Procedings of the Eighth Biennial Pronghorn Antelope Workshop. Jasper, Alberta Canada, May 2-4, 1978, p.78-93.

BOTANICAL COMPOSITION OF FECES FROM PRONGHORN ANTELOPE GRAZING THE OREGON HIGH DESERT[1]

FORREST A. SNEVA, U.S. Department of Agriculture, Burns, Oregon
M. VAVRA, Eastern Oregon Agricultural Research Center, Union Station
Union, Oregon.

Abstract: Microhistological examination of pronghorn antelope (Antilocapra americana oregona) feces were conducted over a 2 year period to determine botanical composition. On this juniper-sagebrush-bunchgrass community the mean annual botanical composition was 62.2, 21.0, 13.1 and 4 percent browse, grass, forb and unidentified, respectively. Sandberg's bluegrass (Poa Secunda) was the principal grass taken in the spring and downy bromegrass (Bromus tectorum) taken following green-up in the fall. Bitterbrush (Purshia tridentata) was more important in the summer than in the winter while sagebrush was a component year around. Juniper was an important constituent during the winter. Forbs, primarily blue mustard (Streptanthus cordatus) was selected during the spring and summer months.

The data base from which the current knowledge of food habits of the pronghorn antelope is derived is extremely limited. Yoakum (1958) summarized the existing data which included Einarsen (1948), Mason (1952), and Ferrell and Leach (1952). Tsukamota and Deibert (1968) presented the composition of 115 samples and Richardson (1972) reported composition of 52 samples. All of the above estimates were based on composition of rumen contents. Seventy-one percent of the total samples (356) were from hunter kills; thus, information of diet composition in other seasons of the year is from low sample numbers.

There is need for more seasonal dietary information for the pronghorn antelope if range and wildlife managers are to manipulate, protect or conserve habitats to assure continuation of acceptable levels of pronghorn antelope numbers in the sagebrush-bunchgrass regions.

Recent advances in methodology utilize microscopic determination of plant species in the feces of grazing animals for an estimate of dietary selection. The opportunity provided by this technique to examine a larger number of animals throughout the season without sacrificing the animal should markedly add to our knowledge of grazing animals' dietary habits.

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[1]Cooperative investigations of the Science and Education Administration, U.S. Department of Agriculture and the Oregon Agricultural Experiment Station, Squaw Butte Experiment Station, Burns, Oregon, OAES Technical Paper No. 4785.

This report presents the botanical composition of pronghorn antelope feces on 17 sample dates seasonally distributed over a 2 year period.[1] The report discusses those results and compares them with results in the published record.

DESCRIPTION OF THE STUDY AREA

The study area, located 40 km west of Burns, Oregon, is a 166 km^2 unit of a larger area wintering approximately 5-7,000 mule deer (Odocoileus hemionus). Most deer are common from December to May, but some deer are resident to the area yearlong. About 30 wild horses and 2-300 antelope are yearlong residents. Cattle and sheep graze portions of the area each year under Bureau of Land Management permit from April 1 to January 1, according to allotment management plans.

The study area is a typical desert-forest fringe area of the cold desert. It lies about 1,370 m above sea level with local elevation variations of 60 to 90 m. The vegetation is a complex mosaic dominated by an overstory of juniper (Juniperus occidentalis), big and low sagebrush (Artemisia tridentata and A. arbuscula) and an understory of bluebunch wheatgrass (Agropyron spicatum) and Idaho fescue (Festuca idahoensis). Associated species include antelope bitterbrush, Thurber's needlegrass (Stipa thurberiana), Junegrass (Koeleria cristata) and Sandberg bluegrass. Broadleaf succulents are many, but comprise less than 15 percent of the total herbaceous production. Blue mustard was a forb important to the study.

Average annual precipitation is 29.2 cm, with the majority occurring as snow in the winter or as spring and fall rains. Summers are characteristically dry.

METHODS

Fresh samples of antelope fecal material were collected periodically from May 1975 to April 1977. Locations of animals were observed in the field and then searched for fresh pellets. Five or six pellet groups were collected each date except for June 29, 1976 and September 24, 1976 when only one antelope was observed and November 5, 1976 when three samples were obtained.

