

Sheep Behavior Under Unherded Conditions on Mountain Summer Ranges¹

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Highlight

Purebred Rambouillet, Targhee and Columbia sheep were observed on mountain summer ranges in southwestern Utah. Under unherded conditions Rambouillet sheep travelled greater distances and spent more time resting, while Columbias travelled the least distances, rested least and grazed longer than the other breeds. All breeds travelled farther in the morning than in the afternoon but grazed longer in the afternoon. There was a tendency for the sheep to water and take salt in the mornings rather than in the afternoons. Overgrazing on established bedgrounds was caused by animals grazing these areas in the evening prior to bedding down. Fencing along the crests of the ridges and more strategic salt placement appear to be the most useful means of improving distribution.

One of the most important problems facing the range manager and livestock man is that of achieving optimum distribution of livestock. Because of high labor costs many stockmen cannot afford competent sheep herders. In some areas, such as southwestern Utah, the trend is to fence sheep into an area and

allow them to drift over the entire range at their own discretion.

This study was conducted to determine the general behavioral patterns of unherded sheep and to ascertain whether behavioral differences existed between breeds. Such information should be valuable in improving sheep and range management.

Study Area

The study area was located in the Coal Creek Drainage of Iron County, Utah, locally known as the College Ranch. The elevation is approximately 8,500 feet. A com-

bination of spruce and fir grow on the north-facing slopes, and oak-brush (*Quercus gambelii*) is prevalent on the south-facing slopes. Within these major types are aspen and open areas characterized primarily by Kentucky bluegrass (*Poa pratensis*) and letterman needlegrass (*Stipa lettermanii*).

The topography consists of major ridges and small canyons. Water for stock is usually sufficient both in quantity and distribution, being supplied by permanent streams or developed springs piped into troughs.

This study area was purchased in 1943 by Utah State University from a local sheepman. Prior to purchase, approximately 3,000 sheep were supported on the 2,789 acres during the summer grazing season. Ogden and Andrews (1957) conducted a range survey of this area and classified it as being in fair to poor condition. They attributed poor distribution of the sheep to non-herding and inadequate fencing and suggested that additional fences and a deferred-rotation grazing system be put into operation.

Bennett et al. (1963) made a comparative study of Rambouillet, Targhee and Columbia sheep on this study area and found that the Targhee breed gave the greatest total return per ewe. They also found that the Columbia, a larger

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breed than either the Targhee or Rambouillet, required more feed and may have been unable to meet their feed requirements under the existing range conditions. Matthews et al. (1967), working on this same range, noted that the Targhees were apparently better adapted to the available feed and other factors of the environment or possibly were genetically superior to the other breeds for level of production. The Columbias exhibited a lower reproductive performance than the other two breeds but produced heavier lambs at weaning.

Methods and Procedures

A direct and continuous method of observation similar to that used by Tribe (1949), Southcott et al. (1962), Herbel and Nelson (1966) and Herbel et al. (1967) was employed in this study. Three breeds of sheep were used. Different colors of paint were used to distinguish the Columbia, Targhee, and Rambouillet breeds. Individual animals were marked on the top of the head, on one hind quarter and on the opposite front shoulder in a manner similar to that described by Tribe (1949). Standard sheep brands and marking paints were used for this purpose. The markings remained visible for the entire grazing season except markings on the head which eventually rubbed off. The marking pattern made it possible to identify particular sheep from nearly any angle.

Five animals of each breed were selected at random each summer, appropriately marked and returned to the main herd.

During the period of observation, one ewe was randomly selected at approximately noon and observed until she bedded down at night. The same animal was located on the bedground prior to daylight the following day and observed until noon of that day, a procedure which resulted in one sheep being observed for one continuous daylight period. This time schedule was employed to ascertain whether the

Table 1. Distances travelled (miles) between breeds and between grazing periods.

Comparisons	Early period		Late period		Both periods	
	No. of observations	Mean dist.	No. of observations	Mean dist.	No. of observations	Mean dist.
Rambouillet vs. Targhee	12	3.2	3	1.9	16	2.4
Rambouillet vs. Columbia	11	3.2*	3	1.9	15	2.9*
Targhee vs. Columbia	10	1.8	3	2.2	14	1.9

* Differences significant at the 0.05 level.

sheep had preferred areas or "home ranges" and to determine whether any movement off of the bedgrounds occurred during the night. A single sheep was followed, since Southcott et al. (1962) reported that one marked sheep was a reliable indicator of group activity. Herbel and Nelson (1966) and Herbel et al. (1967) used this same procedure with cattle in New Mexico.

