

# Forage Use by Cattle and Sheep Grazing Separately and Together on Summer Range in Southwestern Utah

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## Abstract

Grazing trials were conducted on high elevation summer range in southwestern Utah, with cattle and sheep stocked separately and together in .4-ha paddocks. Vegetation measurements were taken before and after grazing treatments to quantify vegetation utilization as measured by several sampling techniques. Sheep removed less grass and more forbs and shrubs than cattle. Cattle showed a strong reluctance to browse mountain snowberry (*Symphoricarpos oreophilus* Gray) even when herbaceous forage was greatly reduced. In the common use grazing treatments, all 3 forage categories were well utilized. Cattle and sheep grazing together used more forage, especially mountain snowberry, than calculated from single use averages.

Summer rangelands in southwestern Utah are an integral part of the local livestock production system and have been grazed almost exclusively by domestic sheep for decades. The extensive and heavy sheep grazing induced a general shift in the herbaceous vegetation from what was probably a tall forb-grass community to a grass dominated community. Despite these vegetation modifications, sheep continue to be the major livestock species on Cedar

Mountain in Iron County, Utah, the location of the study area.

Sheep are well suited to vegetation containing a mixture of grasses, forbs, and shrubs, and they use all 3 forage categories. Some of the coarse grasses are often left ungrazed, however, and therefore increase in abundance. Letterman needlegrass (*Stipa lettermanii* Vasey) has done just that on much of the mountain range in southern Utah. On the other hand, an increase in shrubs may follow prolonged, heavy, cattle grazing. Common use by cattle and sheep may result in more efficient range management and improved range condition by balancing forage demand.

Much has been written about common use of mountain ranges, but few studies have been conducted to compare the diets of cattle and sheep when stocked in common on mountain rangeland. In northern Utah, sheep grazing alone consumed significantly more forbs and browse than did cattle grazing alone or sheep and cattle grazing together (Cook et al. 1967).

Schlundt (1980) reported similar results from a study in southern Utah. He found that grasses were removed from pastures grazed by sheep and cattle alone at a rate similar to that of pastures grazed in common by cattle and sheep. Forbs were less used by cattle than were the grasses. Mountain snowberry was browsed to a greater degree by sheep than by cattle. Additionally, shrub use in the common-use pasture was higher than predicted from single-use stocking rates.

Common use is best applied where there is a mixture of grasses, forbs, and shrubs (Heady 1975). Animal behavior, topography, the availability of livestock water, and personal preferences of the

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manager may also contribute to the success or failure of common-use grazing management (Cook 1954, Smith 1965, Heady 1975).

The purpose of this study was to compare forage utilization levels of cattle and sheep grazing alone and in common during short grazing trials at high stocking densities. Utilization was measured for individual plant species and forage categories.

### Study Area

The study area consisted of stands of oak and aspen woodlands interspersed with large open areas of grassland and grass-shrub mixtures. Major forage species on the study site included Letterman needlegrass, Kentucky bluegrass (*Poa pratensis* L.), mountain snowberry, herbaceous sage (*Artemisia ludoviciana* Nutt.), yarrow (*Achillea millefolium* L.), vetch or cowpea (*Vicia americana* Muhl.), and whiplash daisy (*Erigeron flagellaris* Gray). Plant names follow Welsh and Moore (1973).

For the study reported here, eight 0.4-ha paddocks were located on a high mountain loam range site at an elevation of 2,500 m. The paddocks were representative of much of the mountain range in the area, a mixture of grasses, forbs and snowberry.

### Methods

#### Grazing Treatments

The purpose of the grazing treatments was to determine how grazing by sheep and cattle alone and together affected the relative availability of various plant species and individual plants. During the 1981 trials, grazing treatments were applied to the .4-ha (1-acre) paddocks with 20 ewes and 40 lambs or 4 cows with calves for the single use-treatment; or 10 ewes and 2 cows, all with offspring (5:1 sheep:cow substitution ratio) for the common-use treatment. Grazing trials lasted 4 days. The 1982 grazing trials were identically stocked but lasted 5 days resulting in stocking rates equivalent to .76 ha/AUM in 1981 and .60 ha/AUM in 1982. Two paddocks were left ungrazed. In each grazed paddock, utilization of herbaceous and shrubby vegetation was estimated using several techniques. Because snowberry was by far the most abundant shrub on the site, shrub sampling focused on this species, and browsing use was estimated separately from that of herbaceous vegetation by stratifying the shrub cover.

Three sampling techniques were used to estimate utilization of herbaceous vegetation: (1) standing crop before and after grazing, (2) percentage of grazed plants, and (3) average heights of grazed and ungrazed plants, with utilization being based on the weight of the difference between the grazed and ungrazed heights as determined from height-weight relationships. Where height-weight relationships were unsuitable (mostly small forbs), use was ocularly estimated.

Standing crop measurements before and after grazing described vegetation disappearance (utilization). A double sampling procedure was employed using a 1:4 ratio of clipped to estimated, .2-m<sup>2</sup> plots (Mueggler 1976, Mueggler and Stewart 1981).

