

Range animal diet composition in southcentral Wyoming

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Abstract

Because of the ongoing controversy about shrub forage value for different ungulates and significance of the shrub communities for spring-fall grazing in southcentral Wyoming, the relative importance of various forage classes was determined by fecal analyses in the spring, summer, and fall diets of pronghorn (*Antilocarpa americana* Ord), mule deer (*Odocoileus hemionus hemionus*), elk (*Cervus elaphus*), cattle (*Bos taurus*), and domestic sheep (*Ovis aries*) in the mountain brush and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis* Beetle and Young) plant communities. Mountain big sagebrush (*A.t.* ssp. *vaseyana* Rydb. Beetle) comprised 76% of pronghorn spring diets in the mountain brush plant community, and Wyoming big sagebrush comprised 91% of the pronghorn spring diets in the Wyoming big sagebrush plant community. Antelope bitterbrush (*Purshia tridentata* Pursh.) comprised about 80 to 90% of the pronghorn and deer summer and fall diets in the mountain brush plant community. Graminoids, primarily *Bromus*, *Carex*, *Juncus*, and *Stipa* spp., made up 80+% of elk, cattle, and sheep diets in either plant community. Forbs and shrubs other than sagebrush or bitterbrush were a minor component of either plant community and diets of any of the 5 kinds of animals. A shrub management program to maintain species diversity while increasing bitterbrush and graminoid production under common use grazing by both browsers and grazers is recommended for this area.

Key Words: common use grazing, shrub communities, livestock-wildlife relationships

Wildland shrubs are an important component of world, United States, and Wyoming rangelands. Sagebrush (*Artemisia* spp.) alone occupies over 110 million hectares of shrublands (Beetle 1960).

In Wyoming, mountain big sagebrush (*A. tridentata* ssp. *vaseyana* Rydb. Beetle) occurs on all foothill ranges in combination with other shrubs and herbaceous species. These areas are used as spring-fall or, in years of limited snowfall, winter habitat for big game and as summer range for livestock.

Mountain big sagebrush and Wyoming big sagebrush (*A.t.* ssp. *wyomingensis* Beetle and Young) generally rank higher in animal preference and nutritive value than basin big sagebrush (*A.t.* ssp. *tridentata* Nutt.) in Wyoming (Beetle 1960). In Oregon, mountain big sagebrush was preferred to Wyoming big sagebrush by both mule deer (*Odocoileus hemionus hemionus*) and domestic sheep (*Ovis aries*) (Sheehy and Winward 1981). Mountain big sagebrush produces more biomass, occurs in a different vegetation type, and has a higher potential than Wyoming big sagebrush for increased browse forage production for both livestock and big game animals through shrub community manipulation practices.

If browse production in big sagebrush vegetation types is to be increased under a shrub management program for common use

grazing by several kinds of animals, basic information on the forage value of big sagebrush and other co-dominant shrubs is needed. This includes a need for the relative importance of different shrub species in the diets of different animals grazing sagebrush vegetation types during different seasons. The objective of this study was to determine the presence and relative importance of shrubs in the diets of pronghorn, deer, elk, cattle, and sheep under common use grazing in 2 ecologically significant shrub plant communities.

Methods

Study Area

The study was conducted in the upper North Platte River basin, Carbon County, Wyoming. Elevation ranges from 1,500 to 2,600 m; the area receives about 250–475 mm of precipitation, mostly snowfall. Soils are brown sandy loams developed on loess, limestone, sandstone, and turf (Dunnewald 1957).

The mountain brush plant community study area was on Cedar Creek Ranch on the western edge of the Medicine Bow Range, 20 km east of Saratoga. This area ranges from 2,000 to 2,600 m in elevation and receives 400–500 mm precipitation.

Antelope bitterbrush (*Purshia tridentata* Pursh.) is a co-dominant shrub; *Agropyron* spp. and Idaho fescue (*Festuca idahoensis* Elmer) are also commonly associated with mountain big sagebrush. Total shrub canopy cover averaged 30–35%, of which bitterbrush canopy comprised about one-fourth of the total. The area is closely grazed by cattle 2 to 3 months in summer and is in fair to good condition.