The sheep were followed on foot rather than horseback, since this procedure allowed the investigator to remain quiet and unobserved. The distance between the observer and the sheep was kept to a minimum, but a sufficient distance was necessarily maintained to avoid frightening the animals.

The grazing season was divided into an early grazing period (June, July, and August) and a late grazing period (September and October).

Because of the differences in sample sizes between breeds and between grazing periods, the statistical analysis of activities was made with a "t" test. Group comparisons were made for all possible combinations between breeds and between grazing periods.

Travel distances were computed by tracing sheep movements on an aerial photographic mosaic, and distances were calculated with a map tracer.

This study was conducted in 1965, 1966 and 1967. At first, the study was conducted only during the summer months, but in 1967 the sheep were allowed to remain on

the range until October; forage was so abundant that data were also collected during this late period. Although this resulted in a small sample size during the late period, these data were thought to be sufficiently valuable for inclusion.

Activities of the sheep were divided into five major categories: (a) grazing, (b) resting, (c) travelling, but not feeding, (d) watering, and (e) taking salt. These five activities accounted for nearly the entire time period between the time the sheep left the bedground and the time they bedded down at night. Minor activities such as ruminating, lying resting, standing resting, etc. could not always be observed because a particular sheep could not be kept in constant view. Attempts to keep a single sheep in constant view necessitated extremely close proximity to the individual which invariably disturbed the entire group and changed their activity.

Results and Discussion

Distance Travelled

Throughout the entire grazing season the Rambouillets travelled the greatest distance in a daylight period (Table 1). This breed travelled an average of 2.9 miles as compared to 2.4 miles for the Targhees and 1.9 miles for the Columbias. A significant difference, at the selected 5% level of probability, was found between the distance travelled by the Rambouillets and by the Columbias.

Table 2. Distances travelled (miles) between grazing periods and between morning and afternoon.

	No. of observations	Mean dist.
All breeds early vs. late	23	2.5 2.2
Rambouillet early vs. late	8	3.2 1.8
Targhee early vs. late	7	2.3 2.5
Columbia early vs. late	6	1.8 2.2
All breeds morning vs. afternoon	47	1.5* 0.9

*Differences significant at the 0.05 level.

During the early grazing period, the three breeds showed similar but more pronounced differences. The Rambouillets again travelled the greatest distance (3.2 miles) followed in order by the Targhees (2.3 miles) and the Columbias (1.8 miles). A significant difference was again found between the Rambouillets and the Columbias.

No significant travel differences were found between breeds during the late grazing period or within breeds when the early period was compared to the late period.

An increase in the distance travelled for all breeds occurred between the early and late periods, but these differences were not significant (Table 2).

The greatest distance travelled was 4.6 miles by a Rambouillet in July. The shortest distance was 1.2 miles by a Columbia, also in July.

An interesting contrast is the distance travelled by all breeds in the morning as compared with the distance travelled during the afternoon. During the morning the sheep travelled an average of 1.5 miles but only 0.9 miles during the afternoon (Table 2). These were significant differences.

Time Spent Grazing

Throughout the entire grazing season the Columbias spent 75.7% of the time grazing, followed in order by the Targhees with 68.7% and the Rambouillets with 67.6%

Table 3. Time (%) spent grazing between breeds and between grazing periods.

Comparisons	Early period		Late period		Both periods	
	No. of observations	Mean time	No. of observations	Mean time	No. of observations	Mean time
Rambouillets vs. Targhees	11	62.0 66.3	3	87.0 74.6	15	67.6 68.7
Rambouillet vs. Columbia	11	62.0** 74.9	3	87.0 77.6	15	67.6 75.7
Targhee vs. Columbia	9	66.3* 74.9	3	74.6 77.6	13	68.7 75.7

* Differences significant at the 0.05 level.

** Differences significant at the 0.01 level.

(Table 3). These differences were not, however, statistically significant.

During the early grazing period the Columbias spent 74.9% of their time grazing as compared to 66.3% for the Targhees and 62.0% for the Rambouillets. Significant differences were found between the Columbias and Rambouillets and between the Columbias and Targhees.

As the grazing season progressed, the percentage of time spent grazing increased for each breed, but the only significant increase was found with the Rambouillets (Table 4).