Samples were stored frozen until analyzed. Sample preparation and analysis followed the procedure of Sparks and Malechek (1968). Twenty microscope fields were observed on each of three slides for each sample.

Acknowledgment is made to the support given by the Oregon Fish and Wildlife Commission.

RESULTS AND DISCUSSION

Approximately 4 percent of botanical composition was unidentified. Averaged across all dates the mean botanical composition of antelope feces was 62.2, 21.0 and 13.1 percent browse, grasses and forbs, respectively. Yoakum's summary (1958) reported comparable values of 68.8, 7.0 and 20.9 percent, respectively. However, the latter means are unevenly weighted because most of the samples are from hunter kills that were taken in late summer or early fall. Yoakum's results differ in that he observed more forbs and less grass in antelope diets than we observed.

Seasonal means of dietary composition observed in this study and results reported by Yoakum (1958) are shown in Table 1. Browse composition is alike except for the spring period during which we found less browse in the feces. The decrease in browse was compensated mainly by an increase of the grass component. Grass composition was least important during the summer period, whereas forb composition during the winter months was extremely low (< 2 percent).

Table 1. Seasonal dietary composition of the pronghorn antelope.

	Winter[1]		Spring		Summer		Fall	
	Y[2]	SV[3]	Y	SV	Y	SV	Y	SV
	Percent							
Grass	5.7	11.8	9.2	36.0	Trace	6.6	13.2	29.6
Forb	7.2	1.8	23.3	21.0	32.4	21.5	21.0	8.2
Browse	85.3	83.9	65.6	37.1	64.9	68.4	59.1	59.6

[1]Winter (December to February, inclusive); Spring (March to May, inclusive); Summer (June to August, inclusive); Fall (September to November, inclusive).

[2]After Yoakum (1958).

[3]Study results.

Yearly, or even seasonal, dietary composition means will rarely provide sufficient information for the range or wildlife manager to properly execute his responsibility of good resource stewardship. This is particularly true in semi- and arid regions where annual climatic fluctuations are great and when seasonal climatic incidents can significantly alter vegetation characteristics temporarily. The latter becomes extremely important in interpreting research, particularly when the study is of short duration.

Figure 1 presents the botanical composition by grass, forb and browse components for each sampling date. Grass was an important dietary constituent in the spring of each year, more so in 1976 than in 1977 and again in the late summer-fall period but more important in 1976 than in 1975. In the spring period, Sandberg's bluegrass was the principal grass selected but in 1977 greater amounts of the larger, later-growing perennial grasses were taken. In the late summer-fall period, Sandberg's bluegrass was again the principal grass but in 1976 downy bromegrass constituted from 13 to 51 percent of the total diet with Idaho fescue and Thurber's needlegrass contributing 20 and 9 percent, respectively. Precipitation from July through June for 1975 and 1976 was 23.4 and 24.9 cm, respectively; both amounts are below the long time normal of about 30.5 cm. However, over 5.1 cm of rain fell in August and September 1976, causing a flush of new grass growth that was reflected by the increase of grass in diets of antelope on October 5. In 1975, precipitation sufficient to cause new growth did not occur until the month of October and diets of antelope reflected this in the November samples. The spring of 1977 followed an extremely dry winter and it was observed that many Sandberg's bluegrass plants failed to initiate new growth. Grass composition in 1977 diets was only 22 and 39 percent for March and April compared with 80 and 57 percent for the same months in 1976. In addition, particularly in the month of April 1976, more use of grasses other than Sandberg's bluegrass was noted.

Forbs were selected primarily in the spring and summer periods. Blue mustard provided the bulk of the forb diet and on May 12, 1975 comprised about 71 percent of the total diet. Other forbs taken included buckwheat (Eriogonum), yarrow (Achillia), arnica (Arnica) and granite gilia (Leptodactylon). The small proportion of forbs in antelope diets is probably due to the small percentage of forbs in the particular plant community of the study area.

Previous reported research documents sagebrush, bitterbrush and rabbitbrush as the primary species contributing to the diet of the pronghorn antelope. Sagebrush was the major browse contributor in our study but use of it by antelope varied throughout the season (Figure 2). Diet composition of sagebrush was greatest in the winter periods; however, in 1976 from 39 to 67 percent of the diet was comprised of this species in late August to late September. Yet, in 1975 sagebrush in the late summer-fall period was less than 20 percent of the diet.

