

## FOOD HABITS OF BISON AT WIND CAVE NATIONAL PARK

Robert B. Dahlgren and Jewel K. Popp  
Iowa Cooperative Wildlife Research Unit  
Iowa State University

### Objectives

Wind Cave National Park (WCNP) in southwestern South Dakota represents a vestige of the prairie ecosystem. American bison (Bison bison) are the most numerous ungulates in the Park and the largest herbivore. Thus bison have potential for considerable impact on the rangelands.

Relatively few studies (Meagher 1973, Peden et al. 1974, Peden 1976, Reynolds 1978) were conducted on bison food habits. None was conducted on mid-grass prairies typical of WCNP. Dietary information is important for determining the value of the range to bison as well as management of bison in relation to other herbivores.

The objectives of this study are to determine seasonal food habits of bison, key forage species, and how the bison interact with other major herbivores in range use.

### Procedures

WCNP is located in the southeastern foothills of the Black Hills of South Dakota. The Park covers 28,059 acres and lies in a transition zone between coniferous forest and grasslands of the state (Shult 1972). Approximately 75 percent of the Park is covered by mixed-grass prairie and the remainder is covered by ponderosa pine (Pinus ponderosa). Lovaas and Bromley (1972) have described the predominant range sites and the vegetation on them. Range sites of importance in this study are described as follows. Silty range sites (level to hilly uplands) are dominated by mid-grasses such as western wheatgrass (Agropyron smithii), blue grama (Bouteloua gracilis), green needlegrass (Stipa viridula), needle-and-threadgrass (S. comata) and bluegrass species (Poa spp.). Shallow range sites (steeper slopes and ridgetops) are dominated by little bluestem (Andropogon scoparius). Stoney-hills range sites are characterized by big bluestem (A. gerardi) and little bluestem. Clayey range sites (gently sloping to steep prairie uplands of the northeastern portion of the Park) are a mix of mid- and short-grasses. Western wheatgrass, green needlegrass, blue grama, common buffalograss (Buchloe dactyloides) and bluegrass predominate. Overflow range sites (intermittent stream courses) are variable but usually dominated by tall and midgrasses, such as big and little bluestem, western wheatgrass, green needlegrass and the bluegrasses. The closed forest range site (wooded sites on moderately steep slopes) are dominated by ponderosa pine

-162-

with a sparse understory of grasses, usually bluegrass. Sedges occurring on range sites include sun sedge (Carex heliophila) and threadleaf sedge (C. filifolia). Common forbs include fringe sagewort (Artemisia frigida), white sagewort (A. ludoviciana), scurfpeas (Psoralea spp.), heath aster (Aster ericoides) and dotted gayfeather (Liatrus punctata).

Field work was conducted in summer from mid-June to mid-September and in autumn from mid-September to mid-November. Feeding-site examinations were conducted as described by Cole (1956) and Mackie (1970), at least 8 times per month. Beginning in October when mature bulls (approximately 20% of the park's herd) tended to separate from the cow-calf herds, separate feeding-site examinations were conducted on the two groups. Vegetation analysis was conducted at each feeding-site by determining relative frequency of plants present. On 2 feeding-sites per month the vegetation was analyzed intensively using a modified Daubenmire method (Daubenmire 1959). Feeding-site examinations will be used to determine general trends, and bison food habits will be determined by microanalysis of fecal samples as described by Sparks and Malecheck (1968).

Bison were observed while feeding and the locations at which they defecated were recorded, as well as the animal's sex and approximate age. When bison left the vicinity, fecal samples were collected, usually within 3 hours after time of defecation. Approximately 50 g was sampled from each defecation. Samples were oven dried and individually ground in a Wiley mill through a 1 mm (20 mesh) screen. Fecal samples were collected during the summer (40 from bulls, 36 from cows, 6 from yearling bulls, 7 from yearling cows, 17 from calves and 29 of unknown age and sex) and during the autumn (26 from lone bulls, 18 from bulls, 47 from cows, 8 from yearling bulls, 9 from yearling cows, 19 from calves and 4 of unknown age and sex).

