

Diets of Domestic Sheep and Other Large Herbivores in Southcentral Colorado

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Abstract

The botanical composition of herbage consumed by domestic sheep, mule deer, domestic cattle and elk from critical big game winter ranges in southcentral Colorado was studied using the fecal analysis technique. The food habits of domestic sheep grazed during the late spring overlapped those of mule deer by 15%, elk 46%, and domestic cattle by 53%. Mule deer diets were 10% similar to cattle and 30% to elk. Elk and cattle diets averaged 39% identical on the study area. The low similarity in diet between domestic stock and mule elk suggests that livestock grazing in the study area could be made compatible with the winter range needs of mule deer, but the potential competition between elk and domestic stock needs additional study.

Late spring grazing by domestic sheep (*Ovis aries*) has been reported to alter the amount of several forage categories available to mule deer (*Odocoileus hemionus*) during the subsequent autumn and winter (Smith et al. 1979). The grazing of big game winter ranges by domestic stock still remains one of the most controversial issues concerning rangeland management. Presumably domestic sheep use of game winter ranges causes critical winter forage to be less available to big game than does the use of the same vegetation type by domestic cattle. Although the issue surrounding the use by domestic sheep of game winter ranges in Colorado has been just as intense as in other western states where mule deer have been declining over the past two decades, a literature survey produced only one published paper (Doran 1943) on the food habits of domestic sheep on rangelands in Colorado. Doran's (1943) paper concerned domestic sheep food habits on big game summer range of the aspen vegetation type and included comparisons between the selection of plant species by lambs and ewes.

Domestic sheep food habits have been reported in the literature for various habitat types in the western states (Cook 1954; Cook et al. 1962; Van Dyne and Meyer 1964; Wilson et al. 1971; and Olsen and Hansen 1977). However, perusal of the literature over the past three decades clearly indicates that much more is known about the food habits of big game animals on Colorado rangelands than is known about domestic animal food habits on the same lands.

The purpose of this paper is to provide information about domestic sheep diets in relation to those of mule deer, domestic cattle (*Bos taurus*) and elk (*Cervus canadensis*) on big game winter ranges which may be critical to the successful overwintering of mule deer and elk. An objective was to estimate whether the recent past use of the study areas was resulting in excessive dietary overlaps.

Study Area and Procedures

The study area was located on the big game winter range of the Alamosa District, Rio Grande National Forest in the San Juan mountains of southcentral Colorado. The study area extends approximately 8 kilometers west of the forest boundary and the mean elevation is 2,833 m ranging from 2,589 m to 3,000 m.

The vegetation pattern was uniform throughout the area and three basic plant communities could be distinguished. On the more xeric sites a mixture of shrub steppe and pinyon-juniper vegetation types were found. The major plant species of the shrub steppe were rubber rabbitbrush (*Chrysothamnus nauseosus*), big sagebrush

(*Artemisia tridentata*), broom snakeweed (*Gutierrezia sarothrae*), fringed sagewort (*Artemisia frigida*), blue grama (*Bouteloua gracilis*), western wheatgrass (*Agropyron smithii*), bluegrass (*Poa* spp.), Arizona fescue (*Festuca arizonica*), carices (*Carex* spp.) and needleandthread grass (*Stipa comata*). The pinyon-juniper type contained pinyon pine (*Pinus edulis*), juniper (*Juniperus* spp.), true mountainmahogany (*Cercocarpus montanus*), currant (*Ribes* spp.), fringed sagewort, blue grama, and carices.

The major plant species found on mesic sites were ponderosa pine (*Pinus ponderosa*), douglas fir (*Pseudotsuga menziesii*), quaking aspen (*Populus tremuloides*), rose (*Rosa* spp.), currants, thurber fescue (*Festuca thurberi*), Arizona fescue, brome (*Bromus* spp.), prairie junegrass (*Koeleria cristata*), bluegrass, and carices. Plant names follow those recommended by Beetle (1970).

Domestic sheep were released on the study areas in late spring and were herded to higher elevations as the snow melted. Domestic cattle use was heaviest in early summer and progressively decreased as the summer advanced and by late summer most of the cattle had moved to higher elevation ranges. Mule deer and elk typically arrived on the study area in late fall and early winter and remained until late March. In winters with more than average snowfall, they may remain until April or early May.

The botanical composition of sheep, cattle, deer, and elk feces was determined by microhistological examination as described by Sparks and Malecheck (1968). Fecal samples were collected from two areas on the winter range during the summer after domestic stock had used the areas. Each area was approximately one square kilometer in size and was located along the common border of a sheep and cattle allotment. Samples for each herbivore species were derived from 50 single defecations located at random throughout the area. Each subsample was about one cubic centimeter of fecal material. Five microscope slides were made from each sample and 20 fields were examined per microscope slide at 100X magnification. Diet similarity between species of herbivores was calculated using Kulczynski's similarity index (Oosting 1956).

Results and Discussion

The major components of the diet selected by sheep were grasses and sedges (Table 1). Western wheatgrass, blue grama, carices, and

Table 1. (Mean \pm SD) percent relative density of plant fragments in fecal samples of four ungulates in southcentral Colorado from low elevation winter range of big-game.