Bitterbrush was more important in the summer period than in the winter period. In the summer of 1975 bitterbrush in the diet ranged from 71 to 89 percent and in late June 1976, composition was 54 percent bitterbrush. Bitterbrush in the remaining seasons constituted less than 10 percent of the total diet. This selectivity of bitterbrush by antelope in the summer season compares well with that reported by Mason (1952).

Surprisingly, juniper was a substantial contributor to the winter diet of antelope during the winter of 1975-76 (Figure 2). From October 1 to mid-January this tree furnished 37 percent or more to the antelope diet. In the winter of 1976-77 juniper in the diet did not exceed 20 percent.

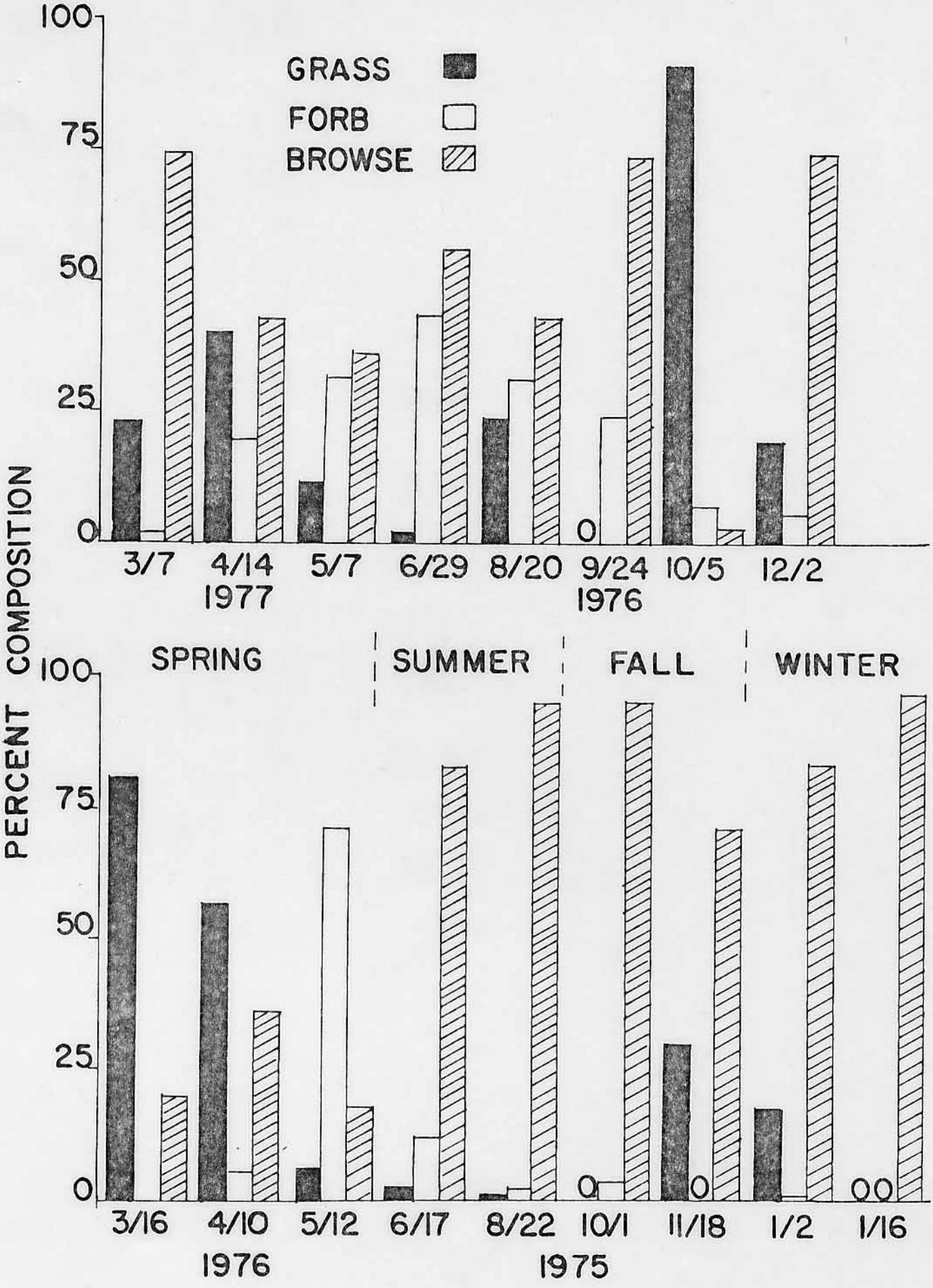

Figure 1. Diet composition of antelope as estimated from fecal analysis.