Range use by bison was determined by recording bison sightings. Locations, time of day, activity and range site being utilized were recorded for each individual or group observed.

On July 27, 25 bison (6 bulls, 10 cows and 9 calves) were captured in the park's 32-acre holding corral. The corral's vegetation had previously been mapped and 31, 2.0 m by 1.5 m exclosures had been randomly placed inside of it. Observations were made daily on their grazing patterns. On the last 2 days that the bison were held in the corral, 60 fecal samples were collected (14 from bulls, 11 from cows, 16 from calves and 10 from bison of unknown age or sex). After the bison were released from the corral, paired 1.0 m<sup>2</sup> plots of vegetation were clipped, both under the exclosure and in the grazed area. The clipped vegetation was separated into 19 categories, then oven dried for 24 hours at 65°C before weighing. Weights of clipped vegetation will be used to determine grazing pressure on the vegetation for comparison with the analysis of the 60 fecal samples.

Samples of 143 plant species, representing 36 families, were oven dried at 65°C for 24 hours. Parts of each plant (root, stem and leaves, and flower or fruit) were then ground separately in a Wiley mill using a 1 mm (20 mesh) screen. Samples of these fragments were then mounted on microscope slides.

Fifty-three feeding site examinations were completed with a total of 41,348 recorded instances of use. Many plant species (73) were encountered in the feeding-site examinations but only 7 contributed over 10 percent of the instances of use for at least one month. These included bluegrass, big bluestem, little bluestem, western wheatgrass, blue grama, threadleaf sedge, and prairie dropseed (Sporobolus heterolepis). Other graminoids were eaten consistently but never exceeded 10 percent of the diet in any month. Some of these more common graminoids included sun sedge, quack grass (Agropyron repens), June grass (Koeleria cristata), green needlegrass and side oats grama (Bouteloua curtipendula). Table 1 is a summary of the major plants eaten by bison each month.

A total of 18,806 bison sightings were recorded during the field season (Table 2). Bison used the silty range site more frequently than any other during summer. During the autumn, use of silty sites diminished and use of both overflow and clayey sites increased accordingly. The use of stoney hills, shallow and closed forest sites changed relatively little.

### Conclusions

Forbs seem to be a relatively unimportant portion of the bison's diet. Only in June did they seem important in the diet (20%). Use of forbs diminished after June, probably due to the ephemeral nature of many of the park's forbs and consequently their lack of availability as summer progressed. From observations of forb use during the feeding-site examinations, it seemed that use of forbs was incidental, and may have been picked up along with whatever graminoid the bison was grazing. The possible exception to this may be the sweet clovers (Melilotus spp.) which the bison seemed to graze intentionally. Although there are over 40 species of grasses in WCNP, only a few appear to be of importance to the bison as forage species. Use of big bluestem was quite high throughout the summer, especially since it has relatively limited distribution (generally restricted to stoney hills or shallow sites). However, use of big bluestem decreased dramatically after the plant began to mature and cure. Grazing on bluegrass was quite consistent throughout summer, possibly due to its relative availability, but use of it seemed to increase during early autumn. At that time many of the native grasses had already cured but bluegrass was still green.

Range use by bison also seemed to shift seasonally. Silty sites received very high bison use during summer. Many sightings recorded on silty sites in summer were on prairie dog towns. The amount of grazing done on prairie dog towns may not be proportional to the relative frequency that bison were seen on them. Bison were often observed loafing on these areas. Shult (1972) commented that "...bison prefer areas denuded of vegetation as wallowing sites. This helps explain the more intense use of prairie dog towns during the summer months when wallowing is at its peak." During autumn, bison herds seemed less inclined to use silty sites and rarely prairie dog towns; however, use on overflow and clayey sites increased. The majority of the autumn sightings were in the northeastern portion of the park on clayey and overflow sites as that was where the herds seemed to

be localizing. This shift may be used to explain the high use of western wheatgrass (26.3%) and blue grama (17%) for the month of November, as these grasses are quite abundant in that portion of the park. Lone bull groups, however, were frequenting the southern portion of the park during November and evidently were eating somewhat different vegetation than the cow herds.