In a separate sampling procedure, the percentage of grazed plants within each species was determined by counting grazed and ungrazed plants in every plot. Average grazed and ungrazed height of each plant species encountered also was recorded. Height-weight relationships for the most important forage species were developed and used in a manner similar to that described by Dwyer (1961). Sampling was done in a series of 10 randomly placed transects. Each transect comprised 10, .3-m<sup>2</sup>, rectangular plots. Data were summed by transect for data analysis.

Snowberry utilization was determined by the method developed by Ruyle et al. (1983) in which caliper measurements of the last intact internode on browsed stems were used to predict biomass removed by browsing. Two models were used to predict the quantity of biomass removed, distinguishing between 2 kinds of browsing—leaf only and entire stem removal.

### Statistical Analysis

Grazing trials were replicated twice each year of the study. Main effects for statistical analysis were grazing treatment and date of sampling period (before and after grazing). Where analysis of variance showed significant *F*-values, means were separated using the L.S.D. test (Steel and Torrie 1980).

### Results and Discussion

To allow better interpretation of the utilization estimates, standing crop biomass for the major forage species is presented in Table 1. Standing crop was estimated just prior to the grazing periods, during the peak of forage production.

Table 1. Standing crop biomass estimates for the major forage species on the Cedar Mountain study area in mid-July, 1981 and 1982.

Species	Standing crop (kg/ha)	
	1981	1982
<i>Stipa lettermanii</i> Vassey	158	140
<i>Poa pratensis</i> L.	228	233
Total grasses	460	435
<i>Artemisia ludoviciana</i> Nutt.	110	120
<i>Achillea millefolium</i> L.	14	15
<i>Erigeron flagellaris</i> Gray	53	68
<i>Vicia americana</i> Muhl.	49	61
Total forbs	295	290
<i>Symphoricarpos oreophilus</i> Gray	830	908

Forage use estimates for sheep and cattle grazing alone and in common compared favorably with the findings of other researchers on similar sites (Cook et al. 1967), and followed similar trends for each sampling method during both years of the study (Table 2). Grasses were used to a greater degree by cattle than by sheep, while sheep used more forbs and shrubs than did cattle. Only Kentucky bluegrass, Letterman needlegrass, and herbaceous sage occurred consistently enough among treatments and plots to allow acceptably precise height-weight and grazed plant estimates of grazing use. Because of heavy grazing or infrequent occurrence, other plant species were not adequately sampled by these methods. Sampling only once after grazing does not account for those very palatable plants that disappear early from the vegetation when it is grazed.

For general comparisons, all sampling methods indicated similar trends among grazing treatments within forage categories. Utilization estimates based on height-weight relationships were most often lowest, while percentage of grazed plants gave the highest estimates (Table 2). Standing crop utilization estimates more often indicated statistical differences among grazing treatments.

On a species level, standing crop utilization estimates indicated that Kentucky bluegrass and Letterman needlegrass were grazed less in sheep paddocks than in cattle or common-use paddocks. Herbaceous sage was used more heavily by sheep grazing alone. Yarrow was most heavily grazed under common use (Table 3). Whiplash daisy and vetch were grazed to similar degrees in all 3 grazing treatments. Vetch, a highly palatable forb, was used heavily (96% average) in both years for all treatments. The high desirability of this species to both cattle and sheep make it unsuitable for one-time sampling of utilization after grazing, since the remnant stems are exceedingly difficult to see and are often overlooked.

Differences in mountain snowberry utilization among grazing treatments were larger than those of any other forage class (Table 4). Cattle made little use of the shrub, even at the 27% higher stocking levels of 1982. Sheep used mountain snowberry heavily, browsing 71% of the stems in 1981 and 87% in 1982, with estimated use being 36 and 45%, respectively (Table 4). However, 45% utiliza-

**Table 2. Comparison of utilization estimates by percentage of grazed plants or grazed stems (G), height-weight (H/W), and standing crop (SC) disappearance for the three grazing treatments, both years of the study.**

Grazing treatment	Grasses			Forbs			<i>Poa pratensis</i> L.			<i>Stipa lettermanii</i> Vasey			<i>Artemisia ludoviciana</i> Nutt.		
	G	H/W	SC	G	H/W	SC	G	H/W	SC	G	H/W	SC	G	H/W	SC
1981															
1981															
Sheep	51a <sup>1</sup>	19a	33a	73a	47a	68a	66a	36a	40a	62a	17a	22a	39a	11a	41a
Cattle	81b	30b	66b	24b	14b	31b	75a	33a	58b	81b	27b	48b	10a	16a	20b
Common	71b	31b	62b	63a	39a	61a	81a	39a	62b	81b	32b	60c	16a	17a	22b
1982															
1982															
Sheep	80a	39a	39a	86a	48a	77a	97a	61a	45a	81a	45a	27a	79a	21a	62a
Cattle	95b	53a	70b	7b	7b	52b	98a	65a	64b	90b	32a	60b	11b	5b	24b
Common	88ab	44a	71b	76a	50a	66a	95a	53a	73c	93b	39a	68b	27c	9b	7c

<sup>1</sup>Means in the same column within years followed by a different letter are significantly different at  $p = 0.10$ .

