becomes less and the nutritive value of the forage decreases.

In addition to the changes in nutritive value of the forage, the animals are advancing in gestation and the nutritional requirements are rapidly increasing.

Thus the knowledge and control of utilization is important in the management of ranges from the standpoint of meeting the nutritional requirements of the grazing animal for efficient livestock production.

#### SUMMARY

During the winter grazing seasons of 1949 to 1952 digestion studies were conducted on typical saltbush ranges of Utah to evaluate the factors affecting the nutritional value of the foraging animal's diet.

It was found that as the degree of utilization increased, the content of the more desirable nutrients in the available forage decreased, and, in addition, the digestibility of these nutrients was decidedly lowered.

Thus it was shown that with heavier utilization the animals were forced to consume the less nutritious portions of the plants and as a result the available nutrients frequently were not adequate to meet the demands of the grazing animals.

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