In other periods of the year juniper diet composition ranged from 0 to 8 percent. Though juniper has been reported as a forage contributor to antelope diets these results suggest that in some years it may represent a substantial portion of their diet.

Rabbitbrush was locally abundant on some habitats of the study area. Only on a few isolated sample dates did antelope browse this species in this study.

Only in the winter of 1975-76 was snow depth sufficiently deep (about 25.4 to 38.1 cm) over an extended period of time to cause a feeding problem in this study. The January 2, 1976 samples were obtained immediately before a storm system; samples collected 14 days later represent a sample taken following about 10 days of restricted food availability. Snow depth of about 30 cm remained throughout the month of January and most of February. In February 1976 we were unsuccessful in locating the antelope and assumed that they had moved to some other area. During the winter of 1976-77 snow depth seldom limited even grass availability and if so, availability was restricted only for a very short duration.

Differing diet composition between years has been discussed only in respect to the year's influence on forage availability. Because the area was also grazed by cattle and sheep in the summer period and is a primary deer winter range, their activities may have also influenced which plant species the antelope had available to them. Similar dietary information for the 2 year period was also obtained for those ungulates as well as for wild horses that are, like the antelope, year round residents. An initial summary of dietary composition of all ungulates for this study has been prepared (Vavra and Sneva 1978).

The microhistological method for determining botanical composition of animal feces as an index to diet composition is not without some weaknesses, errors or bias. Though the method estimates diet composition for the most part or undigested portions of the plant cuticle, the relative frequency of those fragments occurring in the feces is influenced by the digestibility of the plant species, which varies seasonally and by ungulate species. In this study blue mustard shattered more readily in the grinding process and is believed to have caused a higher frequency of "hits" during microscopic analysis, resulting in an overestimation of this species contribution to the diet. We were unable to differentiate among the sagebrush subspecies, if such were present in the diet. Despite these drawbacks the technique has shown good reliability in ranking forage components in their importance in the diet as compared with that determined from esophageal or stomach analysis, Vavra et al. (1978). Our plans include a continuation of this study to provide for <u>in vitro</u> digestion coefficients of forages selected seasonally in 1978 and 1979.

Domestic and wild animals grazing on rangelands are extremely mobile. Feces of some of these species can be quite similar and thus difficult to differentiate. In this study we operated under a guideline of visual sighting and then sampling. We also recorded the general vegetation of the sampling site. However, because the time required for passage of forage