When the percentage of time spent grazing during the early period was compared to the late period for all breeds, a significant increase of from 67.1% to 79.7% was found. These data indicate that as the grazing season progressed or as forage became less available, the time spent grazing in-

creased. Other authors have noted the same tendency in grazing animals (Tribe, 1949, and Southcott et al., 1962).

Time Spent Resting

Throughout the entire grazing season all breeds spent about the same amount of time resting. The Rambouillets spent 28.2% of their time resting as compared to 26.5% by the Targhees and 22.2% by the Columbias (Table 5). These slight differences were not statistically significant.

During the early grazing period the Rambouillets again spent the greatest percentage of time resting (33.8%); the Targhees were intermediate (30.0%), and the Columbias spent the least time resting (23.9%). Significant differences were found between the Rambouillets and Columbias and between the Targhees and Columbias.

As the grazing season progressed the time spent resting decreased for each breed (Table 6). Significant differences between periods were found for the Rambouillets and Targhees. During the late period a significant difference was found between the Rambouillets and Targhees (Table 5).

The average percentage of time spent resting during the early period was greater (29.8%) than that spent during the late period (14.8%) for all breeds (Table 6). These differences were significant at the 1% level of probability.

The Rambouillets spent a greater percentage of time resting during

Table 4. Time (%) spent grazing between grazing periods.

	No. of observations	Mean time
All breeds early vs. late	22	67.1** 79.7
Rambouillet early vs. late	8	62.0** 87.0
Targhee early vs. late	6	66.3 74.6
Columbia early vs. late	6	74.9 77.6

* Differences significant at the 0.05 level.

** Differences significant at the 0.01 level.

Table 5. Time (%) spent resting between breeds and between grazing periods.

Comparisons	Early period		Late period		Both periods	
	No. of observations	Mean time	No. of observations	Mean time	No. of observations	Mean time
Rambouillet vs. Targhees	11	33.8	3	8.7*	15	28.2
Rambouillet vs. Columbia	11	33.8*	3	8.7	15	26.5
Targhee vs. Columbia	9	23.9	3	18.1	13	22.2
		30.0*		17.6		26.5
		23.9		18.1		22.2

* Differences significant at the 0.05 level.

the early period and for the entire season because of their tendency to shade up earlier and leave the shade later than the other two breeds.

Time Spent Travelling but Not Feeding

Throughout the entire grazing season the Targhees spent the greatest percentage of time travelling but not feeding (4.7%) followed in order by the Rambouillets (4.1%) and the Columbias (2.0%).

As the grazing season progressed, the percentage of time travelling but not feeding appeared to increase for each breed and for all breeds combined. However, no significant differences were found for this activity.

Most of the time spent travelling but not feeding occurred in the mornings when the sheep trailed to their preferred shading areas.

Watering and Salting

The sheep generally watered early in the morning, either during or following the morning grazing period.

Table 6. Time (%) spent resting between grazing periods.

	No. of observations	Mean time
All breeds early vs. late	22	29.8**
Rambouillet early vs. late	8	14.8
Targhee early vs. late	6	33.8**
Columbia early vs. late	6	8.7
		30.0*
		17.6
		23.9
		18.1

* Differences significant at the 0.05 level.

** Differences significant at the 0.01 level.

The water on the study area was usually located in the canyon bottoms and the sheep fed down from the ridges into the bottoms to drink. This tendency was not incidental to feeding because the sheep often went considerable distances to water. After the sheep had obtained water they either continued to graze or shaded up. There was little tendency for sheep to water in the afternoons. All verified observations of watering activity indicated that 87% of this activity occurred prior to 11:00 A.M. and 73% prior to 8:30 A.M.

When the forage was wet, as after a rain, the sheep did not seem to want or require water. Doran (1943) found that sheep spent very little time drinking, and he speculated that dew supplied much of their water requirement.

Salting activity also was most pronounced during the morning hours. Although sheep preferred to take salt in the morning, they generally drank first and took salt later. Eighty percent of the verified salting activity took place in the morning, 30% of the time prior to 8:30 A.M. Determination of the effect of salt on distribution was difficult because the salt was placed on some bedgrounds, in preferred shading areas, near water, near roads and on established sheep trails. The sheep appeared to be more salt hungry after feeding on wet forage.

Shading

Sheep generally shaded up in groups in the bottoms of canyons

and seemed to favor certain areas and even specific trees. Abandoned buildings also appeared to be preferred shading areas.