Plant species*	Sheep	Cattle	Deer	Elk
<i>Agropyron smithii</i>	36 \pm 5	29 \pm 27	1 \pm 1	14 \pm 11
<i>Bouteloua gracilis</i>	18 \pm 2	5 \pm 6		1 \pm 1
<i>Carex</i> spp.	15 \pm 7	40 \pm 35	3 \pm 1	17 \pm 2
<i>Koeleria cristata</i>	9 \pm 3	9 \pm 1	2 \pm 2	8 \pm 1
<i>Festuca</i> spp.	1 \pm 1	6 \pm 2	2 \pm 1	14 \pm 17
<i>Artemisia</i> spp.	7 \pm 3	1 \pm 1	16 \pm 2	23 \pm 12
<i>Cercocarpus montanus</i>			12 \pm 2	1 \pm 1
<i>Juniperus</i> spp.			10 \pm 6	
<i>Pinus edulis</i>			28 \pm 14	
<i>Pseudotsuga menziesii</i>			13 \pm 9	6 \pm 3

*Other taxa in the diets were *Aristida*, *Blepharoneuron*, *Muhlenbergia*, *Oryzopsis*, *Poa*, *Sitanion*, *Stipa*, *Ceratoides*, *Berberis*, *Chrysothamnus*, *Descraineria*, *Eriogonum*, *Fragaria*, *Lupinus*, *Penstemon*, *Picea*, *Purshia*, *Ribes*, *Rosa*, *Shepherdia*, *Sphaeralcea*, *Symphoricarpos*, *Yucca* and *Potentilla* in small (<5%) amounts.

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Table 2. (Mean \pm SD) percent dietary overlap of four ungulates in south-central Colorado when feeding on low elevation winter range of big-game.

Relationship	% Dietary overlap
Domestic sheep vs. cattle	53 \pm 27
Domestic sheep vs. elk	46 \pm 11
Domestic sheep vs. mule deer	15 \pm 7
Cattle vs. elk	39 \pm 0
Cattle vs. mule deer	10 \pm 1
Mule deer vs. elk	30 \pm 3

prairie junegrass were found in the highest proportions. Sagebrush (*Artemisia* spp.) was also an important forage species. The percentages of grasses and grasslike plants in cattle and elk diets were similar in sheep, but the ranking in importance was different among all three herbivores. Mule deer consumed primarily browse species such as true mountainmahogany, juniper, pinyon pine, and douglas fir (Table 1).

Diet similarity was greatest among sheep, cattle, and elk (Table 2). Olsen and Hansen (1977) reported diet similarity between cattle and elk to be as high as 89% during spring on the Red Desert, Wyoming. This same study showed elk diets to overlap with sheep by 30%, and cattle and sheep diets were 35% similar. In northwestern Colorado Hansen and Clark (1977) found that cattle and elk diets overlapped by 46%. Hansen and Reid (1975) found cattle and elk to have diets that were 50% similar in late summer, but only 20% similar in early spring in southern Colorado.

Deer and elk diet overlap was much higher in this study than that reported by Hansen and Clark (1977). In southern Colorado deer and elk diet similarity was found to be as high as 40% in August, but only 3% in January (Hansen and Reid 1975). Cattle and deer diets and sheep and deer diets overlapped very little in this study in southcentral Colorado (Table 2). Other studies (Hansen and Reid 1975, Hansen and Clark 1977) also have reported low dietary overlap among cattle and deer during the fall and winter seasons.

The diets of domestic sheep in southcentral Colorado contained a higher percentage of grasses and grasslikes than was reported by Doran (1943) for western Colorado. Doran found that sheep preferred forbs in the area he studied. Forbs are very abundant in the aspen type studied by Doran and were relatively scarce in our study

areas in southcentral Colorado.

Since the elk population in the study area has been increasing we assume that forage was not lacking for either elk or domestic stock even though there is a high degree of dietary overlap. The low diet similarity between deer and domestic stock suggests that there is practically no competition for food between deer and livestock on the study area. The unusually high diet overlap among deer and elk may indicate that competition for forage may be occurring between them. This high degree of dietary overlap may have been a contributing factor to the recent decline in mule deer on the study area. Elk consumed large amounts of sagebrush, as did sheep, which may have an effect on the amount of this forage species available to deer by midwinter.

Literature Cited

- Beetle, A.A. 1970. Recommended plant names. Univ. of Wyoming Agr. Exp. Sta. Res. J. 31:1-24.
- Cook, C.W. 1954. Common use of summer range by sheep and cattle. J. Range Manage. 7:10-13.
- Cook, C.W., K. Taylor, and L.E. Harris. 1962. The effect of range condition and intensity of grazing upon daily intake and nutritive value of the diet on desert ranges. J. Range Manage. 15:1-6.
- Doran, C.W. 1943. Activities and grazing habits of sheep on summer ranges. J. Forestry. 41:253-258.
- Hansen, R.M., and L.D. Reid. 1975. Diet overlap of deer, elk and cattle in southern Colorado. J. Range Manage. 28:43-47.
- Hansen, R.M., and R.C. Clark. 1977. Foods of elk and other ungulates at low elevations in northwestern Colorado. J. Wildl. Manage. 41:76-80.
- Olsen, F.W., and R.M. Hansen. 1977. Food relations of wild free-roaming horses to livestock and big game, Red Desert, Wyoming. J. Range Manage. 30:17-20.
- Oosting, H.J. 1956. The Study of Plant Communities. W.H. Freeman and Co., San Francisco. 440 p.
- Smith, M.A., J.C. Malecheck, and K.O. Fulgam. 1979. Forage selection by mule deer on winter range grazed by sheep in spring. J. Range Manage. 32:40-45.
- Sparks, D.R., and J.C. Malecheck. 1968. Estimating percentage dry weight in diets using a microscope technique. J. Range Manage. 21:264-265.
- Van Dyne, G.M., and J.H. Meyer. 1964. Forage intake by cattle and sheep on dry annual range. J. Anim. Sci. 23:1108-1115.
- Wilson, A.D., W.C. Weir, and D.T. Torrell. 1971. Evaluation of chamise (*Adenostoma fasciculatum*) and interior live oak (*Quercus wislizeni*) as feed for sheep. J. Anim. Sci. 32:1042-1045.