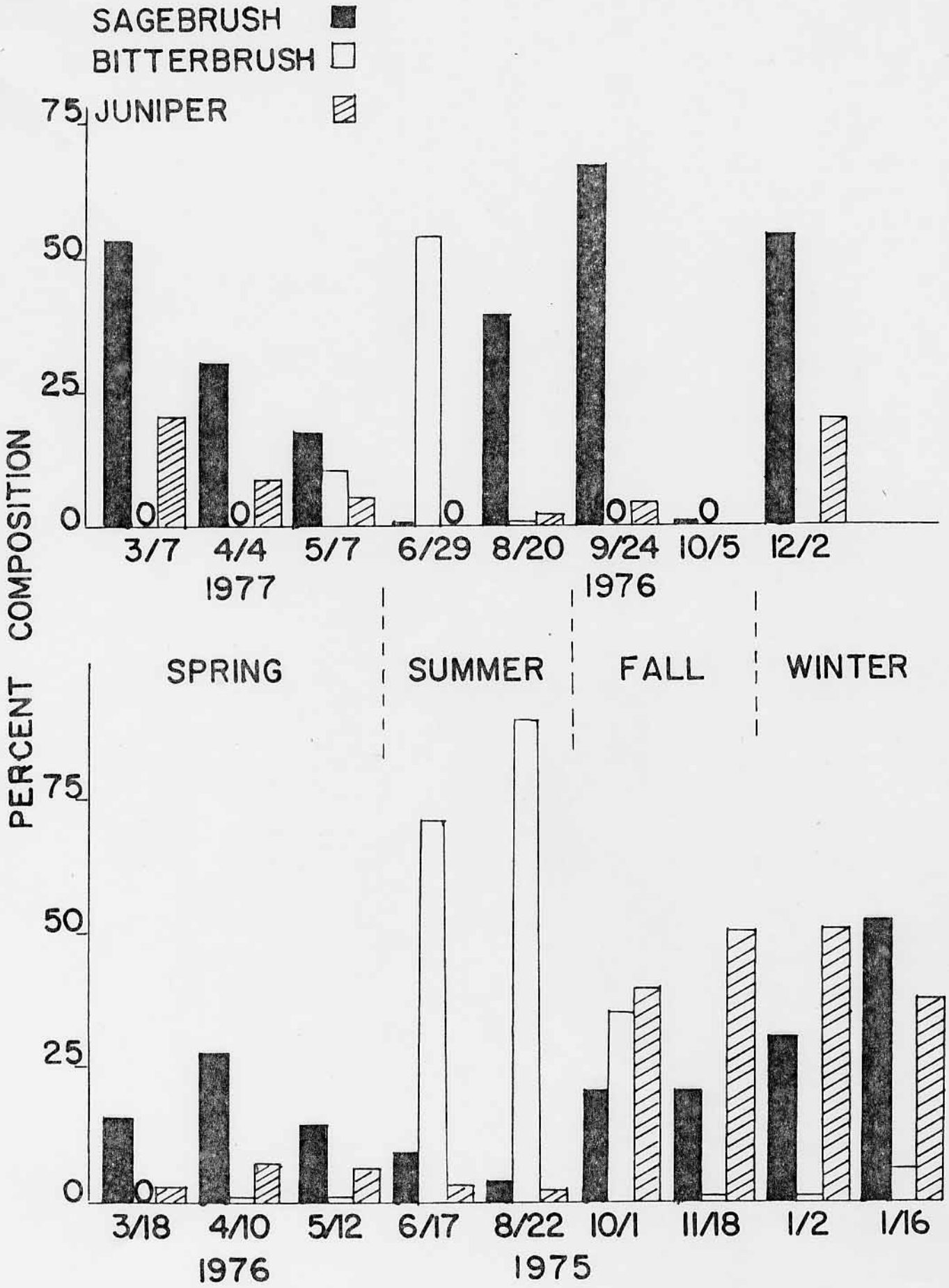

Figure 2. Browse components in the diets of antelope as estimated by fecal analysis.

in the gut of ungulates is in the order of 24 to 96 hours, it is unlikely or at least questionable if the vegetation in the locale of sampling would be a good representation of that found in the feces.

The high proportion of juniper and sagebrush browse intake during the fall and winter is of some concern. Nagy and Tengerdy (1967) suggested that essential oils in deer diets containing more than 50 percent sagebrush may depress bacterial action in the rumen. However, Smith et al. (1965) did not indicate any visible nutritional impacts on antelope sustained on a diet of 75 percent sagebrush and 21 percent juniper. They suggested that antelope may have different digestive attributes than deer. Perhaps the essential oil components in sagebrush or those in juniper are not all inhibitory; some may stimulate digestion, as has been shown by Oh et al. (1967) for essential oils in Douglas fir (Pseudotsuga menziesii) needles.

SUMMARY

Botanical composition of pronghorn antelope feces were determined on 17 dates over a 2 year period from a juniper-sagebrush-bunchgrass rangeland. Sagebrush was a major dietary constituent in the fall-winter period but differences between years were evident. Bitterbrush was important as a summer-fall component to the diet. Sandberg's bluegrass and downy bromegrass were the principal grasses selected and blue mustard was the only forb that was taken in large quantities during the spring-summer period.

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COMMENTS AND QUESTIONS

BEALE: You mentioned 40 or 50 percent use in their diet of juniper. What are your other browse plants like? Do you have a shortage, then, of sagebrush or something?