**Table 3. Percent utilization of standing crop by grazing treatment for stocking levels of .76 ha/AUM in 1981 and .62 ha/AUM in 1982.**

Grazing Treatments	Percent Utilization					
	<i>Achillea millifolium</i> L.		<i>Erigeron flagellaris</i> Gray		<i>Vicia americana</i> Gray	
	1981	1982	1981	1982	1981	1982
Sheep alone	48a <sup>1</sup>	67a	58a	69a	99a	99a
Cattle alone	40a	42b	53a	67a	95a	93a
Common use	60b	96c	61a	65a	98a	96a

<sup>1</sup>Means in a column followed by a different letter are significantly different at  $p = 0.10$ .

**Table 4. Percent utilization of mountain snowberry (*Symphoricarpos oreophilus* Gray) for sheep, cattle and common use grazing treatments during 1981 and 1982.**

	1981 (.76 ha/AUM)			1982 (.62 h/AUM)		
	Sheep	Cattle	Com-mon	Sheep	Cattle	Com-mon
Grazed stems	71a <sup>1</sup>	9b	52a	87a	8b	87a
Utilization	36a	3b	23c	45a	12b	41a
$\bar{x}$ Snowberry cover in treatment	24	18	12	24	18	12

<sup>1</sup>Means in a row, within years, followed by the same letter are not significantly different at  $p = .01$ , except 1981 utilization ( $p = .10$ ).

tion (calculated in the traditional manner of the current year's biomass removed divided by total current year's standing crop) represented an upper level of use of total current year's growth on

this shrub because of the way sheep stripped the leaves and left the stems essentially intact (Fig. 1). This was different from cattle browsing where entire stems were taken (Fig. 1). Under common use most of the stems were stripped of leaves similar to conditions in paddocks grazed only by sheep (Fig. 1), supporting our conjecture that most of the mountain snowberry use in these treatments was by sheep. During both years of the study, common use resulted in higher than expected snowberry use, based on the average of utilization values of sheep and cattle grazing alone.

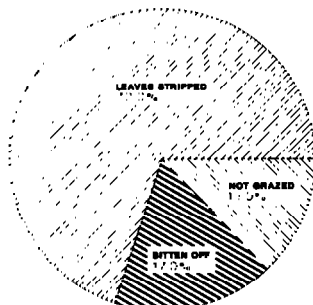
In larger pastures surrounding the study paddocks, cattle and sheep grazing in common separated on a topographical basis. But where stocking densities were increased, cattle and sheep congregated more often, reducing topographical influences. It is not known how stocking rates and densities alter other grazing relationships among the 2 animal species and care must be used when extrapolating these results to large pastures.

In this study common use grazing tempered the differences in forage utilization of the single use grazing treatments. All 3 forage categories—grasses, forbs, and shrubs—were well grazed. However, utilization of grasses, forbs, and shrubs in the common use paddocks did not represent an intermediate level utilization by cattle and sheep grazing alone as reported by Cook et al. (1967). Here, cattle and sheep grazing together used more forage, especially mountain snowberry, than had been calculated from single use averages. On these sites simultaneous grazing by cattle and sheep distributed the grazing pressure more evenly over the 3 forage classes. The advantage of common use may be that it enables the vegetation to maintain a stable composition at higher levels of use than does single species stocking.

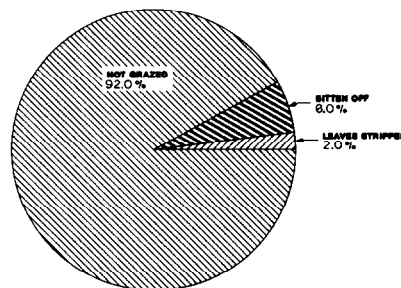
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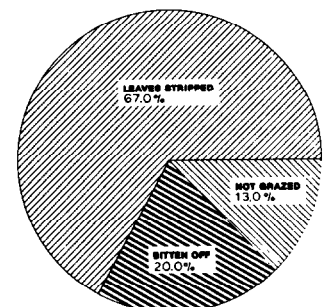
Snowberry Use By Sheep (1982)  
.60 AUMS/Ha



Snowberry Use By Cattle  
.60 Aums/Ha



Snowberry Use By Sheep and  
Cattle Grazing Together  
.60 Aums/Ha



**Fig. 1. Mountain snowberry (*Symphoricarpos oreophilus* Gray) use by sheep, cattle and mixed species depicting the browsing methods. Sheep stripped the leaves from the stems whereas cattle took entire stems. Common use resulted in most of the browsed stems stripped of leaves, similar to those in sheep treatments.**

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