The Wyoming big sagebrush plant community study area is also located on the western edge of the Medicine Bow Range, either side of I-80 between Walcott and Elk Mountain. This area ranges from 1,400 to 1,700 m in elevation and receives 250–300 mm of precipitation.

Wyoming big sagebrush is the major shrub in this area. The major grasses include *Poa secunda*, *Poa canbyi*, *Agropyron smithii*, *Agropyron spicatum*, and *Agropyron dasystachyum*. The area is primarily spring-fall and winter range for elk (*Cervus elaphus*), mule deer, pronghorn (*Antilocarpa americana* Ord), domestic sheep, and cattle (*Bos taurus*). Pronghorn use the area during all seasons with infrequent use by cattle and sheep during summers. Bitterbrush is a minor component (1–5%) of the shrub layer, which has a canopy cover of 15–20%. The area is in good condition.

Data Collection and Analyses

Dung samples were collected between August 1987 and late October 1988. Collection dates were arbitrarily grouped into "Spring", "Summer", and "Fall" seasons based on phenological stages of dominant species classes (e.g., cool-season grasses, shrubs, forbs). Multiple dung samples were not collected for all animal-season-plant community combinations because of the unavailability of fresh dung from a particular kind of animal, season, or plant community.

For sheep, deer, and pronghorn, 1 dung sample consisting of fecal pellets from at least 10 different pellet groups within the same grazing area was collected biweekly within spring, summer, and fall seasons. For cattle, grab samples were taken at the same times from at least 5 dung pats. Wet samples of about 100 g each were collected, placed in plastic zip-lock bags, and stored in a freezer.

Samples were thawed, oven-dried at 50° C, and ground in a Wiley mill (1-mm screen). Microscope slides were prepared as described by Hansen and Flinders (1969) and Green et al. (1985). Plant species were identified by the Composition Analysis Lab, Colorado State University, Fort Collins using the microhistological technique described by Sparks and Malechek (1968).

Plant material in the samples were identified only to genera, but with observer accuracy, based on reference samples, within 10% of the true mean for the major genera. For discussion, various genera were grouped into species classes (e.g., "Grasses", "Forbs") or as individual genera (e.g., "Sagebrush", "Bitterbrush").

Levels of significance among means of species classes for different kinds of animals within a season or for different seasons per animal and mean separations were determined using the SAS General Linear Models procedure (Joyner 1985) and Tukey's *hsd*-procedure (Steel and Torrie 1980). All differences discussed are statistically significant $P < 0.05$ unless otherwise stated.

Results and Discussion

Mountain Brush Plant Community

Multiple-date dung samples were collected for pronghorn and elk in spring (mid-April-early June); for pronghorn, deer, and cattle in summer (early June-early September); and for pronghorn, deer, and elk in fall (early September-late October) in the mountain brush plant community. Deer samples, collected only 1

date in spring, showed 75% graminoids (primarily *Bromus* and *Carex*), but were not included in analyses.

Animal Differences by Season

Sagebrush was more abundant in spring diets of pronghorn (76%) than in elk spring diets (5%) (Fig. 1). In contrast, graminoids comprised 84% (primarily *Bromus*) of elk spring diets and only 3% of pronghorn spring diets. Although pronghorn spring diets contained 19% bitterbrush and elk spring diets contained 6% bitterbrush, differences were significant at only the 20% level.

During summer, pronghorn consume relatively more sagebrush (10%) than deer or cattle (0-1%). Deer and pronghorn consumed more bitterbrush (83-89%) than cattle (2%), and cattle ate more (93%) graminoids (i.e., *Bromus*, *Stipa*, and *Carex*) than deer and pronghorn (5-9%).

During the fall, pronghorn, deer, and elk diets contained similar amounts of sagebrush (2-6%) and forbs (3-15%). However, deer and pronghorn diets contained more (79-85%) bitterbrush and less (1%) "Other Shrubs" (i.e., *Berberis*, *Chrysothamnus*, and *Salix*) than those of elk (0% bitterbrush; 6% other shrubs). Elk again consumed more (90%) graminoids (i.e., *Carex*, *Bromus*, *Poa*, and *Juncus*) than deer and pronghorn (1%).