SNEVA: No. there was no shortage. At least there was no shortage on the total plant. Now whether they are specific towards current growths and not willing to accept old growths, leafage, this may be a situation. But as far as availability of sagebrush in general, no, there was no shortage here.

HELMS: What composition did your bitterbrush make up in this area?

SNEVA: I don't have a good handle on it. We are still continuing in this area and we will get vegetative estimates in terms of area and possibly some productivity. I would say that it is rather small, but again, what bitterbrush plants we have are not hedged clear back, so that I don't think we would classify them, the bitterbrush plants, as being severely overgrazed, despite the limitations that there is not too much of it.

HELMS: This was interesting because of the utilization by cattle of the bitterbrush in Wyoming. Generally if you have cattle on bitterbrush range you have utilization there.

SNEVA: The cattle are here during the late fall, but again we see no bitterbrush in the fecal material and this may be due to the fact that there is plenty grass available. I think the cow is herbaceous, preferably, and I think if the availability is there I don't think they'll go to browse unless they're lacking the grass end of it, probably.

HELMS: They're not in there then til late fall?

SNEVA: Well, the cattle are in there actually from April, beginning of April, to the first of December, but again it's under allotment management plan. Some areas are being grazed early, some are being grazed late, some are being rested clear around the year. So there are areas that an antelope can move to that would not be grazed in any particular year.

YOAKUM: Were any of your samples taken on crested wheat seedings?

SNEVA: No, there is no crested wheat grass seeded in that area. Close by there is one, about two or three miles to the south of this particular area I was sampling, but I never did sample them off of it.

YOAKUM: So crested wheat never showed up in any of your samples?

SNEVA: No.

PYRAH: One thing, did you measure any plant composition in your study area?

SNEVA: Not yet, it's in the plans. We are actually going ahead with this study. I'm collecting vegetation samples this year on the basis of what we see occurring in the diet. We're going to in vitro digestion next year on the samples so that we can correct the fecal estimate with digestion coefficients and attempt to get a better handle on composition.

PYRAH: Did you try to collect any rumen samples to correlate with your fecal samples?

SNEVA: No, we haven't here. We may do that next year when we go into some sacrifice kills with the in vitro digestion because we work with the rumen contents of antelope and with deer. But generally the work being done elsewhere in this area of rumen versus fecal correlation shows that while the exact level of percentage composition is not in total agreement nevertheless when they rank species in importance both methods rank the same species.

PYRAH: There's usually quite a large difference between forbs and shrubs, and since forbs are particularly important for antelope during the summer it looks like the method itself may underestimate something that has high importance for antelope.

SNEVA: This is possibly true. There is more problem with this method with forbs than with the grass species and the browse species. In this particular case the blue mustard fragmentated very badly under milling. We feel we're overestimating the forbs, but I think part of our problem here, our low forb situation here, is probably attributed to the fact that this is not a strong forb community. It never has been. The best we can ever do is 10-15 percent total composition by weight on forbs.

MITCHELL: I think you said that the cattle were not grazing the Poa secunda. Is that correct?

SNEVA: That's right. They weren't taking it here.

MITCHELL: What is the basis for this conclusion; was it direct observation?

SNEVA: No, we're not seeing any samples of blue grass coming through in the fecal material.

MITCHELL: So your technique is such that you can differentiate the species, can you? Is this on the basis of the heads or the vegetative parts?

SNEVA: This is on vegetative parts.

MITCHELL: I see; using auricles and this sort of thing?

SNEVA: No, this is basically what they call the histological features of the grass. It's based on the cellular structure of these grasses.

MITCHELL: So you're analyzing cow pats as well as fecal groups from pronghorns, are you?

SNEVA: Yes. We sampled all five animals actually; I presented only the data for antelope here.

MITCHELL: Do you offer any reason why perhaps they may not be grazing Poa, what appears to be here a very succulent grass?

SNEVA: Well, in part the cattle aren't coming on there til April 1st, for one thing. The Poa secunda of course in our country is generally composed of low bunches, maybe an inch up to an inch and a half in diameter. Leaf height at that particular time is only an inch and a half or so, and I think they'd much rather graze the bigger bunch grasses even though they have old growths in them.