#### Acknowledgments

This study was funded by the National Park Service through the Iowa Cooperative Wildlife Research Unit (U.S. Fish and Wildlife Service, Iowa Conservation Commission, Iowa State University, and Wildlife Management Institute, cooperating). We are grateful to Adrian P. and Paula R. Wydeven, graduate students at Iowa State University, and to Richard Klukas, Wildlife Biologist, WCNP, for their assistance with advice and help in field work.

#### Literature Cited

- Cole, G. F. 1956. The pronghorn antelope -- Its range use and food habits in Central Montana with special reference to wheat. Mont. Fish Game Dept. Mont. Agr. Exp. Sta. Tech. Bull. 516: 11-63.
- Daubenmire, R. 1959. A canopy-method of vegetation analysis. N.W. Sci. 33(1): 43-64.
- Lovaas, A. L. and P. T. Bromley. 1972. Preliminary studies of pronghorn antelope - blacktail prairie dog relations in Wind Cave National Park. Proc. 5th Bienn. Antelope States Workshop, Billings, Mont. pp. 115-156 (mimeo).
- Mackie, R. J. 1970. Range ecology and relations of mule deer, elk and cattle in the Missouri River Breaks, Montana. Wildl. Monogr. No. 20, 79p.
- Meagher, M. M. 1973. The bison of Yellowstone National Park. National Park Serv. Sci. Mono. Ser. 1. 161pp.
- Peden, D. G. 1976. Botanical composition of bison diets on shortgrass plains. Am. Midl. Nat. 96(1): 225-229.
- Peden, D. G., G. M. Van Dyne, R. W. Rice and R. M. Hansen. 1974. The trophic ecology of Bison bison on shortgrass plains. J. Appl. Ecol. 11(2): 489-498.
- Reynolds, H. W., R. M. Hansen and D. G. Peden. 1978. Diets of the Slave River Lowland bison herd, Northwest Territories, Canada. J. Wildl. Manage. 42(3): 581-590.

Schult, M. J. 1972. American bison behavior patterns at Wind Cave National Park. Ph.D. thesis. Iowa State Univ., Ames. 178pp.

Sparks, D. R. and J. C. Malecheck. 1968. Estimating percentage dry weights in diets using a microscopic technique. J. Range Manage. 21: 264-265.

Table 1. Percentages of major plants eaten by bison each month, 1978.

	June n=7,955	July n=10,018	Aug. n=8,071	Sept. n=5,357	Oct. cow herd n=3,233	Oct. bull groups n=1,498	Nov. cow herd n=3,923	Nov. bull group n=1,293
<u>Agropyron smithii</u>	26.3	6.0	5.7	22.1	6.9	6.5	26.3	0.3
<u>Andropogon gerardi</u>	20.0	48.8	26.2	4.5	6.5	7.3	--	13.5
<u>A. scorparius</u>	7.3	14.8	13.4	8.6	1.0	3.3	1.5	--
<u>Bouteloua gracilis</u>	--	0.2	2.0	--	5.5	2.3	17.0	0.7
<u>Carex filifolia</u>	0.6	--	3.7	14.2	0.7	3.5	7.2	6.0
<u>Poa spp.</u>	3.9	16.7	29.5	25.4	50.3	65.4	28.7	22.4
<u>Sporobolus heterolepsis</u>	--	--	--	--	--	--	--	30.2
Other graminoids	21.9	8.2	11.9	13.9	21.1	10.3	17.6	12.6
Forbs	20.0	5.3	7.6	11.3	8.0	1.4	1.7	14.3
Total	100.00	100.0	100.00	100.0	100.0	100.0	100.0	100.0

Table 2. Percentages of bison sighted on various range sites each month, 1978.

	Overflow	Stoney Hills	Silty	Clayey	Shallow	Closed Forest
June	20.5	7.5	53.8	0	13.3	4.9
July	7.1	17.2	54.6	5.3	14.9	0.9
August	2.4	0.5	89.3	0	7.7	0.1
September	16.2	0.1	72.7	0	7.0	4.0
October	10.0	16.5	39.0	22.0	12.5	0
November	48.5	8.1	19.7	16.8	9.6	0