Seasonal Differences by Animal

For pronghorn, sagebrush was much higher in the spring diet (76%) than in summer or fall diets (5-10%). Pronghorn and deer are opportunistic herbivores, selecting the most palatable and succulent forage available at any given time. Sagebrush growth begins in spring, when over-wintering leaves expand and become physiologically active with increases in crude protein and non-structural carbohydrates (Kelsey et al. 1982). Simultaneously, crude terpenoid concentration declines.

MOUNTAIN BRUSH PLANT COMMUNITY

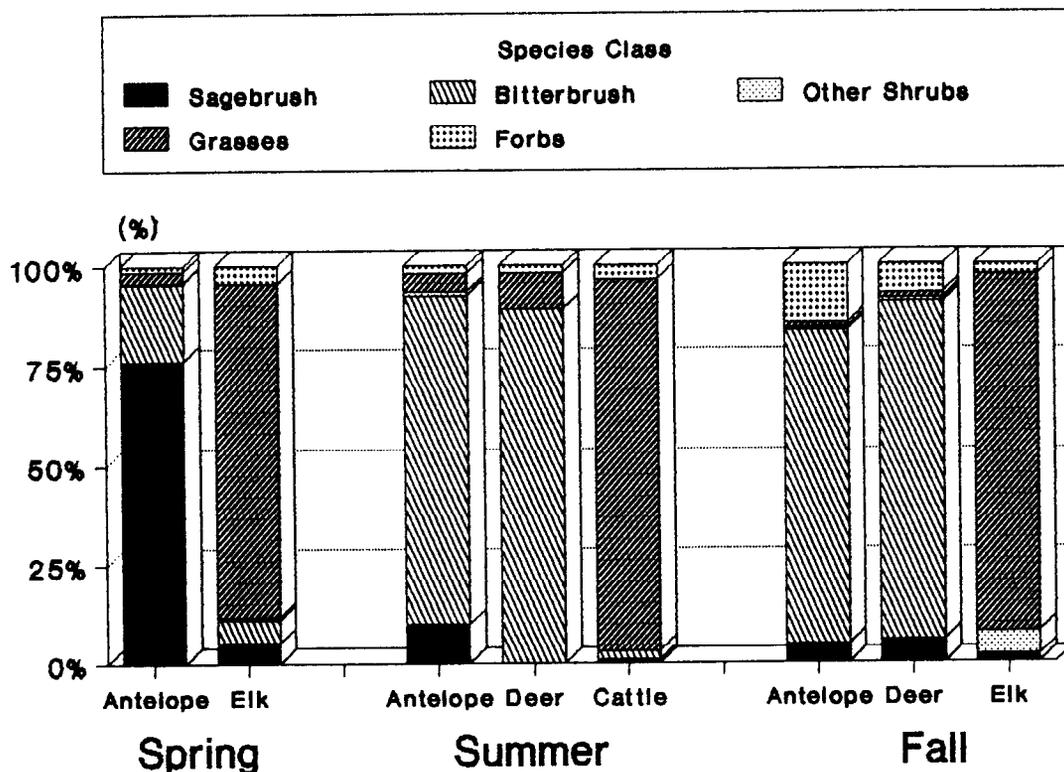


Fig. 1. Species class composition (%) of diets of different animals by season in a mountain brush plant community, southcentral Wyoming.

Thus, pronghorn and deer utilized sagebrush most heavily during periods of lowest monoterpenoid concentration and highest nutrient content. Relatively low utilization of sagebrush during other seasons may occur because of increased monoterpenoid concentration and availability of alternative browses.

Similar pronghorn diets were reported by Hansen (1982) and Olsen and Hansen (1977). They found big sagebrush to be an important browse plant in pronghorn diets during all seasons, with highest utilization occurring during spring. Severson et al. (1968) and Yoakum (1978), however, reported higher sagebrush levels in winter pronghorn diets and almost equal sagebrush contents during spring and fall.

Bitterbrush was much higher in pronghorn summer and fall diets (79–83%) than in spring (19%). Graminoids (1–5%) and other shrubs (0–1%) were minor components of pronghorn diets during all seasons. Forbs (primarily *Lupinus*) were more ($P < 0.10$) important in fall diets (15%) than in spring or summer diets (1–2%).