One aspect of this study involved determining whether temperature was the primary factor initiating the daily shading activity. During the entire grazing season the mean air temperature at the time of shading was 58 F, while that of leaving the shade was 64 F. These differences were significant at the 5% level of probability. During the early grazing period the mean air temperature at the time of shading was 62 F and 67 F at the time the shade was left. These differences approached significance at the selected 5% level of probability. No significant differences were noted during the late grazing period. One observation during the late grazing period showed that sheep shaded up when the temperature was only 38 F.

These data indicate that temperature alone did not cause the animals to shade up; rather this behavior seemed to be initiated after the animals had satisfied their hunger. This conclusion is supported by the observation of higher temperatures when the animals left the shade than when they began to shade up, as well as by the fact that the sheep continued to shade up in the fall when temperatures were quite cool.

Over the entire grazing season, the mean time of shading up, for all breeds, was 10:12 A.M., and the mean time of leaving the shade was 2:05 P.M.

Morning vs. Afternoon Grazing

During this study the sheep displayed a period of grazing activity in the morning and another in the afternoon separated by a period of rest during the middle of the day. For all breeds and for the entire grazing season, the morning grazing period was significantly shorter (268 minutes) than the afternoon (326 minutes).

The afternoon grazing period

appeared to be a more intensive feeding time than was the morning. The evidence for this conclusion is that the sheep graze for a longer period of time in the afternoon, yet travel a shorter distance. The sheep were observed to be more contented during the afternoon and did not search out water or salt as they did in the morning.

Bedding Habits

The usual tendency for sheep in mountainous country is to seek out the highest areas for bedding down. In this study the sheep had a few preferred bedding areas, generally located on high ridge tops free of trees or large shrubs. The same bedgrounds were used throughout the entire grazing season. Weather conditions apparently had no effect on the selection of bedgrounds. The same bedgrounds were used on warm July nights and on cold windy nights in September. There was, however, a tendency for the Columbias to use areas other than the more preferred bedgrounds. This breed apparently preferred to bed down in the lower areas rather than trail to the tops of the ridges as did most of the other sheep. Apparently this tendency is related to their shorter travelling distances and longer grazing periods.

During the early part of the grazing season the sheep left the bedgrounds before or just after daylight. At daybreak the ewes stood up, collected their lambs, and then moved off the bedgrounds. The animals left together in a large group, separating into smaller groups as they fed. Later in the grazing season the sheep often remained on the bedgrounds as long as an hour after daylight. No grazing occurred on the bedgrounds in the mornings; grazing was initiated only after the sheep left the bedding areas.

In the evening the sheep usually reached the bedgrounds before they were ready to bed down, in some instances 2½ hours early. They spent this time feeding. Thus,

an overgrazed condition at established bedgrounds results.

General Observations

Certain areas of the range were highly preferred by the sheep. These were specific bedgrounds and valley bottoms. If the sheep were not herded or otherwise kept away from these areas, overuse always resulted. Sheep also had a tendency to remain in certain feeding groups, particularly in the morning, but there did not appear to be any particular family grouping or establishment of home ranges as was observed by Cresswell (1960) and Hunter and Milner (1963). Observations were made of one group of sheep moving through another group without any apparent mixing.

No quantitative data were obtained on forage preferences, but the following observations were made: (1) The single most important forage species was Kentucky bluegrass. It was the preferred species from early in the season until the middle of October. The production of the grass was rather low, but it continued to grow as long as soil moisture was available. (2) When the forage was wet, the sheep spent their entire grazing time feeding on oakbrush and snowberry (*Symphoricarpos* spp.). As the forage began to dry the animals again preferred herbaceous species.

Management Proposals

The results of this study suggest two main methods of improving the management of both range and sheep. These are the strategic location of fences and salt.

Division fences should be placed on the crest of the ridges and should follow the length of the ridges. The reason for fencing along the ridges is to reduce the amount of time spent on any one bedground and to provide protection for part of the bedground at all times. These fences also would prevent the sheep from crossing from one drainage to another, which would maximize distribution

and also reduce the distance travelled. With a rotation grazing system, more uniform utilization of the forage would be obtained, and pastures could be grazed when optimum conditions for forage and water existed.

More favorable placement of salt also should have a considerable impact on distribution. Salt should be moved away from water, bedgrounds, main roads, and trails and placed in less preferred and lightly used areas.

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