Forbs are often important components of pronghorn and deer diets (Mitchell and Smoliak 1971). However, our results showed relatively low forb contents. Microhistological procedures generally underestimate forbs because high digestibility leaves relatively few forb fragments in the dung (Holechek et al. 1982). Thus, our estimates of forb consumption may be negatively biased. Forb intake by pronghorn and deer were highest during fall. *Lupinus* plants were common in the fall of 1988 and readily grazed by pronghorn and deer. Additionally, mature forb plant parts may have been less digestible in fall than more succulent spring and summer forbs.

Deer summer and fall diets were similar with respect to sagebrush (0–6%), bitterbrush (85–89%), other shrubs (0–1%), and forbs (2–7%). However, deer diets contained more graminoids

(primarily *Bromus* and *Poa*) in the summer (9%) compared to fall (1%).

Stevens et al. (1989) found the highest sagebrush levels in spring deer diets and the lowest during fall. Pudney (1972) also found the highest levels of sagebrush in deer diets during the winter/spring grazing season. In Montana, mountain big sagebrush was the most preferred taxon for mule deer; Wyoming and basin big sagebrush were intermediate; and black sagebrush least preferred (Personius et al. 1987). Mountain big sagebrush was more preferred by mule deer than basin or Wyoming big sagebrush in Montana (Scholl et al. 1977) and in Utah (Welch and McArthur 1979).

Elk spring and fall diets were similar with respect to sagebrush (2–5%), graminoids (84–90%), and forbs (3–5%). However, elk consumed more bitterbrush in spring (6%) than fall (0%), and more other shrubs in the fall (6%) than spring (1%).

Cattle and elk generally depend on grasses for forage and seldom use sagebrush. However, in some areas and during certain seasons, elk utilize relatively high amounts of sagebrush and other browse (Young 1938). Big sagebrush can be an important elk forage during fall and winter (Kufeld 1973). In 2 Colorado studies, sagebrush was only slightly utilized by elk, cattle, and horses (Hansen and Clark 1977, Hansen and Reid 1975).

Wyoming Big Sagebrush Plant Community

Samples were collected in the Wyoming big sagebrush plant community for pronghorn, sheep, and cattle in the spring (mid-April–late May), and for sheep and cattle in summer (June–mid-September). Deer samples collected only once in late fall showed 86% sagebrush, 8% bitterbrush, 4% *Chrysothamnus*, and 2% *Bromus*.

WYOMING BIG SAGEBRUSH PLANT COMMUNITY

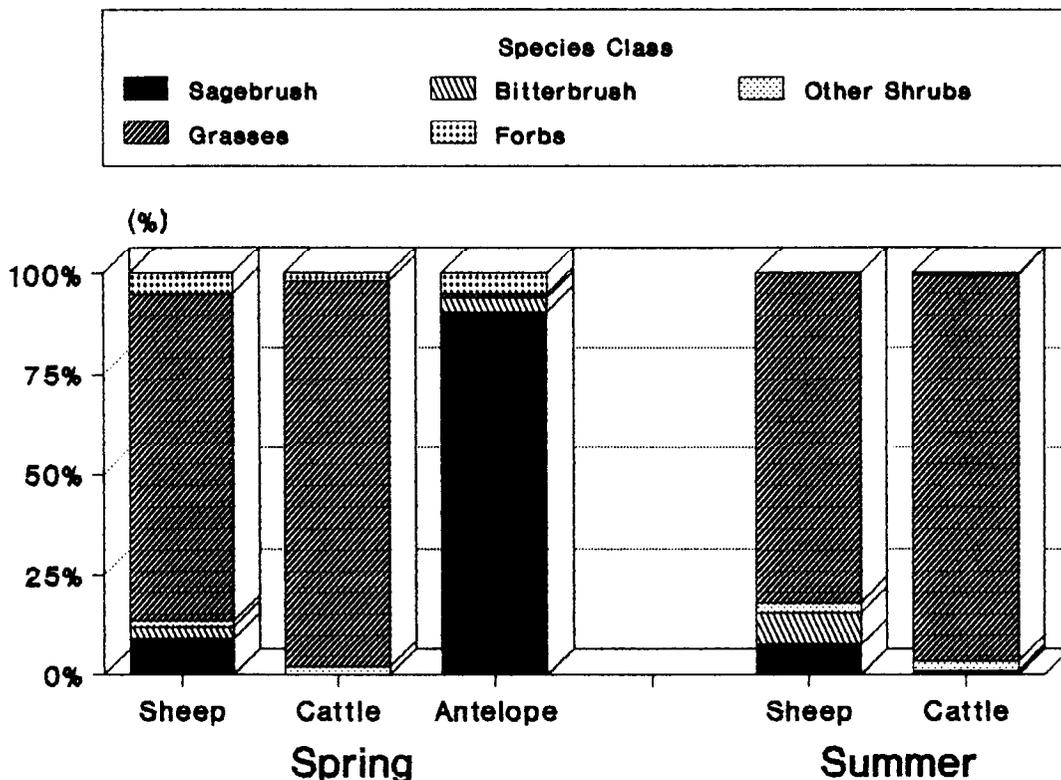


Fig. 2. Species class composition (%) of diets of different animals by season in a Wyoming big sagebrush plant community, southcentral Wyoming.

Animal Differences by Season

Sagebrush comprised 91% of spring pronghorn diets, but only 0–9% of cattle and sheep spring diets in the Wyoming big sagebrush plant community (Fig. 2). In Wyoming's Red Desert, preferred pronghorn habitats in sagebrush-grasslands included primarily Wyoming big sagebrush, low sagebrush, and silver sagebrush (*A. cana*) (Sundstrom et al. 1973).

Another major diet difference was graminoids, comprising 81 to 96% of sheep and cattle diets and only 1% of pronghorn diets. Bitterbrush, other shrubs, and forbs were relatively uncommon in the plant community and corresponding diets of pronghorn, sheep, and cattle. Differences in bitterbrush levels in pronghorn diets from the 2 plant communities (19% vs. 3%) reflected differences in availability.

During summer, sheep consumed relatively more bitterbrush than cattle (8% vs. 1%), but less graminoids than cattle (95% vs. 81%). The proportions of sagebrush, other shrubs, and forbs in cattle and sheep diets were similar and minor (0–7%). Domestic sheep in Wyoming commonly utilize Wyoming big sagebrush with the highest amounts consumed during winter.

When spring and summer diets were combined for sheep and cattle in the Wyoming big sagebrush plant community, sheep consumed more sagebrush (8% vs. 0.3%), more bitterbrush (5% vs. 0.4%), and less graminoids (81% vs. 96%) than cattle.

Seasonal Differences by Animal

A comparison of spring, summer, and fall diets for sheep in the Wyoming big sagebrush plant community showed no significant differences for sagebrush (3–9%), bitterbrush (1–8%), other shrubs (0–3%; *Eurotia*), graminoids (81–91%), or forbs (0–5%). Differences in sagebrush (0–0.4%), bitterbrush (0–0.06%), and other shrubs (2.0–2.4%, *Eurotia*), graminoids (96%), or forbs (0.4–2.0%) amounts in spring and summer diets for cattle were not significant at $P < 0.05$.

Conclusions

Herbivores, in this study, were either (1) browsers (i.e., pronghorn and deer) or (2) grazers (i.e., elk, cattle, and sheep). Sagebrush and bitterbrush were the 2 most important shrubs in pronghorn and deer diets. Other shrubs were of minor importance. Grazers consumed predominantly graminoids and a minor proportion of forbs and shrubs.

Based on diet composition data, sagebrush, bitterbrush, and other shrubs should be managed, rather than eradicated, to increase forage availability and selection potential. The apparent importance of big sagebrush to pronghorn and deer dictates that shrub manipulation programs consider maintaining some sagebrush for these animals.

In southcentral Wyoming shrub communities, pronghorn utilize sagebrush in significant quantities during the growing season, but deer, elk, cattle, and sheep do not. Cattle diets in both the mountain brush or Wyoming big sagebrush plant communities seldom contained sagebrush. Bitterbrush is more important than sagebrush for deer during summer and fall. Therefore, management of the mountain brush community for range animals other than pronghorn should focus on increasing bitterbrush and grasses rather than big sagebrush.

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